

# Designing the Domestic Internet of Things using a Practice-Oriented Perspective

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Philosophy in Innovation Design Engineering

Michael Kann

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## Authors Declaration

This thesis represents partial submission for the degree of Doctor of Philosophy at the Royal College of Art. I confirm that the work presented here is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis. During the period of registered study in which this thesis was prepared the author has not been registered for any other academic award or qualification. The material included in this thesis has not been submitted wholly or in part for any academic award or qualification other than that for which it is now submitted.

Signature:

A handwritten signature in black ink, consisting of a stylized, cursive 'N' followed by a long, sweeping horizontal line that extends to the right.

Date:

16<sup>th</sup> August 2021

Supervisors:

Professor Ashley Hall

Dr Delfina Fantini van Ditmar

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## Abstract

The Internet of Things (IoT) is a system of sensing, actuating and networked objects, often discussed as delivering efficiency through machine determined, automated decision making and action to achieve 'Smartness' in a logistically based paradigm. When applied to the domestic space these values are touted as beneficially controlling lighting, heating and entertainment to improve efficiency and comfort, while reducing costs. This approach follows the external goods of effectiveness, reducing everything to an objective value/cost proposition; however, the home is a subjectively experienced space incorporating differing values, so this reductive perspective overlooks a wider spectrum of inhabitant's concerns relating to their daily activities and the domestic space. Furthermore, this approach can supplant involvement in domestic activities by treating these as computable problems to solve, alienating users through automation, a lack of transparency and poor understanding of the reasoning behind machine decision making.

Existing attempts to address this topic indicate Techno-Centric approaches impact on understanding and engagement with the domestic space; Human-Centric perspectives focus on supporting people's subjective experiences by prioritising their activities, sense-making and sensory experiences within the design process; Beyond Human-Centric IoT perspectives broaden this understanding to propose non-hierarchical, flat ontologies for the IoT and the implications this has on integrating human/non-human agency in the IoT, generally and domestically. This supported an approach utilising Practice Theory, a development of organising concepts for theorising social life, with sociality dependent on activities conducted with materials to develop a coherent sense of self and which understands place as a meshwork of human/non-human agency.

Practice Theory is applied within a Design Research approach using a synergistic Participatory Action Research (PAR) / Participatory Design (PD) process. Exploring Domestic Practices contextualised the IoT through a range of methods including interactive installations, interviews and design workshops, uncovering participant attitudes towards the IoT, generating Practice Themes and specific examples of practices and constituent elements. These acted as User Generated Values (UGV) in a Values-Led PD process to inform the project pathway and the conceptualisation of a Practice-Oriented IoT through PAR's Action-Reflection spirals. Additionally, a parallel PD process explored the effective communication of UGV within Professional Design Practice (PDP) workshops with the intent of reducing communicative distance between end-users and developers, supporting

communication of user's attitudes towards the IoT and Practice within PDP through inclusion as guiding values. Models of the IoT balancing Practice and technical concerns, workshops and toolkit were developed iteratively, leading to an outcome modelling the IoT and Practice within a flat ontology. Through this, and by embedding Practice within the IoT itself, IoT agency was reframed from automation towards assistiveness in Practice and IoT values shifted from efficiency in external goods of effectiveness towards internally derived goods of excellence, supporting skill development, engagement and reflection on action.

This identifies the value of using PAR and PD to consider people's values, goals and existing practices when developing the domestic IoT. This was particularly valuable in exploring Practice to understand people's activities in the home and contextualise attitudes towards the IoT. This informed the development of a framework balancing the IoT's technological nature with people's activities and values, a system guided by Practice elements reciprocally informing and supporting participant engagement in dynamically developing domestic practices.

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## Glossary

### *UGV – User Generated Values*

Guiding principles and trans-situational goals that reflect user’s desired modes of end states. These attributes are prioritised through working with participants and are uncovered through following a Values-Led Participatory Design approach.

### *IOTUGV – Internet of Things User Generated Values*

Guiding principles that reflect user’s desired modes of end states in regards to the Internet of Things following Values-Led Participatory Design, in this work contextualised by a Practice-Oriented.

### *DPUGV - Domestic Practice User Generated Values*

Existing modes of end states in regards to domestic practices uncovered through user discussions following Values-Led Participatory Design and represented as examples of elements of Practice.

### *DV - Domestic Values*

The subjective qualities of home, including happiness, belonging, responsibility, self-expression and critical experience. In this work these have not been uncovered through a Values-Led Participatory Design process, but are instead derived from Sixsmith (1986)

### *PDP - Professional Design Practices*

The work and creative activities undertaken by designers, with a focus on concept development methods, explanatory techniques, IoT workshops, their structuring, content and evaluation methods. Used in this work to differentiate between Practice and design related activities.

# 1 The Internet of Things and the Smart Home

The Internet of Everything: Circle Story (Riggert, 2014) illustrates a potential day in the life of a near-future family, showcasing Internet connected devices predictively and autonomously intervening by assuming responsibility for various household tasks. This represents a common understanding of the domestic application of the Internet of Things (IoT) and Smart Objects, detecting inhabitant's habits and preferences to improve home life by pre-empting their needs. This extends in literature to a system that does the same for heating, music and entertainment, a perspective based on efficiency applied through automated machine agency to enhance convenience within the home and save costs. However, this overlooks some important considerations regarding the practices of the domestic space, which are not solely defined by efficiency or convenience.

Understanding the foundations and impact of these technologies on domestic experience forms the focus of this work, with an interest in how a decision making, automated IoT with a focus on domestic efficiency and convenience impacts on people's engagement with the practices of the home, and therefore domestic understanding, social communication and meaning making. Existing research explores development of this field from alternative and novel perspectives, but there seems to be little impact on the development of IoT products and services, which tend to follow this technological imperative that promotes efficiency. Therefore, understanding differing IoT approaches, understanding and contextualising the domestic space IoT using Practice Theory, working with people to explore domestic practices and IoT perspectives and communicating these within design processes may guide designers and developers in understanding the IoT in the context of home. This intends to support the development of alternative outcomes to those guided by common IoT efficiency models, providing a perspective on how the IoT can be integrated into the domestic space in a manner recognising and supporting people's involvement in the meaningful, social and physically situated activities of the home.

Mapping the IoT using Techno-Centric, Human-Centric and Beyond Human-Centric perspectives will detail existing research spaces, exploring the concerns of technological development and domestic application; the influence of human-centred approaches to supporting experience and engagement; and how going beyond human perspectives can broaden understanding to inform the impact of IoT agency when allied with people and their activities. As well as developing a wider appreciation of the concerns of a range of

approaches to the IoT, this will detail common methods, content, concepts and research interests.

Following this, an approach framed by a Practice-Orientation within a synergistic Participatory Action Research (PAR) framework and Participatory Design (PD) methodology will be used to explore people's general understanding of the IoT, their opinions of any beneficial, desirable or detrimental qualities, contextualised by engagement with and understanding of this system through domestic practices. This aims to uncover tacit values representing participant opinions of current and potential domestic IoTs and the constitutive elements of Practice to understand attitudes and gather specific attributes relating to the IoT and Practice, which will support developing an alternative perspective on the domestic IoT. Incorporating Practice-Orientation within the IoT will allow for a re-evaluation of the agency and values of this system and support positioning these perspectives and constituent Practice elements within the IoT, leading to a wider reframing of the this system through Practice. Communicating this to professional designers through ideation processes building on existing IoT design methods will explore the impact of this approach with the wider community of IoT professionals by incorporating these aspects into Professional Design Practice (PDP) toolkits, where the effectiveness of this reframing of the IoT can be evaluated by understanding the impact of Practice-Orientation, the differing values/virtues this can represent and how these correspond with the subjective experience of home.

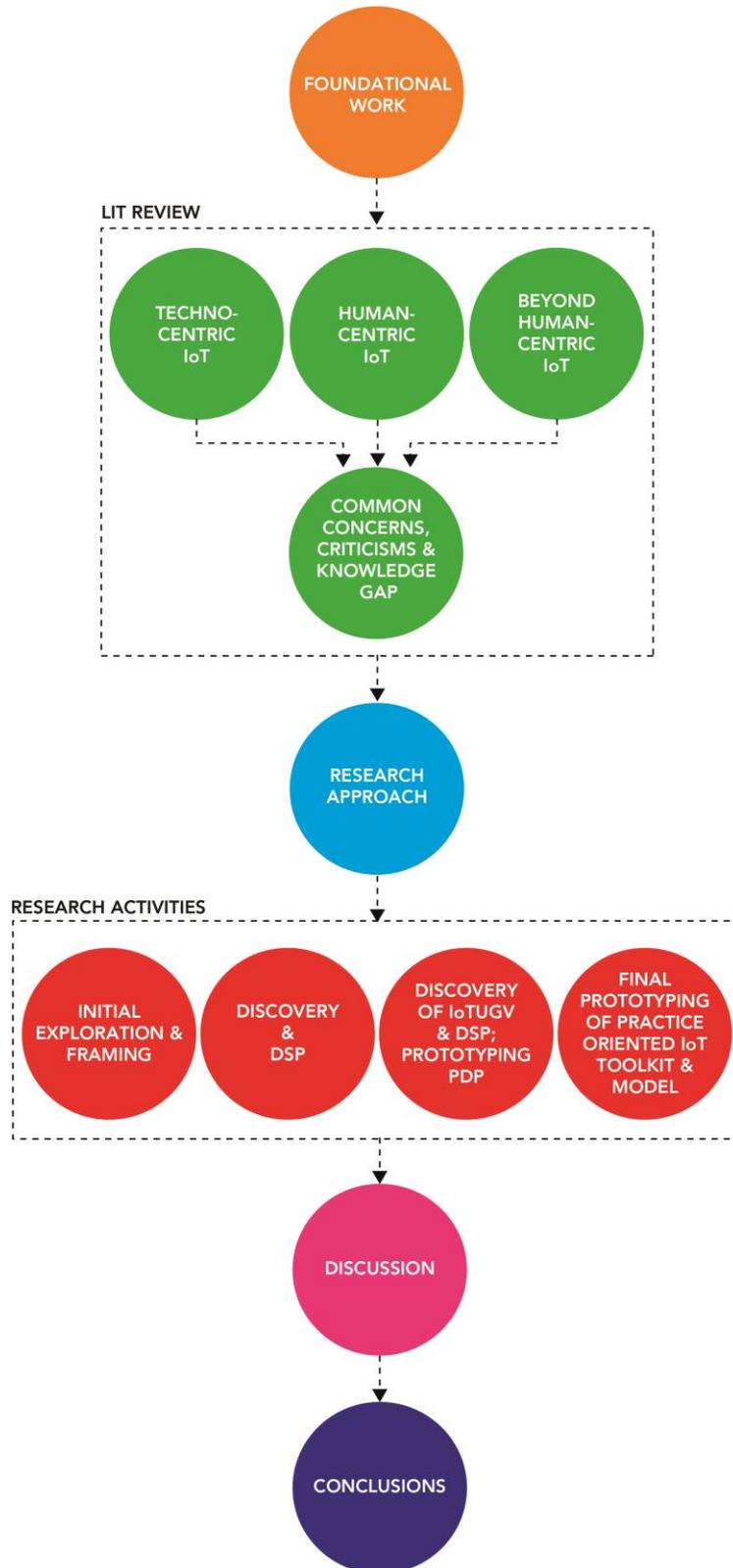


Fig.1: Thesis Structure Diagram

## 2 Foundational Work

During my studies at the University of Brighton I became interested in design's narrative potential through Emotionally Durable Design (Chapman, 2015) and Critical Design, in particular how interaction with electronics could augment experience of objects and environments (Dunne and Raby, 2001). This began my interest in cultivating narrative by embedding technology in furniture to represent long and short-term use and history, with other influences including the Drift Table (Boucher and Gaver, 2006) and the History Table Cloth (Boucher et al., 2004). I explored these themes in the 'Minos Table' (Fig.2), achieving interaction and narrative development in an analogue manner by using leather for long-term patina development to reflect historic patterns of use, treating this with thermochromic pigment that reacted at 31°C to communicate shorter term interactions.



*Fig.2: Minos Table (l) and thermochromic surface (r)*

Reflecting on my practice following graduation I was eager to explore these themes, continuing in the MA by Design: Furniture, Ceramics and Jewellery course at Central St. Martin's College of Art & Design. These three disciplines were linked by exploration of 'intimate architecture'; meaningful objects closely related by use at a personal scale. I proposed to follow my previous interests through self-described 'reactive furniture,' concentrating on developing long and short-term narratives through digital interaction.

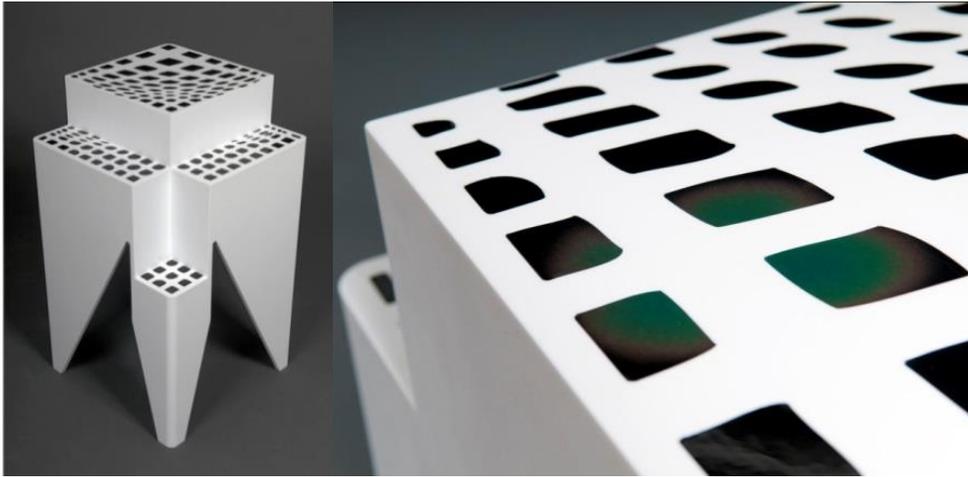
During these studies I presented my work at the 2008 Interactive and Adaptive Furniture Workshop, Aarhus University, where varied approaches of designers, architects, technologists and sociologists indicated a growing trend of new technologies intermingled with everyday objects, particularly furniture. I felt technologically driven disciplines used furniture objects to 'smuggle' technologies into the home by, for example, providing a rationale for working on modular robots that, for example, autonomously build furniture

(Sproewitz et al., 2009) or self-stabilising lap tables (Yu et al., 2008). Following Philips' Ambient Intelligence work (Aarts and Marzano, 2003), I argued furniture designers should lead these developments as their expertise regarding interaction, aesthetics, history, culture and meaning of this typology could support this integration. Focusing on 'the culture of use' of furniture I explored how people used their objects and the meaning behind interactions. This led to an exploration of textuality and tactility that built on existing interactions to encourage playfulness, leading to long-term narrative development. This culminated with 'Chesterfield' (Fig.3), encouraging exploration in a manner sympathetic to furniture's visual and cultural history through aesthetic and surface. Capacitive touch sensors embedded in specific drawer handles detected interaction, triggering their actuation so they could be gripped and the drawer opened. This combination of technology and furniture created an intervention into daily life without sacrificing functionality or 'furniture-ness.'



*Fig.3: Chesterfield (l) and handle detail (r)*

Following graduation, I continued to work at the intersection of technology, art and design, informing my understanding of the application of technologies for artistic purposes through freelance roles at Moritz Waldemeyer, rAndom International, Troika and Conrad Shawcross Studio. Projects included light installations 'Lucid Flux I & II,' exhibited at 2010's Salone del Mobile, Milan and Design/Art Basel; 'Rain Room,' which used bespoke solenoid controlled panels and computer vision to maintain two metres of dry space around visitors as rain filled the venue and 'Cloud II,' which used mirrored flip-dots to display pre-programmed ripple animations.



*Fig.4: Lexham (l) and inlay detail (r)*

Concurrently I was developing my interests in interaction, experience and technology through my personal practice, illustrated by three projects: the ‘Lexham’ bedside tables; ‘Madam Bottwright’s Bureau’ and ‘ReadMe.’ ‘Lexham’ (Fig.4) is a pair of bedside tables with a surface motif inspired by OpArt and inlaid with 137 pieces of thermochromic material to create a temperature responsive surface reflecting short and medium-term use and environmental conditions. ‘Madam Bottwright’s Bureau’ (Fig.5) used a restored reproduction Victorian bureau embedded with electronics to provide clues to users, encouraging ludic exploration of the object and contents to describe the real-life history of an East London pub and its inhabitants.



*Fig.5: Madam Bottwright’s Bureau (l) and solenoid detail (r)*

‘ReadMe’ (Fig.6) embedded sensing and actuation in a shelf to detect stored books and push unread ones to the floor, compelling people into interacting with them to reset the shelves and highlighting easily overlooked objects through malicious agency. This was a culmination of previous interests and developing expertise, which led to a focus on the

impact of Embedded Intelligence (Guo et al., 2011), the IoT and machine agency in the home.



*Fig.6: ReadMe (l) and spilled books (r)*

These experiences informed a critical position towards technology driven developments, especially those minimising cultural understanding by replacing user interactions with automation through machine determined agency in the home, which led to my interest in the IoT. These interests and my background were important in developing an alternative perspective of these systems in the home, focusing on user engagement through a culturally located, experientially attuned understanding. This formed the basis for exploring how people understand the IoT and its potential impact on domestic life, in conjunction with identifying what people consider important in terms of lived experience through their domestic practices.

### 3 Literature review

In exploring the development of the Internet of Things (IoT), generally and in the domestic space, the overarching categories of Techno-Centricity, Human-Centricity and Beyond Human-Centricity will be used to map four core themes of concern to this work: disciplinary perceptions, understandings and biases towards the IoT; the effect of these biases on the values, Practices and human/non-human agencies within the IoT; the manifestation and inclusion of values/virtues within the IoT and the impact of Practice-Oriented support new ways of understanding the IoT. Exploring the IoT's technological foundations in the *Fundamentals of the IoT* aims to detail these underlying motivations and initial applications in the home. *Towards a Human-Centric IoT* explores how technological imperatives are tempered to suit people and their domestic experience. *Beyond a Human-Centric IoT* charts developments transcending human focus, and is titled to differentiate from the More-Than Human Centred Design approach. Understanding current developments in the IoT balancing people's attitudes, experience and engagement with the home and systemic considerations will identify current perspectives and approaches towards the IoT, allowing for further development building on this work.

Some literature is informed by topics outside a specific IoT focus, which is not included in this thesis. This includes Ubicomp (Weiser, 1991); Ambient Intelligence (Aarts and Marzano, 2003); domestication and adoption of technology (Venkatesh, 1985; Venkatesh and Nicosia, 1997); the social lives of things (Appadurai, 1986) and general explorations of Practice and technology (Kuutti and Bannon, 2014; McCarthy and Wright, 2004). While not this work's core focus, recent research into IoT New Product Development (NPD) may have informed the design and testing of the toolkit and workshop processes for Professional Design Practices (PDP), especially as IoT NPD models differ from traditional ones due to data provision allowing real-time case studies and evolving customer experiences (Lee et al., 2019, p.5) and consideration of IoT services (Lee et al., 2018, pp.2288–2289). Artificial Intelligence (AI) is also an important research area within the IoT, but is not a core concern as while understanding how IoT outcomes are determined is important I am more interested in how Practice-Oriented can provide new insights into agency and values within the domestic IoT and how these can be communicated.

This is framed by three questions:

**RQ1: What new perspectives can Practice-Oriented provide on agency and values in the context of new IoT Practices?**

**RQ2:** How can the Techno-Centric nature of the IoT be integrated into the qualitative domestic experiences of people to better support Domestic Practices (DP)?

**RQ3:** How can potential user’s perspectives on the IoT and Practices be constructively communicated to IoT developers within the context of Professional Design Practices (PDP)?

### 3.1.1 The Fundamentals of the IoT

Named during a presentation at Proctor and Gamble in 1999 (Ashton, 2009), the IoT is said to have become a reality between 2008 and 2009 when the number of connected devices numbered 1.25 billion (Evans, 2011, p.3), predicted to grow to 27 billion connections by 2025 (Growth Enabler, 2017, p.13). The initial IoT concept envisioned Internet enabled logistical systems using Radio Frequency Identification (RFID) tags attached to objects that linked to Internet databases of information; through digital identification and representation of physical objects, detailed modelling, predictability and efficient self-regulated management of goods, services and resources could be achieved (Kotis and Katasonov, 2012, pp.2–3; Wang et al., 2012, pp.1–2). This was particularly suited to supply chain applications where RFID and sensor networks are well established (Whitmore et al., 2015, p.265) ‘with millions of shipments being moved, tracked, and stowed by a variety of machines, vehicles and people each day’ (Macaulay et al., 2015, p.14). Atzori et al.'s (2010, p.2789) IoT review argues that Things-, Internet- and Semantic-oriented visions in concert constitute the IoT (Fig.7), useful categories for framing exploration of Techno-Centric approaches.

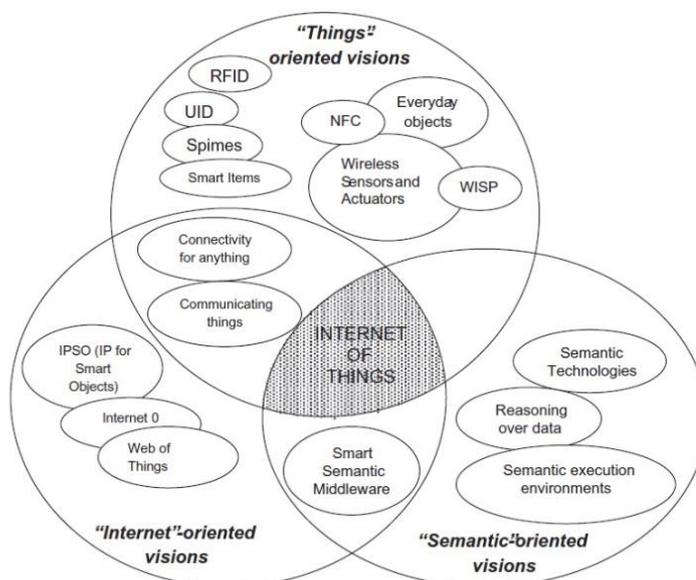


Fig.7: IoT paradigm as a result of the convergence of different visions

While the IoT was initially envisioned as an Internet enabled RFID system, this developed with Gershenfeld et al.'s (2004) discussions of everyday objects connecting to data networks. Technological developments led to the inclusion of other ID tags, sensors, actuators and mobile phones (Atzori et al., 2010, p.2787), creating a system that can be 'considered to be *things* that can act upon, measure, or provide services based on real-world entities' (Hachem et al., 2011, p.1). These elements can be thought of as the IoT's foundation, with various IoT hardware platforms (Tayeb et al., 2017, pp.2-4) converting physical inputs into digital signals transmitted to control centres (Suresh et al., 2014, p.2), so objects can share information to recognise changes and react autonomously to create value (Aguzzi et al., 2013, p.18). Allied with this, growing Internet connectivity methods (Gubbi et al., 2013, p.1645) enable new forms of communication between objects and people, and objects themselves, adding to existing connectivity between anyone at any time, in any place by allowing connectivity to and between anything (Pena-Lopez, 2005, p.2). Adding Internet connectivity and networking to objects with embedded digital technologies creates interconnected hybrid digital/physical objects, a convergence central to the IoT, described as 'Things' with 'identities and virtual personalities' (Duce, 2008, p.6); 'hybrids composed of elements from both physical and digital worlds' (Fleisch et al., 2015, p.7) or 'everyday objects...equipped with identifying, sensing, networking and processing capabilities' (Whitmore et al., 2015, p.261). Reviews of communication frameworks applied to Smart Objects, Fog and Cloud Computing (Tayeb et al., 2017) and architectural models for the IoT are identified as important topics in supporting connectivity (Madakam et al., 2015, pp.167-169) with core challenges including difficulty in scalability and volume of generated data owing to a lack of standardised communication protocols, definitions, architectures and interoperability (ibid. p.172).

While these connections allow everyday objects to communicate via networks, sensing and making sense allows for acting upon the environment automatically (Whitmore et al., 2015, p.264). The IoT is an important source of large volumes of information (or 'Big Data' (Chen et al., 2014, p.179)), with sensing elements within supply chains generating large amounts of data which can be analysed to provide insights and inform new methods (Macaulay et al., 2015, p.8). This is achieved through 'intelligent information processing technology' and Artificial Intelligence analysing and making decisions to inform intelligent, connected and actuating Things (Arsénio et al., 2014). There is recognition of the role people play in this sense making (Guo et al., 2011, p.4), considering people as nodes of information transfer where social behaviours can broker information (Guo et al., 2012). Furthermore, integrating

the IoT with social networks can create a 'Social Internet of Things' (SIoT), utilising relational models between people and things to manage relationships by mimicking human behaviours (Atzori et al., 2012, p.3597).

### **3.1.2 The IoT, the Home and Technological Imperatives**

The IoT's application to the domestic space has led to increasing commercial interest (Perera et al., 2015, p.597) with predictions that by 2030 the majority of home devices will connect to the Internet (Growth Enabler, 2017, p.12) creating the second highest level of IoT deployment in advanced economies, worth \$200-350 billion in 2025 (McKinsey's Global Institute, 2015, pp.5-7). As these develop in complexity and interoperability they can create a piecemeal Smart Home, with Smart Objects acting as the IoT's building blocks (Kortuem et al., 2010). This tends to follow an understanding that monitoring inhabitant habits and preferences can pre-empt lighting, heating, music and entertainment needs (Innovate UK, 2016) leading to 'energy and cost savings, greater home efficiency through automation' (Lindsay et al., 2016, p.1). This network of physical devices provides 'electronic, sensor, software and network connectivity inside a home' controlled via interfaces on tablets, mobile phones or computers (Alaa et al., 2017, p.48) with the promise of improving resource efficiency, removing household chores and maximising comfort through predictive automation (Duce, 2008, pp.18-19).

Technology concerns are the largest of the four main IoT research domains in the domestic space (Solaimani et al, p.378), with issues including Smart Grids and Homes, wireless sensor networks, Smart Homes, home automation and IoT through networking, interoperability, security and privacy (Risteska Stojkoska and Trivodaliev, 2017, pp.1460-1461) and a focus on existing technologies, software and architectures in domestic IoT implementation (Li and Yu, 2011, pp.2088–2090). Scalable, open architectures responsive to user configuration and presence can improve consumption and energy usage (Souza and Amazonas, 2013, p.6) or allow diverse sensors to communicate through Semantic Sensor Networks (Berat Sezer et al., 2015, p.12), while standardised communication between IoT devices can create safer environments (Branger and Pang, 2015, p.330). Various hardware detects environmental conditions to provide feedback to users (Kadima and Jafari, 2017, p.82) and drive automation (Soumya et al., 2016, p.849; Vinay Sagar and Kusuma, 2015), creating comfortable spaces and saving resources.

Beyond middleware, architecture, standardisation and interoperability, the technology domain considers design and development, including user contexts of interfaces, detection

of intentions, feelings, situations and activities, user habits and personality and user behaviours (Solaimani et al., 2015, p.375). Keeping '*Humans-in-the-Loop*' is discussed as informing the IoT (Stankovic, 2014, pp.5–6), with challenges including understanding the spectrum of control, interpreting long-term behaviour development and incorporating human behaviour within systems. A later review identifies unresolved technical and ethical issues; particularly relevant is the cognitive dissonance that may occur when *Humans-in-the-Loop* concepts are introduced to people's daily lives, rather than explored within research approaches (Nunes et al., 2015, p.962). Recognition of human activity as part of data provision elements in context aware systems (Chegini and Mahanti, 2019, pp.158–159) is explored by, for example, combining Cognitive Dynamic Systems with IoT enabled Smart Homes to provide adaptive environments where implementation is activity based (Feng et al., 2017). This is also applied to reduce behaviour prediction, but fails to recognise the role of people in the home, instead recommending ways to improve technology application for automation (Alaa et al., 2017, pp.60-61) or provide context-aware, automated services to people through the IoT; an approach explicitly minimising human engagement (Wei and Jin, 2012, p.1). When consumer involvement is recommended, it focuses on device development to offer 'enhanced utilitarian value compared to...non-IoT objects' (Aldossari and Sidorova, 2018, p.9) or application of self-described 'human perspective[s]' towards the IoT and Smart Homes to explore perceptions of current IoT paradigms (Zhai et al., 2014, pp.120-126), rather than how people might engage with this in the home. Further exploration of combining the IoT with social networks aims to engender sympathetic interaction with the home (Atzori et al., 2012) or gather data by mimicking social networks to again minimise direct human interaction (Doody and Shields, 2012).

### 3.1.3 Echoes of A Circle Story

The Techno-Centric IoT can be understood as a 'radical evolution of the current Internet into a 'Network of interconnected objects that...harvests information from the environment...[and] interacts with the physical world' (Gubbi et al., 2013, p.1646). This develops physical objects with digital identities (Fleisch et al., 2015, p.7), bringing together artefacts and infrastructure (Monteiro et al., 2013) to generate and communicate data. This data can be analysed and acted upon autonomously by physical objects (Pollock and Williams, 2010) through a system with embedded, context aware, personalised, adaptive and anticipatory characteristics (Madakam et al., 2015, p.172) which 'can manage [itself] given high-level objectives from administrators' (Kephart and Chess, 2003, p.41).

This follows Ashton's description of a logistical system that 'empower[s] computers with their own means of gathering information,' creating a digital proxy to be categorised, organised and manipulated to 'track and count everything and greatly reduce waste, loss and cost' (Ashton, 2009). Key benefits include core value drivers of 'efficiency, productivity, customer satisfaction [and] innovation' (Hoss, 2014, p.5), while surveys of customer attitudes report similar expectations (Bosche et al., 2016, p.1). There is little criticality towards the IoT's domestic application, with research exploring implementation, communication, computational frameworks and architectures, technological components, data sensing and analytics. These are typically innovation dominated (Whitmore et al., 2015, p.267) and driven by technological imperatives (Aguzzi et al., 2013, pp.19–20). This aims to create 'a better world for human beings, where objects around us know what we like, what we want, and what we need, and hence act accordingly without explicit instructions' (Perera et al., 2015, p.585). Within the home this echoes Cisco's IoT advertising vision, manifesting a Smart Home monitoring inhabitant's habits and preferences to make home life easier by pre-empting people's needs by automating lighting, heating, music and entertainment (Deloitte, 2016, p.9; Innovate UK, 2016) to provide convenience, improved quality of life or increased productivity, reduce running costs and provide efficiency (Bothun and Lieberman, 2017, pp.7–8).

From this position 'the Smart Living domain is still primarily dominated by a technology push' with a 'lack of attention to more Socio-Technical and social-organi[s]ational issues' (Solaimani et al., 2015, p.378), as well as Socio-Ethical and political issues. This failure to consider the home beyond logistical concerns continues domestic efficiency biases initiated by labour saving devices between 1901 and 1920 and domestic engineers such as Lillian Gilbreth, who applied production line techniques from factories to the home (Rybczynski, 1987, pp.152–156). However, this has minimally effected the time women spend on domestic work, instead reducing men's housework time (Bittman et al., 2004, pp.412–414). This has echoes in the IoT, where technological driven innovation skews towards technically interested men 'at the expense of the home as lived and living Practice' (Wajcman, 2016, p.130), using interactions as data points to automate tasks, minimising engagement in pursuit of convenience so the 'efficiency doctrine...slips very easily into the empty vessel that is the Smart Home' (McGuirk, 2015).

The simplification of complex social situations as problems with computable solutions or easily optimised processes follows a prevalent Silicon Valley, Solutionist approach. This drive towards 'perfection' through quantification and efficiency (Morozov, 2013, p.5)

minimises Socio-Technical considerations and subjective qualities of home, including happiness, belonging, responsibility, self-expression and critical experience (Sixsmith, 1986, p.287). These qualities can be seen in Beadle and Moore's (2006) exploration of virtues in organisational practices, relating to the internal goods developed in the search for excellence in Practice. The predominant Techno-Centric approach to the domestic IoT more closely correlates with the external goods that relate to prestige, status or money (ibid. p.8) and can be argued to be a manifestation of 'capitalist and other bureaucratic organisations [which] fail to provide the kind of conducive environment within which the virtues may flourish and internal goods...may be achieved' (ibid. p.11).

This issue is evident in this approach, as there is minimal consideration of the impact of pre-responsivity in Technological Deterministic systems (Gunnarsdottir and Ambas-Ayllon, 2012) such as the IoT, which can minimise participation. Keeping '*Humans-in-the-Loop*' is proposed to ensure people's behaviours are incorporated into the IoT's control, tending to support behaviour prediction for effective automation through contextual awareness, decreasing engagement. This removal of human agency is dysfunctional and ineffectual, hiding technological complexity behind invisible interfaces, preventing learning how to function in such systems (van Kranenburg, 2008, p.18) and providing a serious obstacle to the construction of new knowledge (Ben-Ari, 2001, p.57). Within Practice Theory agency is directly visible, with humans knowledgeable, competent carriers of practices who link the elements needed to perform them (Røpke, 2009, p.2493), while conducting practices objectifies the intentions behind these into practical intelligibility (Friedland, 2018, p.1378).

The Techno-Centric IoT is therefore representative of the efficient cause, which creates difficulties in thinking about the institutional quality of such objects (Friedland, 2018, p.1375) and suppresses the internal virtues of finding excellence in Practice, while automation minimises intelligibility, which tells people what makes sense for them to do next given the goals involved in the practice, the emotions and the ways objects invite or trigger behaviours (Spaargaren, et al., 2016, p.6). This approach is based on shallow understandings of how people live and act through Practice, failing to consider the IoT's potential impact on the creation of new material and culture practices informed by evolving social norms (Wajcman, 2016, p.31) and societal and technological changes in these spaces (Gradinar et al., 2019, p.8).

### 3.2.1 Towards a Human-Centric IoT

Human-Centricity in the IoT attempts to address Techno-Centric shortcomings by applying methodologies such as Human Centred Design (HCD) to identify users ‘gestures, rituals, needs and aspirations’ as starting points of designs, developing digital/physical propositions with aesthetic impact to humanise technology (Vitali et al., 2017, p.S2593). Similarly, User Experience (UX) and User Centred Design (UCD) are applied in ‘Discovery’ phases to establish problems and, by working iteratively with users in development through brainstorming, idea generation and validation, aim to develop IoT applications supporting users’ capabilities and contexts to drive development of ‘people-aware IoT applications’ (Fauquex et al., 2015, p.57). Systemic re-evaluation is also used to explore IoT development, where understanding user narratives, IoT usage and contradictions in the broader context of an evolving Socio-Technical IoT comprising ‘humans, human activity, spaces, artefacts, tools and technologies’ may help develop an ‘Internet of Humans’ (Shin, 2014, pp.528–530). This echoes a ‘Humans-in-the-Loop’ perspective, but instead draws key aspects together to build a broader perspective on the IoT that encompasses Socio-Technical frameworks, rather than using humans as inputs for determining automated behaviours.

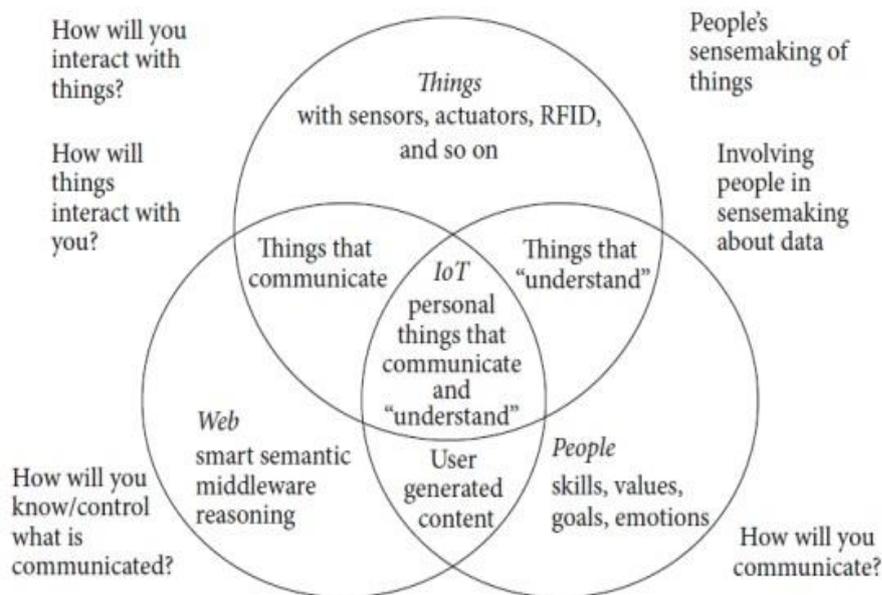


Fig.8: Updated IoT triad, including human perspectives

Arguing Techno-Centric perspectives generally fail to consider their impact on people’s engagement with IoT systems, Soro et al. (2017, p.3) update Atzori et al.’s (2010) IoT model, replacing *Semantic Reasoning* with *People* to incorporate their skills, values, goals

and emotions for sense making of data and user generated content (Fig.8). Further mapping offers a counterpoint to Techno-Centric limitations by including human and Socio-Technical perspectives on Things, Data and People (Fig.9), recognising the intimate and subjective elements of people’s involvement, identifying the social, design and physical challenges involved (ibid. pp.6-11) and how IoT and human agency effect each other.

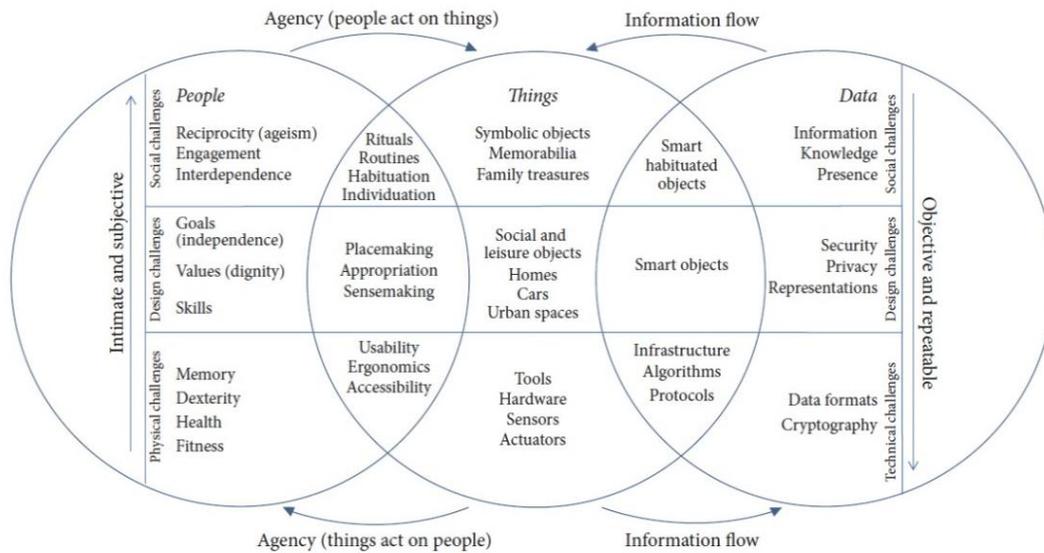


Fig.9: An extended IoT framework incorporating Socio-Technical perspectives

A Techno-Centric IoT focus on Things, Semantics and overlapping aspects means Human-Centric notions of agency, flexibility, multiple users and interconnected objects are often overlooked (Koreshoff et al., 2013a, p.3), so Atzori et al.'s (2010) model is again modified. However, semantic elements are maintained, with people located within this to support sense-making of data, overlapping with sense-making of Things (Fig.10). While useful in communicating key IoT topics to an HCI audience, this fails to meaningfully address people’s involvement in sense-making and its suggested application is rather simplistic. This is recognised in the suggestion Participatory Design (PD) and Tangible Interaction (TI) frameworks (e.g. (Hornecker and Buur, 2006)) are applied to provide Human-Centric perspectives on the IoT.

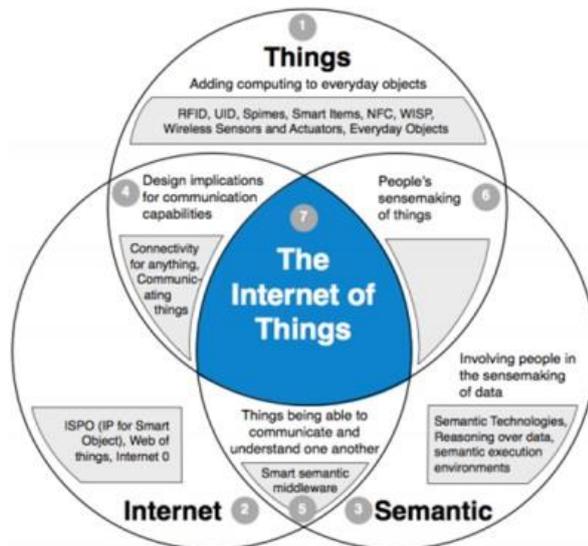


Fig.10: Modified model of IoT paradigms for HCI community

Interactional concerns explore moving from specialised IoT devices towards physical/digital everyday objects, supporting unobtrusive and seamless communication and interaction between these realms (Kranz et al., 2010, p.52). As hidden or incomprehensible services can create unclear coupling between physical and cognitive affordances in IoT devices (Matassa and Simeoni, 2015, p.78), the physicality of interfaces can be used to foster intuitive metaphors, emotional attachment and integration into daily routines (Angelini et al., 2018c, p.3) and support technology individuation (Ambe et al., 2017). Physically engaging user experiences and understanding of complexity can provide opportunities for new applications, increase user understanding and trust (Angelini et al., 2018a, pp.6–7). Physicality can also promote user wellbeing and work-life balance by encouraging slow interaction, reflection, and recovery outside work environments by acting on users' periphery of attention, delineating boundary issues caused by always-on devices (Cecchinato et al., 2016, pp.2–3). This suggests physical engagement is an important consideration in developing an IoT that can respond to new practices through supporting user understanding of devices and services through experience.

However, a design focus on the physical manifestations of IoT artefacts can be limited when developing such complex interactive systems; instead a fundamentally relational model for design and analysis of IoT objects and systems (Ghajargar et al., 2018) informs how smart objects work in different relationships to users, their activities and situations so people are involved as more than sensemakers. While IoT technologies tend to work in 'Comply with Me' and 'Engage Me' relationships (ibid. pp.25-26) proposed 'Make Me Think' relationships (ibid. p.27) can support physical engagement, communication and interactions with other

artefacts and environments, developing long-term, enduring relationships between people and IoT devices as tools for reflection (Fig.11). Considering the IoT as a reflective system supporting relationships between devices is vital, where user’s activity defines relationships between people, devices, and context and sensorial and physical considerations are crucial due to object affordances and user behaviours (ibid. p.32). This moves away from single to multiple objects, connected through digital networks and by user activities, with considerations of non-functional aspects and key interactional concerns.

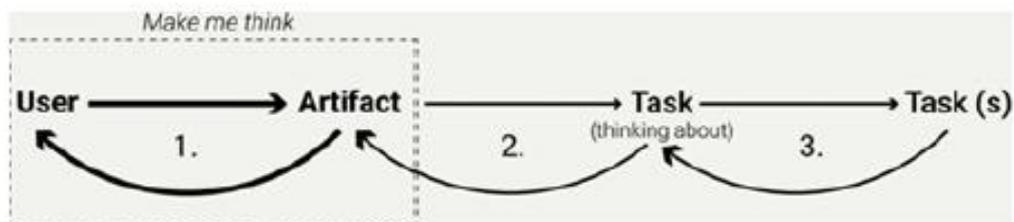


Fig.11: 'Make Me Think' interaction in the IoT

While Techno-Centric 'Humans-in-the-Loop' positions were problematic, Human-Centric approaches have more consideration for user’s long-term involvement. Instead of using past behaviours to determine fixed IoT actions, situational, relational semantics are proposed to determine systemic behaviours, with end user assigned personalised situational semantics suggested to support situationally changeable behaviours, representative of human interaction with objects and user assigned meaning (Loke, 2011, pp.228–230). While exploration of human control in the IoT argues 'identifying models of human behaviour' and 'determining how to introduce human behaviour into control methodologies' can be beneficial (Cervantes-Solis et al., 2015, p.223), 'Theme-discovery' may support higher outcomes of activities, rather than individual rules with this 'Humans-in-the-Loop' approach improving interaction between people and objects (ibid. p.227). 'Human-Dynamics' is used to understand data gathered through individual and aggregated participatory sensing, using statistical analysis and data mining to understand this and support behaviour change in people, rather than determine systemic outcomes (Jara et al., 2013, pp.109–110).

Human-Centric approaches to data are also beneficial in understanding user conceptualisation and interaction with devices, with ethnographic methods applied to investigate behaviour during initial setup identifying communications are clustered around user activities and that visualisation may combat a lack of data awareness that can be attributed to the invisible nature of IoT actions (Vania and Tallyn, 2017, p.9). Similarly, improving user awareness can support understanding of the complexity behind IoT data

transactions to positively impact user perception of IoT systems, as investigated through a modified coffee machine in a series of interviews with users (Pschetz et al., 2017, pp.2969–2971). Placing participants within a context of production and consumption makes them more comfortable about sharing information, an approach using people’s opinions and understandings to provide deeper engagement and personalisation. Critically addressing Technological Solutionism and people’s data experiences in Quantified Self approaches moves away from immediate utility, instead exploring how data representation can ‘highlight complex emotional and social entanglements of a data-driven life...offer[ing] a number of departure points to reimagine the design and use of Personal Informatics and IoT devices’ (Elsden et al., 2015, p.2344). These approaches suggest user actions and opinions, visual clarity, system legibility and contextual experience are important considerations when transitioning from Techno-Centric to Human-Centric data concerns.

### **3.2.2 Human-Centric IoT Smart Homes**

Human-Centric approaches to the domestic IoT have differing concerns to Techno-Centric approaches, illustrated by the most frequent new terms in relevant literature between 2012-2014 being human, interaction, smart, bringing people, process, data and things together, connected and improved quality (Chin et al., 2019, p.52). Placing user preferences, desires and behaviours at the heart of research and development minimises issues including poor understanding, loss of control and privacy (ibid. p.57) so adoption, acceptance and appropriation of new technologies are improved through social perspectives (ibid. p.61), mutually shaping technologies and users interacting in daily routines, activities and behaviours. Similarly, User-Centred methods help identify expectations to inform design recommendations, recognising appliance’s central domestic role in performing daily activities. Recommendations include flexibility in control of managing household activities and maintaining responsibility for automated outcomes to increase user competence, knowledge of household activities via feedback and understanding of machines overruling decision making, as inflexible automation can be detrimental to household experience, advocating adaption to daily routines (Coskun et al., 2018, pp.13–15). Furthermore, a functional focus rarely considers multiple users, values, needs or social constructs that impact on families in the domestic IoT, so End User Development (EUD) methods can allow participants, ‘the experts of their own experiences,’ to undertake reflective development processes, eliciting tacit values and latent needs to inform future IoT development (Verweij, 2019, p.2).

Exploration of embodied and rich interaction with the domestic IoT (Frens, 2017) focuses on human-object interaction, observing that many IoT devices hide complexity by using touch screens as core interaction methods. Instead, as people interact with the world through perceptual, motor, cognitive and emotional skills, exploiting physical qualities may support user's IoT interaction and engagement (ibid. pp.108-109). Four interaction approaches are identified to support the design of IoT interfaces appropriate to function, context of use, and user preference, while multi-specific IoT devices can be tailored for different roles to remain relevant while IoT systems evolve (ibid. pp.111-117). Interactive Intentional Programming (IIP) is proposed as a way of programming the Smart Home in a way that suits user needs. Instead of following rule-based approaches, IIP can differentiate and resolve clashes between intentions, which may support the higher goals of strengthening family connections and prove more effective at capturing information about scenarios and intents to create adaption through long-term feedback loops (Funk et al., 2018a, pp.63–65). This suggests that physical engagement can communicate rich information and flexibility in social scenarios, while maintaining adaptability through long-term feedback and systemic evolution incorporating human engagement.

Focusing on physical opportunities provided by objects may discount 'Internet-enabled forms of informational contact with the human social world' (Smart et al., 2019, pp.556–558), while understanding objects as commodities to 'smartify' may ignore subjective and meaningful associations; instead considering these as 'social objects' can support relations between things, people and environments while building on people's goals, values and object attachment to inform IoT development. Objects possess representative, practical or symbolic qualities and tie into the domestic routines and habits, so understanding activities can inform design and appropriation of IoT objects through UCD and PD methodologies exploring Socio-Material assemblages, the agency of actors and accounts of object interaction (Soro et al., 2017b, pp.618–619). Further critique of logistical IoT approaches discuss object agency, memory content, representation, creation and interaction, IoT applications and social implications. Actor Network Theory (ANT), which describes how the social is constructed through technologies, objects and artefacts with equal agency distributed between human/non-human actants, is proposed for exploring the IoT and is used to understand how object memories in home appliances may inform device's understanding of their use and future behaviours (Kroner et al., 2012, pp.1189–1190).

Social perspectives can also identify emotional and social relations through domestic 'habituated objects,' which support older people's routines and represent comfort through

daily activities and traditions; status or prestige through memory or social interaction; connect people to others and times in their lives and are emotionally symbolic for creativity or relaxation (Vaisutis et al., 2014, pp.1938–1939). Emotional connections to objects used in routines could support developing specific objects for specific relationships, but should respect the underlying emotions and social relations objects facilitate, the communication desired, how to enhance associated memories, respect privacy, safety and trust and when objects should remain unconnected to avoid interfering with associated memories and relationships (ibid. p.1940). Further exploration of associated memories and object biography identify design opportunities supporting interaction with personal, social memories by creating object stories linked to artefacts, leading to rich networks of meaning referencing genealogy or social histories of families and communities (Barthel et al., 2013, p.331). However, a tension emerges between material objects and associated immaterial memories in the IoT even if irreplaceable objects are lost, any associated memories are likely to remain as associated data (Speed, 2011, pp.19–21), so meaning and attachment becomes dependent on social data rather than physical form.

Recognition of home as a critical social space shaped by routines, practices and hierarchies raises concerns about data allowing for inferences to be made about lifestyles, habits, choices and presence of inhabitants, along with other sensitive issues such as food purchases and entry/exit times, perhaps revealing user's religion (Urquhart et al., 2018, pp.321–333). User-Centred approaches identify negative individual and social issues (Coughlan et al., 2012, p.148) including balancing privacy with useful information; flexibility in data sharing; maintaining social dynamics through ambiguity; others interpreting data, balanced with personal space and identity; development of trust with objects and using a range of methods to explore new design possibilities (ibid. pp.154-155). Explicitly situated within HCD, a Socio-Technical perspective is applied to explore data and trust in the domestic IoT (Worthy et al., 2016) as identifying people's concerns is important to understand the basis of attitudes, choices, behaviours and influences on creative technology use, meaning user values are supported through design, specific use cases and social impact to drive engagement (ibid. p.427). A technology probe and follow-up interviews identified the core challenges to IoT design as receding awareness of objects and data collected; social proximity and data control; de-identified, aggregated data, the lack of concern regarding the use of personal data and knowledge of the purpose data serves (ibid. p.432). Similarly, a Human-Centric approach towards domestic IoT privacy applies a Contextual Integrity privacy framework and survey, identifying four values that concerned

participants: Trust, Security, Privacy and Transparency (Apthorpe et al., 2018, p.59:17), with these perhaps allayed by retaining data locally. Similarly, when considering how IoT devices can be respectful, decentralised architecture and local data storage are proposed to keep devices honest and establish user trust (Van Kleek et al., 2018, pp.5–6). Human-Data Interaction is discussed as a valuable way of addressing these issues, supporting insights, tools and techniques that manage human interaction with data and data processing while building trust (Mortier et al., 2014, p.10). Placing people at the centre of data flows helps interactions with pervasive computing systems such as the IoT and associated data through three core principles of legibility, agency and negotiability (Gradinar et al., 2019, pp.13–14).

### 3.2.3 Human-Centric IoT and Domestic Experience

Human-Centric IoT approaches build on criticisms of the Techno-Centric IoT, moving beyond efficiency by considering Socio-Technical user concerns to explore people's attitudes, choices, behaviours and relationships with technology. A range of methods within PD, HCD and UCD are applied to identify people's activities and needs, define problem boundaries and involve user contexts, abilities and opinions in people-aware IoT developments (Fauquex et al., 2015; Soro et al., 2017b; Vitali et al., 2017).

This critically evaluates the functional benefits of the domestic IoT, mapping this design space to avoid negative social impacts by considering multiple users and discovering their values, needs, preferences and skills to inform socially relevant IoT developments through physical engagement, function and context (Frens, 2017; Verweij, 2019). Core concerns related to Practice include agential issues, including the negative impact of fixed automation on engagement with domestic experiences, with recommendations of improving this through routines, which mutually shape the IoT and people's activities (Chin et al., 2019, p.52). Further to this, the home is experienced through involvement in daily domestic activities (Coskun et al., 2018, p. 15), without which there is a negative impact on user's understanding, sense of control and privacy. Specific topics include rich communication through physical interfaces and focusing on user experience and engagement to improve intelligibility, thereby promoting unobtrusive interaction between digital and physical realms (Kranz et al., 2010, p.52) addressing unclear coupling between physical and cognitive affordances in IoT devices (Matassa and Simeoni, 2015, p.78). Furthermore, digital intelligibility is explored by placing users within the context of production and consumption, improving understanding of automated decisions (Pschetz et

al., 2017) or through the use of ethnographic techniques to evaluate people's engagement in setting up IoT devices (Vaniae and Tallyn, 2017).

This focus on agency also links with values/virtues, explored in this perspective through emotional attachment, trust, understanding and involvement in daily activities (Angelini et al., 2018). This extends to the emotional and social relationships between people and objects embedded in routines (Vaisutis et al., 2014) and the biographical nature of objects highlighting personal and social natures, suggesting linking narratives with objects provides design opportunities for rich networks of meaning (Barthel et al., 2013). Experiential, emotional and social elements may improve confidence in sharing data (Elsden et al., 2015) as Trust, Security, Privacy and Transparency are core user concerns (Apthorpe et al., 2018, p.59:17), with decentralised architectures and locally stored data suggested to address these (Van Kleek et al., 2018, pp.5–6). HDI is proposed to build trust by centralising people within data flows (Mortier et al., 2014, p.10), while principles of legibility, agency and negotiability (Gradinar et al., 2019, pp.13–14) can improve human understanding and participation with IoT data. Situationally changeable behaviours, user assigned meaning (Loke, 2011, pp.228–230) and 'Theme-discovery' are suggested to improve interaction between people and objects (Cervantes-Solis et al., 2015, p.227), while 'Human-Dynamics' may support behaviour change in people, rather than determine systemic outcomes (Jara et al., 2013, pp.109–110).

The IoT's wider ecologies, Socio-Material assemblages and shared agency (Soro et al., 2017b, pp.618–619) are explored with models bridging Techno-Centric and Human-Centric perspectives incorporating people's skills, values, goals and emotions (Soro et al., 2017) to support human sense making of IoT outcomes and effective IoT application (Koreschhoff et al., 2013). This continues a problematic '*Humans-in-the-Loop*' approach where people or their activities are incorporated into sense making, albeit with a Socio-Technical awareness of the potential negative impact the IoT could have on long-term engagement. Further to this, Smart et al. (2019, pp.556–558) reject the understanding of objects involved in routines as commodities to 'smartify,' instead considering these social objects with temporal, material, mental, social and cultural dimensions supporting people's aspirations and goals. Ghajargar et al.'s (2018) ecological perspective further establishes the importance of recognising relationships between multiple objects and people engaged in practices as assemblages sharing agency, while Kroner et al. (2012) explore the IoT using ANT with the social constructed through the equal agency of technologies, objects and artefacts distributed between human/non-human actants.

Human-Centric IoT developments focus on the role of users, their values, engagement and how practices can support these and the domestic experience. There is greater recognition of the importance of human agency in engaging with the IoT to shape social and material structures, sharing some commonalities with Practice where this is a 'mutually constitutive relationship between objects and human actors: actors acting on things, and things triggering actions and 'producing' agency' (Spaargaren, 2011, p.819). This also provides greater legibility of the IoT's complex data driven elements, previously masked by separating IoT ends and means (Robbins and Giaccardi, 2019, p.25). These are linked, as for human activity to remain a fundamentally open event the world at the point of action should be intelligible, while conduct should never be fully determined and predictable (Nicolini, 2017, p.20). Moving towards a systemic approach showed some commonalities with Practice-Oriented, with human/non-human agency in the IoT's constellations understood as equally important and the flat ontology of ANT applied to understand co-construction of the social. This is important, as material arrangements carry meanings jointly with the practices and places they are involved in (Friedland, 2018, p.1366), where there is an emphasis on the interconnected ensembles of embodied Practice, allowing actors to perform the world through body/mind that carries and carries out the social, dissolving the dichotomy between mental and physical. Furthermore, Schatzki (2016) discusses flat ontologies in relation to Practice, where social phenomena are all on one level, bundled through practices and material arrangements consisting of bodies, organisms, artefacts and objects of nature (ibid. pp.32-33). Therefore, while a Human-Centric IoT approach is useful in changing a technical focus towards human agency, Practice meaning and IoT values and starts to address issues relating to Practice ontologies, moving *Beyond a Human-Centric IoT* will support greater understanding of the integration of the IoT's Techno-Centric nature with qualitative domestic experiences by exploring alternative perspectives that focus on Practice, shared agency and the internal values of these social activities.

### 3.3.1 Beyond a Human-Centric IoT

While Human-Centric IoT perspectives proved useful in moving beyond Techno-Centricity, prioritising people minimises IoT agency and associated considerations, with socially located and systemic perspectives beginning to address this. Users commonly perceive the IoT as an anthropocentric system and are concerned about object agency replacing human agency (Jia et al., 2012, p.1186); however, moving *Beyond a Human-Centric IoT* is important when considering the agency of non-human actors, which complicates people's role and

position in the IoT (Cruickshank and Trivedi, 2017a, p.564). Object Oriented Ontology (OOO) and New Materialisms can support flat ontologies accommodating non-human agents where all entities are equal (Cruickshank and Trivedi, 2017a, p.573; Lindley and Coulton, 2017, p.3) and ‘problematize the human as the unit of concern in design processes, especially when designing for the IoT’ (Cruickshank and Trivedi, 2017b, p.S4167). More-Than Human Centred Design (M-THCD) similarly moves beyond Human-Centricity by reframing the complex interdependencies between humans/non-humans in the IoT by considering people as another thing within the IoT’s ‘hyper connected and data-mediated assemblages’ (Coulton and Lindley, 2019, p.466). A ‘constellation’ metaphor is proposed (ibid. p.472) as a way of designing for the IoT within OOO understandings, allowing devices to exist in their own right without human perception and become significant through involvement in wider ‘constellations’ incorporating non-tangible IoT elements. This is further explored to clarify the intersection of design and philosophy using Design Fiction, with OOO proving ‘a generative and analytical tool to help understand the design context’ and key to ‘deconstructing the problem [and] assembling possible solutions’ (Lindley et al., 2018, pp.13–14). These approaches indicate moving *Beyond a Human-Centric IoT* can help meaningfully incorporate, but not prioritise, people within the IoT while considering wider human/non-human assemblages or constellations.

Similarly, OOO and ANT can inform understanding of distributed agency in the IoT; in the former, objects are real or not independent of relations and have equal standing, in the latter the object’s reality is defined by relations with other actors, with constant dynamic transformation of things through coupling (Cila et al., 2017, p.449). Focusing on agency may benefit IoT design and research by providing new opportunities for designing without only concentrating on people, with proposed categories of IoT agency including the Collector, Actor, and Creator (ibid. p.456). Exploration of this shared agency considers co-performance, conceptualising the role of ‘artificial agency’ in everyday life through turning to Practice (Kuijjer and Giaccardi, 2018), again identifying an anthropocentric bias in traditional understandings of Practice, where it is thought people perform, interpret and make decisions while artefacts passively allow the actions of practices to be conducted. A case study of a thermostat identifies co-performance can support understanding the role of digital artefact’s daily life, provide new design theories considering differing aptitude between co-performers and sensitive appreciation of differing ideas of appropriate Practice (ibid. p.10). Further questions around who or what the objects of the IoT are explores the IoT’s values, combining previously discussed Socio-Technical approaches with those where

humans/non-humans are considered equal in an approach informed by OOO (Nicenboim, 2015). Human/non-human agency can be drawn together through understanding objects as active participants in human social life, with Practice supported by artefacts; however, digitally augmented objects blur users/people/things so ‘users’ are no longer solely human. *Social Things* account for this distributed agency, with OOO approaches argued as more suitable than PD ones (Nansen et al., 2014, pp.90–92).

Focusing on IoT physicality through ‘Re-thingifying’ describes the IoT as an ‘emerging set of material problems’ involving understanding materiality as Things and environments converging to form specific associations and experiences (Gabrys, 2016, pp.12–16), while physical interaction with IoT products connected to specific activities or practices can intermingle these culturally to broaden understanding of products physical and digital capabilities (Knutsen et al., 2011, pp.202–203). Identifying the automation and device paradigm common to Techno-Centric IoT products as minimising engagement, a proposed model (Fig.12) positions physical *Traces* as the keystone of interaction between materials, practices and people. Considering these in a Socio-Ecological context with physical feedback can lead to co-constituted reciprocity between these aspects and technology, which will become more important as digital capabilities are added to objects (Robbins et al., 2016, pp.1–9). This again moves beyond Human-Centricity, considering an ecological perspective incorporating engagement and legibility through the convergence and shared capabilities of people and IoT devices, material elements and practices.

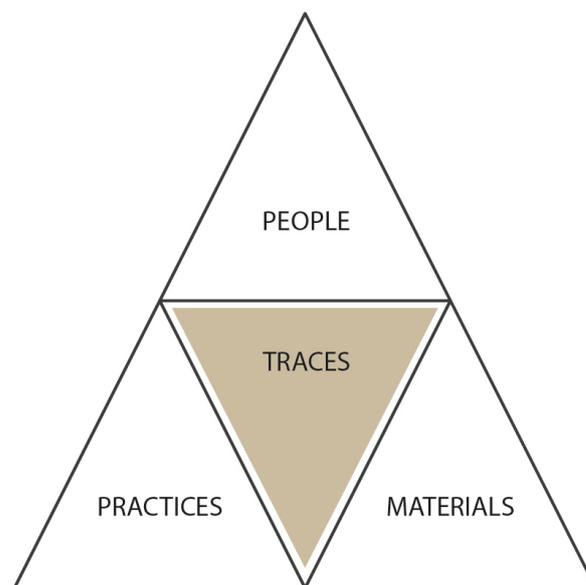


Fig.12: Traces joining Socio-Ecological elements as a keystone

Direct exploration of Practice in integrating the IoT into daily life suggests 'commensurability' is important, allowing IoT practices to correspond with daily practices (Giaccardi, 2015, p.28). Practice can help interaction correspond with people's physical and social actions; Practice foundations can support intimate relationships between physical objects and the practices performed using them (ibid. p.30). Practices are connected and mutable, so arranging these in open-ended ways through assemblages of objects, practices and values can support rich, material interactions based on and around practices, rather than overlaid onto them, allowing digital and physical to be designed as intimately connected parts of reality (ibid. p.31), with parallels to previous ecological IoT perspectives. Practice can also support appropriation through interaction tailorability, highlighting dependencies between practices and supportive infrastructures that become invisible to practitioners (Ludwig et al., 2017, p.4), while collaborative appropriation (Ludwig et al., 2019) addresses social dimensions through Communities of Practice (CoP) (Wenger, 1998). A proposed Internet of Practices (IoP) resolves IoT adoption through users re-imagining the relationship between technology and their practices, where the IoT acts upon internal (working and behaviour of technology), Socio-Material (location, environmental and data usage) and task/process (purpose of device use) contexts (Ludwig et al., 2019, pp.5-7). This recognises the practices and communities surrounding device use, with the IoP overlaid onto the IoT to support a community (Fig.13) by, for example, sharing knowledge through an IoT camera to allow novices to directly appropriate expert practices, thereby tackling deskilling and enhancing skill competency and diversity, even across cultures (ibid. pp.11-13). This indicates Practice may be valuable in reframing the IoT, bringing together concerns around IoT engagement, physical and digital representation, activities and experience, sociality and agency, all within ecological perspectives that recognise humans without prioritising them.

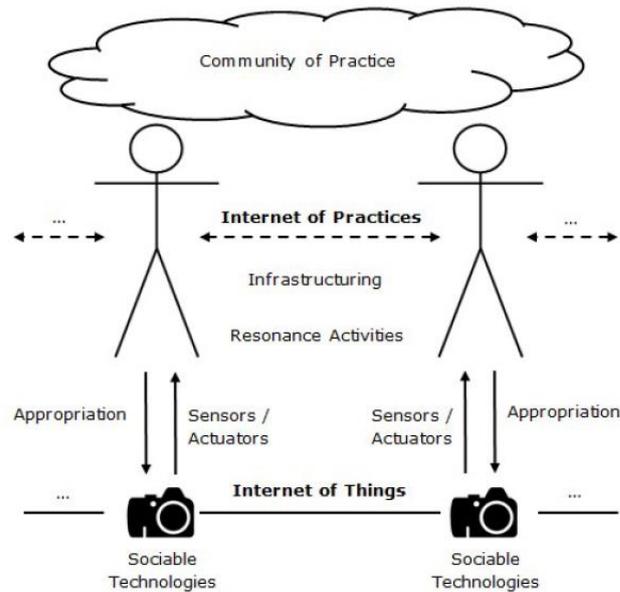


Fig.13: Modelling of IoP, where activities supported by objects build community

### 3.3.2 Beyond-Human Centricity in the Domestic IoT

Previously discussed reviews of Smart Homes identified Techno-Centric approaches can be detrimental to household experience if supplanting pleasurable activities and social roles in the home, suggesting IoT solutions should increase user competence in household practices (Coskun et al., 2018, p.15). Additionally, practices, routines and rituals were applied within Human-Centric approaches to integrate Socio-Technical and Techno-Centric concerns. While some exploration of Practice and behaviour change follow efficiency paradigms (Yang et al., 2017; Mustafa and Ku Azir, 2017), Practice-Oriented refocuses typical Smart Home understandings, identifying domestic qualities as security, control, activity, relationships, continuity, identity and values (Gram-Hanssen and Darby, 2018, p.95). While not always opposing these, typical Smart Homes may not consider them; furthermore, reconciliation between Smartness and Home is difficult, in particular boundaries of home and control (ibid. pp.99-100). Local IoT systems need designers to consider dynamic structural and behavioural complexities in artefact networks that act as ecologies, located in people's personal spaces and dealing with specific, situated knowledge that can influence subjective relationships with the world and others through objects acting with agency (Funk et al., 2018b, p.4). Therefore, Practice-Oriented in relation to the domestic IoT may address concerns such as social and systemic perspectives, shared agency, user engagement and involvement.

Similarly to previous criticism of efficiency paradigms, domestic automation is identified as potentially impacting upon Practice by redistributing control so objects control people

(Strengers, 2013), with later exploration detailing human/non-human actants in the context of energy consumption practices (Strengers et al., 2016). This advocates for understanding the home as assemblages of Practice, where agency shared between humans/non-humans creates distributed, co-constituted practices (ibid. pp.776-777) following Shove et al.'s (2012) model of Practice as comprising materials, meaning and competencies. Furthermore, explorations of energy use practices in Smart Homes describes these as 'socially-shared bundles of doings and sayings constituted by technologies, skills, meanings and rules,' (Wilson et al., 2015, p.5) applying this perspective to construct activity ontologies and draw inferences about appliance usage patterns (ibid. pp.13–14). This is a further attenuation of the application of Practice to understand the domestic in concert with IoT technologies, bringing together issues of shared human/non-human agency, engagement and development in practices and subjective qualities including sociality and the meaning of activities.

Exploration of sharing practices in the IoT (Garg and Moreno, 2019) identifies who shares Things and why, the preferences and constraints of sharing IoT devices and how this affects further sharing. Practices of shared use comprises motivation, coordination among multiple users through physical placement and accommodation of user needs by supporting trust between co-users through accountability (ibid. pp.44:9–12). IoT devices should be contextually aware, self-adaptive, provide only relevant information and allow users to choose a level of machine autonomy to support individuals needs and long-term use (ibid. p.44:18). Furthermore, in the domestic space people build assemblages of Things across categories through daily activities, which when methodically conducted are key to ordering domestic life (Crabtree and Tolmie, 2016, p.1746). This allows people to recognise what has or is being done, so incorporating this may provide IoT devices the same legibility (ibid. pp.1746-1747). From this perspective, practices conducted by people using objects order the home, and so can support the development of a domestic IoT that has commonalities with people's current ways of engaging with home.

Moving from the IoT's common control paradigm by exploring situated, fluid assemblages of domestic materials, Thing-Centred perspectives explore how new objects can co-perform tasks and convey information for interpretation in later interactions. This also seeks to prompt reflection on potential conflicts between Things and the consequences of interpreting people's behaviours (Nicenboim et al., 2018, p.1). Further non-anthropocentric exploration uses 'Autographers to access a thing perspective' on everyday home practices, with logging cameras attached to kettles, fridges and cups to reveal relationships between

these and other objects (Giaccardi et al., 2016, p.379). ‘Thing ethnography’ led to understanding the IoT as ‘connected resources’ capable of changing functional behaviours to suit new circumstances where unanticipated use or new combinations of objects can inform design development by mining IoT datasets, leading to ‘Thing-centred design’ (Giaccardi, 2018, pp.71–72). This moves on from anthropocentric perspectives, focusing on co-performance within assemblages of objects to support legibility and reflection on behaviour; however, this perhaps over-privileges objects within a Practice focus.

Social Practices in co-housing contexts frames the impact of technology, material relationships between people and things and how this sustains community life (Jenkins, 2018, p.671); similarly, practices in non-stereotypical homes are explored through ethnographic methods to provide a starting point for developing bespoke domestic IoTs considering porous boundaries, indoor-outdoor, neighbourly relations of ‘seeing while being unseen’ and experiencing subtle connections (Desjardins et al., 2019, pp.4–7). The rarefied practices of rituals constituting the ‘functional and emotional landscape of the home’ (Bichard et al., 2015, p.6) are used when focusing on families regularly separated due to work travel. Intending to maintain social relationships at distance, Cultural Probes (Gaver et al., 1999) inspired five activity, space and family specific IoT *Ritual Machines* (Bichard et al., 2015, pp.71–74). While these proved meaningful for participants (ibid. p.81) their specific purposes meant there was minimal opportunity for these to become part of larger assemblages and wider practices. These approaches are valuable in identifying the meaning of Practice and sociality outside of single or typical domestic spaces, but use these insights as starting points for concepts while failing to consider Practice elements, IoT constellations and human/non-human agency and competency.

### 3.3.3 Humans, Non-Humans, Practice and the IoT

*Beyond a Human-Centric IoT* identified a number of non-anthropocentric perspectives to move from humans as the central concern when designing for the IoT including OOO and **New Materialisms (e.g. (Bennett, 2010))** to support flat ontologies (Cruickshank and Trivedi, 2017a); M-THCD, which draws upon OOO and ANT to propose IoT constellations incorporating tangible and non-tangible elements (Coulton and Lindley, 2019) or exploration of ANT in the IoT to understand distributed agency (Cila et al., 2017) **and the ways humans/non-humans can be objects and carriers of Practice (Gram-Hanssen, 2019).** OOO is also used to investigate who or what objects are in the IoT, or to propose Social Things, which account for distributed agency when users include non-humans (Nansen et

al., 2014). These flat ontologies ensure equal prominence is given to technical and human IoT perspectives, supporting novel understandings of this topic and with similarities to 'Practice Theory as social ontology' which 'holds that the realm of the social is entirely laid out on a single level (or, rather, on no level)' (Schatzki, 2016, p.28).

Again identifying Techno-Centricity can minimise engagement, the legibility provided by material traces are proposed as a keystone between people, materials and Practice in a Socio-Ecological IoT context (Robbins et al., 2016). *Re-Thingification* (Gabrys, 2016) similarly focuses on encountering materiality as a process of things and environments coming together and providing non-humans with agency, without explicitly discussing Practice. Agency in the IoT is more meaningfully explored through a 'Practice-as-performance' lens, where co-performance between humans/non-humans moves IoT understanding beyond Human-Centricity (Kuijer and Giaccardi, 2018); OOO frames how fluid assemblages of domestic materials in Thing based perspectives can help understand object co-performance (Nicenboim et al., 2018), while exploration of ANT in the IoT supports understanding distributed agency (Cila et al., 2017). Further exploration of Practice engagement is useful in recognising the rich material arrangements involved in practices, the importance of IoT practices being grounded in everyday life and keeping practices open ended to allow for development and dynamism (Giaccardi, 2015) through object 'constellations' that connect digital/physical realities (ibid. p.31). However, this fails to more deeply explore the relationship between human/non-human agency, values/virtues and the role Practice can play in connecting these topics to situate the IoT in the home.

Techno-Centricity tends towards automation supplanting pleasurable experiences and social roles in a manner detrimental to experience of home (Coskun et al., 2018, p.15). Within the domestic space, practices are used to frame some projects and related technological, social and material, detailed using ethnographic methods (Bichard et al., 2015; Desjardins et al., 2019; Jenkins, 2018), where people's practices are used as inspiration for concept development instead of applying Practice-Oriented to interrogate and design for the relationships between these elements. However, these do identify some useful values relating to the IoT and the domestic space (community, porous boundaries, functional and emotional elements) that begin to explore the social role of Practice and how the IoT can support this. Further Socio-Technical approaches explore the values/virtues of Practice and the IoT, framing the motivations behind engaging and innovating practices with the skill levels involved in using objects, perhaps supporting appropriation through tailoring interaction, supportive infrastructures and collaboration to create an IoP (Ludwig

et al., 2019, 2017). Furthermore, Practice can focus on domestic qualities (Gram-Hanssen and Darby, 2018) providing understanding of the IoT as a dynamic, behavioural network of artefacts with agency that rely on situated knowledge to influence subjective relationships with others (Funk et al., 2018b), reorienting the IoT's role in the home through Practice.

These approaches indicate the applicability of Practice-Oriented in integrating Socio-Technical concerns similar to those in *Towards a Human-Centric IoT*, but through a systemic perspective balancing human/non-human actants, incorporating the values/virtues and intent of Practice while providing legibility, allowing engagement and supporting innovation. A number of flat ontologies are proposed, but the flat ontology of Practice seems to be effective in bringing these concerns together coherently, most effectively in exploring the impact of redistributing control on Practices and human/non-human actants (Strengers, 2013; Strengers et al., 2016). The IoT enabled home can therefore be understood as a space made up of assemblages of distributed, co-constituted practices constructed from agency linked materials, meaning and competencies, following Shove et al.'s (2012) model.

### 3.4 Common Concerns, Criticisms and the Knowledge Gap

This review has explored Techno-Centric, Human-Centric and Beyond Human-Centric approaches to the IoT. Techno-Centric research in relation to the IoT tends to take an operational position '...solving various operational and planning problems of business and industry' (Kothari, 2004, p.6), focusing on implementation to develop interconnected physical objects with digital identities that communicate, sense and make sense of their environment and act without human intervention. Interaction between humans and computers is understood as an exchange of information where modelling these relationships can support optimisation (Harrison et al., 2011, p.386), improving efficiency and productivity through automated logic, following core concerns of communication, computational architectures, hardware, data sensing and analysis, with social interaction improving information dispersal. Similar interests emerged in domestic application, monitoring inhabitant's habits and preferences to automate heating, lighting and other services, aiming to make life easier and minimise cost and inefficiency by placing agency in IoT devices and systems.

This approach originated in supply chains and follows a logistical, industrially focused model where efficiency and control are central. However, this technical thinking can 'obliterate the otherness of certain aspects of the world' (Araya, 1995, p.235) in a form of

'Technological Determinism' (Brynjolfsson and Macfee, 2014). Issues 'include the ability to learn, remember and think for ourselves' (Rogers, 2006, p.406); that automation complacency and bias can lead to a false sense of security and over-reliance on these types of systems (Carr, 2016, pp.66–68) and duplicating human capacities leads to atrophy (Brende 2004, p.229). Furthermore, these 'windows through which we...experience, organise and interpret the world' can hide implicit biases in the underlying system, running the risk of users becoming programmed (Rushkoff, 2010, pp.132-133), while Smartness disrupts existing understandings of home, negatively impacting on social imagination due to structural similarities to the Panopticon (Mulgan, 2014). This technological enhancement focused on efficiency may be relevant within industrial applications, but in the domestic space a data driven, Solutionist perspective reduces the space and time of people's inner dialogue, undermining the ability to think and removing responsibility (Pereira et al., 2013, p.26) so people's only commitment becomes allowing machines and their producers to keep optimising their lives (ibid. p.20).

However, 'inefficiency, ambiguity and opacity...are not in any sense problematic [and] ...are often virtues in disguise' (Morozov, 2013, p. 6), corresponding with criticism of modern science's representation of nature as entrapment through a 'calculable coherence of forces' (Heidegger, 1954, p.10), dependent on capitalism, where 'object and information and nature as resource are linked to value as price' (Friedland, 2018, p.1384). The primacy of the efficient cause focuses on external goods or goods of effectiveness, where something is done for the sake of something else (e.g. money, prestige), instead of internal goods of excellence. This also obscures the institutional quality of objects, which are not just defined by people's subjectivity and the object materiality, but ties together desire and action (ibid. p.1375). Optimisation of actions against goals, as in the Techno-Centric IoT, can limit the pursuit of internal goods and the opportunity to learn or create new possibilities in the circularity between acting and understanding, therefore becoming predictable, repetitive (Sweeting, 2015, p.7) and restricting the development of goods of excellence, the virtues of Practice and the movement towards a person's potential.

Human-Centric approaches instead focus on people's understanding of IoT behaviours and data, meaning making and meaningful experiences, quality of interaction and physicality, behavioural change, emotional and social perspectives to improve engagement with and legibility of the IoT. This correlates with Krippendorff's (2004, p.43) suggestion of abandoning Technological Determinism underpinning industrial perceptions of human-machine interactions and shifting from object- to human-centred research and design.

Within this approach there is a focus on ensuring the object of design meets the user's needs (Sanders, 2002, p.1) through understanding their desires and experiences to develop outcomes physically, perceptually, cognitively and emotionally compatible with a full range of human characteristics (Giacomin, 2014, p.610). However, Human-Centric Design tends to meet users' needs or solve their problems by producing a solution that best fits (Sanders, 2002, p.1), which in the IoT focuses on application and usability.

Human-Centric perspectives understand activities as constituted by relationships between multiple objects and people, by considering temporal, material, mental, social and cultural dimensions, social dynamics of shared resources, personal space and ownership, with exploration of routines, rituals and practices used to explore domestic activities. This follows a Human-Centred Design perspective transition from object centred, technological deterministic understandings of machine/human interaction towards those focused on intrinsic motivations (Krippendorff, 2004). Ghajargar et al. (2018) apply this relational approach to define relationships between users, computing artefacts and situations and sensory and physical considerations, to shift IoT agency to a 'Make Me Think' model (ibid. p.11) and support people's experience and action. These explorations move away from Techno-Centric concerns towards incorporating people's engagement, values, skills, goals and agency within the IoT through social objects, improving the '*Humans-in-the-Loop*' concept in an attempt to foster interaction between people and objects in situationally dynamic circumstances, supporting user agency and understanding of machine decision making to move beyond fixed automation.

There are similarities in this to the internal goods of Practice, which don't reference an outcome or result, instead focusing on, for example, having fun, enjoyment and involvement. As such, these projects tend to move beyond the automation paradigm, with further intelligibility supporting the internal values of excellence in Practice instead of prioritising the IoT's external utility benefits by concentrating on the values of the domestic space and people's experiential, emotional and social concerns. However, using ethnographic techniques to identify practices as starting points of designs can be criticised as 'at best...provid[ing] a static snapshot of symptoms and outward manifestation of the multiple and typically collective dynamics at stake in making...configurations that work' (Shove, 2005, p.3). Practice-Oriented avoids treating individual skills, competencies and values in isolation, instead considering the connections between and origins through these elements into account (Spaargaren, et al., 2016, p.6) to support meaningful understanding of and design for these aspects. Furthermore, due to inherent disciplinary biases, Human-

Centric approaches privilege people over the IoT, which is problematic when agency is shared amongst human/non-human actors; instead due to digital/physical hybrids there is a need to redefine human integrity and agency through new framings (Pereira et al., 2013, p.27).

Beyond a Human-Centric IoT therefore explored approaches that don't position humans as the central concern, with the flat ontologies of OOO, ANT, M-THCD, Thing-Centred and Practice-Oriented perspectives applied to balance technical and human IoT perspectives to give equal importance to both. Through exploring distributed agency, co-performance and social relations between things, people, data and other elements comprising the IoT's constellations and Practice assemblages these approaches apply novel, non-hierarchical framings supporting redefining human agency and integrity. A Practice-Oriented seems most applicable in providing new perspectives on agency and values in the IoT: while Human-Centric approaches, IoT constellations and lived practices are a concern, instead of human perspectives on practices providing starting points for design, the ways these are constituted and relate to the IoT were explored, providing opportunities for designing without focusing on people. There are commonalities in the flat ontologies underlying both Practice and ANT, however 'ANT sees the social as comprised only by associations, [instead of] comprised of practices and arrangements' (Watson, 2016, p.10).

When related to the practices of the domestic space, this challenges Techno-Centric and Human-Centric approaches by considering the distributed agencies of humans/non-humans as performers and materials of practices, redefining who and what exercises agency and its distribution within assemblages of Practice and altering divisions of roles and responsibilities between humans/non-humans. However, humans/non-humans are not considered identical and the agency exerted by each differs (Kimbell, 2012, p.144), so incorporating technology in Practice necessitates reconciling technology's autonomous impact with the assumption that human agency makes the ultimate difference in the world by understanding the impact and effect of human agent's interpretation and use of objects and the impact and effects of objects as constituting practices (Spaargaren, 2011, p.817). Shove et al.'s (2012) Practice framework conceptualises distributed, co-constituted Practices through linked assemblages of materials, meaning and competencies, following the ANT perspective that objects/actors are defined through relationships to other objects/actors, with a constant dynamic transformation through coupling as they extend the range of their effects (Bryant, 2009). This positions practices as 'organised constellations of material activities performed by multiple people' (Nicolini, 2017, p.14).

Furthermore, Practice's role in constructing place is addressed within radical constructivist thinking and how spatial experience can be understood as a design activity by the experiencer, bringing together physical and intangible elements (Sweeting, 2018). This incorporates IoT constellations and Practice assemblages as equal, active participants, balancing agencies and supporting co-performance in lived practices, moving beyond both Techno-Centric and Human-Centric perspectives.

Practice-Oriented understands social reality is fundamentally constructed by practices, so the social world is brought in being through everyday activity (Feldman and Orlikowski, 2011, p.1241). Embodied practices allow the actor to perform the world, making this a body/mind that carries and performs the social, blending inside/outside and mental/corporeal (Blazevic, 2011, p.61) in an open event where performance is never fully determined, impossible to predict and always potentially new (Nicolini, 2017, p.20). This means there is skill and judgement relating to these 'mediated object-oriented performance of organised set of sayings and doings...[with] a history, social constituency and...perceivable normative dimension (Nicolini, 2017, pp.20–21). This expands human capacities through the pursuit of virtues internal to acts (Lambek, 2008, pp.139–151), an acquired human quality allowing people to achieve practices, which over time are instrumental in an individual's search and movement towards their *telos* (full potential or end goal) (Beadle and Moore, 2006, pp.8–9). These 'virtue ethics move beyond acts...to character; [shifting] focus from having, to doing, to being... ask[ing] not how we can acquire objects of value nor how we can do what is absolutely right, but how we should live and what kind of person we want to *be*' (Lambek, 2008, p.134).

## 4 Research Approach

Using Practice-Orientation as a research framework could address concerns around integrating the IoT into the home by exploring agency and values/virtues to support new ways of understanding the IoT. Researching people's Domestic Practices (DP) and their relation to the IoT will be conducted using: Practice Theory and Orientation; Participatory Action Research (PAR) as an overarching framework; Participatory Design (PD) as applied methodology; and specific applicable Methods.

### 4.1 Practice Theory and Orientation

While Practice was previously discussed, this will be briefly defined for clarity. Practice Theory is a 'development of new organizing concepts for theory[s]ing social life' viewing this as a 'nexus of Practice' where sociality depends on and constantly changes the wide range of human activity (Schatzki, 1996, p.284) and 'Practice together with materials constitute and house social phenomena' (Nicolini, 2012, p.173). Contingent on temporality and spatiality for organisation and coordination of action in present and future (Schatzki, 2009, pp.35–48), Practice affects social order and individuality, so people understand the world through practices to develop a coherent sense of self (Warde, 2005, p.148), or by newcomers inculcated into mature practices, impacting on individual's values through socially situated activities (Lave, 1991; Wenger, 2008; Nicolini, 2013, p.139). This is particularly relevant to re-evaluating the IoT, incorporating the role of the senses in engaging and analysing Practice, the role of Practice itself and the ways in which spatiality and the environment can enable and modify Practice (Schatzki, 1991).

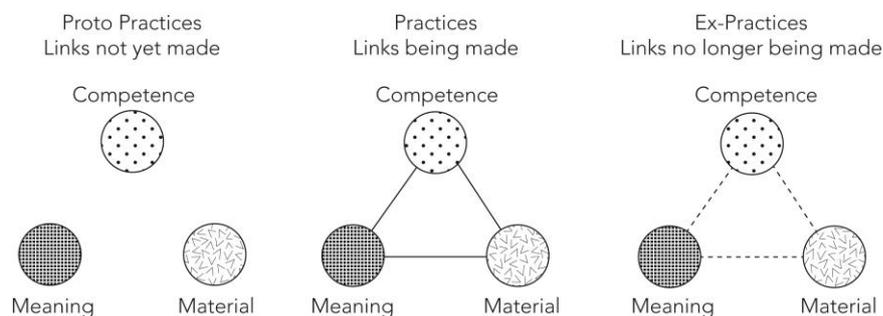


Fig.14: Practice elements and linkages

Shove et al. (2012, p.25) model Practice (Fig.14) as formed by the 'independent relations between material, competences and meanings' that remain effective by the links between these elements being renewed repeatedly by human involvement – however, Watson (2016, p.5) states this says little about how power operates, which is important as Practice

Theory can be argued as about the shaping and possibility of action. Practices are dynamic on-going accomplishments where new materials and ways of doing can be incorporated (Fig.15); these happen in the past and present and imagining new ways of doing and having can inform future practices to incorporate new materials and competencies in a dynamic, constantly developing manner (Shove et al., 2007, p.36).

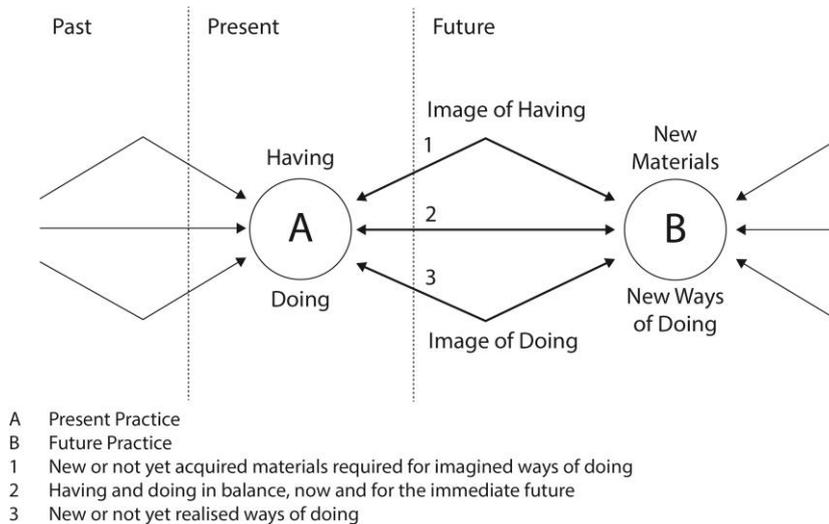


Fig.15: Practice dynamism and development

It is important to distinguish habits, routines, rituals and practices: habits are individualistic, idiosyncratic routine actions in the 'I-Mode', lacking reflection and only making life easier (Giovagnoli, 2017, p.1). Routines are similar with different functions according to individual or societal contexts (Giovagnoli and Dodig-Crnkovic, 2017, p.1) moving from repetition to situational, collaborative work supporting procedures (Crabtree et al., 2003, pp.210–211). Both can contain ritual aspects, for example, the habit of drinking morning coffee can contain ritualistic acts and decisions (Giovagnoli, 2017, p.1); but rituals can be sacred or profane. Religious rituals promote belonging through individual involvement in larger experiences, through shared group focus towards a respected object to create a specific mood (Larsen and Tufte, 2003, pp.91-92) or acts not entirely encoded by performers (Innis, 2004, p.199). These 'We-Mode' Practices (Giovagnoli, 2017, p.2) attribute symbolic value to objects or procedures to signify something else (ibid. p.3).

Practice-Oriented has been applied to the IoT, with Shove et al.'s (2012) model directly applied in a number of projects (Strengers, 2013; Strengers et al., 2016) with other work exploring related elements (Giaccardi, 2015; Ludwig et al., 2019; Robbins et al., 2016). Practice explores new IoT understandings through a flat ontology of distributed, co-

constituted Practice elements, supporting linkages between digital and physical realms, recognising the rich material arrangements of practices, shared human/non-human agency, Practice engagement and innovation through the IoT. Practice is particularly relevant to the home, which can be considered an 'environmental experience of space' encompassing form, meaning and activities where the 'essence of place is defined in social, spatial aspects and environmental services' (Briganti and Mezei, 2012, p.3). Ingold (2008) considers place a 'meshwork,' with Pink (2012, p.55) using this to bring together human/non-human agency, suggesting practices are lived, modified and understood through this to construct places. This supports understanding the IoT in the domestic as a dynamic, behavioural artefacts-with-agency network, reliant on situated knowledge to support subjective relationships, incorporating object use and meaning, social interaction, longitudinal Practice development, and integration of social and technical concerns to build Practice assemblages connected through use and interaction.

The core themes of agency and values/virtues are also linked through Practice, which can be understood as arrays of activities connected through people's agency, with competency achieved by 'skilled agents who actively negotiate and perform practices in the course of their daily lives' (Balke et al., 2014, p.1), 'involving practitioners making a series of skilled movements that in combination lead to the accomplishment of a task' (Pink, 2012, p.41). Competency, or the knowing that results from being a 'competent member of a Practice,' can link multiple sets of doing and actants through shared understandings, leading to intelligibility in Practice (Nicolini, 2013, p.165). Practical knowledge emerges from personal, embodied experience (Lizardo and Strand, 2010, pp.211–212); cognition and sense making emerge from Practice and this knowledge is shared with others and 'inscribed in objects, embodied and only partially articulated in discourse' (Nicolini, 2013, p.222). Non-human agency is understood as inherently connected to and centred through objects (Schatzki, 2002, p.111), while a review of contemporary Practice Theory indicates things should be considered as parts of Practice (Røpke, 2009, p.249), shaping agency and enabling action (Shove et al., 2007, p.4). This also recognises technological developments can de-skill people as competencies are distributed between people and technology (ibid. pp.54–55), while Akrich (1992, pp.207–209) argues artefacts can 'script' user's performances and carry aspects of Practice; however, when the knowledge that is associated with objects disappears 'they continue to exist but not as elements of living practices' (Shove et al., 2012, p.122). The importance of developing competence, which can be understood as practical consciousness, deliberately cultivated skill or shared understandings of good

performance (Giddens, 1984), in collaboration with objects with non-human agency therefore relates to internal values/virtues of Practice. External values relate to utility, but values internal to practices relate to human capacities (Lambek, 2008, p.146), so Practice-Oriented can support changing perceptions of the IoT's value 'as the presumptions of productive Practice' (Friedland, 2018, p.1373) from a Solutionist paradigm driven by solving the 'problem' of domestic efficiency through data driven automation and where people are 'mis-educated' to think of themselves as consumers whose worth is measured by the acquisition of goods (Blackledge, 2009, p.869). Instead, Practice-Oriented can support the IoT's development as a 'governing technology' which can 'articulate with the practices of governing which rely upon them as means of influence...and of shaping the conditions of possibility and thus the actions of others' (Watson, 2016, p.10). This can focus on the internal virtues of the goods of excellence to support a search and movement towards *telos*, focusing on how people want to live and be.

This shows Practice is valuable in researching and re-evaluating the IoT through the emergent themes of 'Practice as activity, Practice as tacit ways of knowing, Practice as human/non-human and Practice as embodied' (Pink, 2012, p.19). This highlights how Techno-Centric approaches negate human agency and applies external values, leading to conflicts with practices and limiting people's ability to get things done in data-driven constellations; Human-Centric approaches evolve this position, incorporating human agency and values in the IoT, but this is anthropocentrically biased. Instead, Practice reframes the IoT's focus and intent to a socially and spatially located system, incorporating embodied activity, knowledge and human/non-human agency. Applying this to understand the materials, competencies and meanings of practices in more depth will support an approach that informs the development of an IoT more focused on people's domestic experiences while considering how non-human agency can link Practice elements.

## 4.2 Participatory Action Research

Researching the IoT and DP should consider people's experience and understanding of these topics to inform the research pathway, so Action Research (AR) and specifically Participatory Action Research (PAR) may prove a suitable approach. Previous application used cyclical processes to develop and study IoT impact on organisational change in patient care services within technological, economic, social and legal dimensions (Park et al., 2017) and in developing new business models moving towards collaborative approaches between business partners and consumers in complex ecosystems of products and services (Turber

et al., 2014). Avison et al. (1999, p.94) discuss the potential of AR in information systems, arguing projects framed as case studies, system designs and software engineering could be improved if AR cycles were followed, while Mumford (2001) describes this as 'worthy of consideration as approaches and tools for the future' in computing, 'provid[ing] opportunities for long-term, in-depth, research which fits well with today's beliefs in the importance of a multidisciplinary approach and in organizational (sic) democracy' (ibid. p.26).

First proposed by Lewin (1946), AR was described as 'comparative research on the conditions and effects of various forms of social action and research leading to social action' (ibid. p.35) through the use of 'a spiral of steps, each of which is composed of a circle of planning, action, and fact-finding about the result of the action' (ibid. p.38). This emphasises democratic participation (Adelman, 1993, p.14) and involves practical problem solving with theoretical relevance (Mumford, 2001, p.13) to engage with non-technical issues by using a range of methods with the intent of improving well-being. The goal of AR is using knowledge gained by studying a group or community in order to change it, so it is open-ended and action is applied iteratively to develop evolving theoretical understandings and measure the effectiveness of new proposals (Koskinen et al., 2011, p.83). This is conducted by developing research democratically and collaboratively with a community (Hayes, 2011, p.15:2) via a Socio-Technical approach balancing technical and human factors. This empowers community partners to determine improvements using collective methods (Mumford, 2001, p.13) so researchers and participants are at the centre of the research process, subjectively informing how data are collected, analysed and reported to shape change (Hayes, 2011, p.15:3).

AR is therefore located in a non-positivist paradigm of reflective rationality (Zuber-Skerritt, 2001, p.5) which is more personal and interpersonal than methodological and interested in perspectives rather than objective truth (ibid. p.7), as co-constructed knowledge is produced through social processes not based in objectivity (Hayes, 2011, p.15:4). AR tends towards qualitative techniques with two main methods of gathering data – observation of what people do and asking for their views in a manner aligned with the central research premise (Burns, 2015, p.188). AR paths tend to be modelled as an interacting research spiral (Fig.16) where each stage involves exploration of the activities through observation, reflection and action in a complex process (Stringer, 2007, p.9).

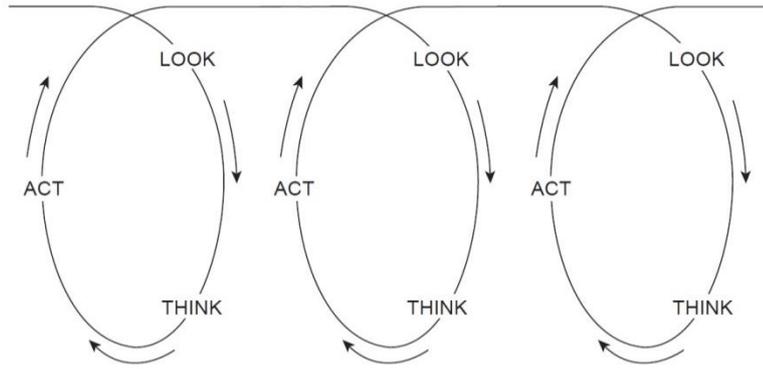
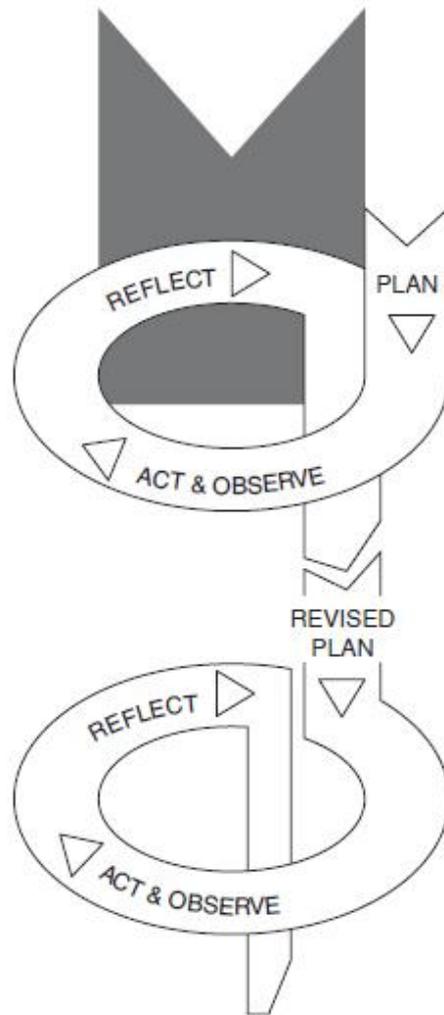


Fig.16: Action Research path as interacting research spiral

PAR can be critical and transformative if conducted well, encouraging shared deliberation of important issues of the future (Kemmis, 2006, p.471) by opening communicative space concerning how things are to questioning and exploring possibilities in social, cultural, material, economic or personal spheres with expectations for researchers to ‘...develop knowledge and work towards social change’ (Ozanne and Saatcioglu, 2008, p.425). Understanding what participants consider problematic due to differences between what exists and what they want to exist, this acts as an agent for change towards preferred futures in ‘...a participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes’ (Reason and Bradbury, 2001, p.1). AR then aims to understand the reality of the situation so it can be transformed, and transform reality in order to understand it (Kemmis, 2009, p.474), informing researchers through reflection ‘*in action*’ and ‘*on action*,’ key concepts in Schön's (1983) exploration of reflective practice. This is also modelled by Kemmis and McTaggart (2000, p.595), who describe spirals of self-reflective cycles to understand the outcomes of research activities, which through reflection can inform the next stage of the process (Fig.17).



*Fig.17: Spirals of self-reflection inform research pathways through revision of plans*

PAR has commonalities with applied research through design, aiming to create new knowledge through an action-reflection approach (Jonas, 2007, pp.189–192) to develop theories applicable to practice (Findeli, 1995, p.44), where the outcome is on creating design knowledge and not necessarily the solution to the project, allowing researchers to respond to research insights and develop activities exploring new knowledge. Design also critically evaluates the implications of developments and is concerned with the researcher’s position, explicitly locating them within the research. This supports engagement with a model of research where the practice of the discipline and research interconnect through a Practice-Based or Practice-Led model, where in the former the creative work is a form of research and in the latter practice creates research insights (Candy, 2006).

PAR is therefore closely linked and applicable to this topic and Design Research (DR), as interpretive research relies on insight to understand people’s action in a manner better

suited to people's behaviour and sensitivities (Swann, 2002, p.51). Reflection and theory rich design is essential to allow for the interrogation of the outcomes of research to progress with a deeper understanding and appreciation of the topic, people's activities and concerns (Frankel and Racine, 2010, p.6). The use of creativity relevant skills within DR informs how individuals understand, navigate and engage with issues in novel and useful ways, influencing the amount of creativity in the outcome through dynamic, iterative design processes that are 'more a process of raising (several) good questions versus one for finding the right answers' (Wylant, 2008, p.14). Similarly, through developing new interpretations of what is meaningful to people, DR rooted in Socio-Cultural understandings can lead to radical innovation (Norman and Verganti, 2014).

### 4.3 Participatory Design

Approaches to exploring user interactions and perceptions of the IoT include Participatory Design (PD) & Tangible Interaction (TI) (Soro et al., 2017a); Human Centred Design (HCD) (Vitali et al., 2017), User Experience (UX) and User Centred Design (UCD) (Fauquex et al., 2015); Social Interaction Design (SID) (Giaccardi et al., 2013), Speculative and Critical Design (Bichard et al., 2015) and Design Fiction (Forlano and Mathew, 2014; Lindley et al., 2018). Some approaches develop people-aware applications to humanise technology, where Discovery-Capturing can help identify trends based on users' needs and context (Fauquex et al., 2015, p.6) or where the starting point of designs can be identified as the 'gestures, rituals needs and aspirations' of users (Vitali et al., 2017, p.S2593). A common feature is an awareness of people's role within technological systems, tending towards subjective approaches working with users at some stage of, or throughout, the research process. These engage with participants through ethnographic interventions, with specific methods identifying user narratives and IoT usage; setting the boundaries of problem identification, including context and users; iterative development with users through brainstorming, idea generation and validation; focus groups, interviews and home visits; technology tours, mappings and cultural probes.

As discussed in *Beyond a Human-Centric IoT*, applying Human-Centric methods in the IoT where the people involved can be understood as 'just another thing within the hyper-connected and data-mediated assemblages' constituting these systems (Gradinar et al., 2019, p.15) may detrimentally prioritise human experience of the IoT. Object Oriented Ontology (OOO) (Nansen et al., 2014, p.92) is discussed as relevant as digitally augmented artefacts blur users/people/Things. This is applied to resolve the lack of a Thing perspective

arising from solely focusing on human actants by centralising objects and according people no special status, which may direct design in the IoT considering the challenges facing HCD practices (Lindley et al., 2017, p.2849). More-Than Human Centred Design builds on OOO by applying a constellations metaphor to develop non-anthropocentric design concepts through Design Fiction methods (Coulton and Lindley, 2019), while Experiential Design Fiction is applied to understand issues involved in adoption through domestic research probes building on IoT storytelling (Lindley et al., 2019). Similarly, Speculative Enactments works with participants to meaningfully explore possible futures so that actions become consequential and prioritise participant social interaction and experience (Elsden et al., 2017).

Balancing people's existing experience and the domestic IoT through a Practice-Oriented framework that intends to encompass IoT constellations means PD seems the most suitable approach. With a history in the development of technological systems, including 'user perspectives on workers, professional relationships to technology and stated goals' this can be understood as a model for the critical practice of developing technological designs (Asaro, 2000, p.257). Furthermore, PD is not only a way to respond to current conditions, but also has a future focus, shifting from concern with use and usefulness to on-going, Socio-Technical processes sustaining a community of participants (Dantec and DiSalvo, 2013, pp.246–247). This can manifest in 'identifying, designing and supporting social, technical and spatial infrastructures that are configurable and potentially supportive of future design-games' (Ehn, 2008, p.96).

Similar PD applications includes developing intimate understanding of technology through hybridity (Muller and Druin, 2017); its use and technological impact on the home in a contextually grounded manner (Baillie and Benyon, 2008); investigating and designing large scale systems (Heitlinger et al., 2018; Simonsen and Hertzum, 2008) and the 'exploration of Socio-Technical issues to raise important questions about the values and biases' within the development of Smart Cities (Forlano and Mathew, 2014, p.20). Furthermore, PD and AR share similar participatory traits and can be understood as a synergetic pair, so combining PD and AR can keep activities within the 'participatory spirit' in the action phase through being informed by PD theory, while a PD study may encourage participants to evaluate open issues if AR principles are used (Foth and Axup, 2006, p.96).

PD advocates for the continued involvement of users (Bjerknes et al., 1987; Bjerknes and Bratteteig, 1987) aiming to work directly with them in the design of technology (Muller and

Kuhn, 1993, p.28) with ‘an attitude about a force for change in the creation and management of environments for people’ (Sanoff, 2007, p.213). A ‘set of theories, practices and studies related to end-users as full participants in activities’ (Muller and Druin, 2002, p.3), the goal is to engage stakeholders with a range of expertise to iteratively develop concepts and jointly decide technological developments (Foth and Axup, 2006, p.94). This provides interdisciplinary knowledge exchanges, supporting the development of a balance of knowledge, where any gaps in understanding can be narrowed by mutual learning between designers and end-users (Béguin, 2003; Fowles, 2000; Mor and Winters, 2007) to develop ‘technologies that *fit into* the existing web of tacit knowledge, workflow and work tools, rather than just doing away with them’ (Spinuzzi, 2005, pp.165–166).

Research within PD is flexible, but includes three stages: *Initial Exploration*, where designers and stakeholders meet and explore technologies, understandings of systems and artefacts, workflow, routines and other elements; *Discovery*, where designers and participants work together to prioritise attributes as User Generated Values (UGV) and develop future concepts that represent desired outcomes; and *Prototyping*, where designers and users develop artefacts that can fit into the environments discussed in the *Discovery* stage (Spinuzzi, 2005, p.167). Within Values-Led PD (Iversen et al., 2010) values emerge from a dialogical process between stakeholders and designers and are ‘trans-situational goals, varying in importance, that serve as guiding principles in the life of a person or group’ (Schwartz et al., 2012, p.664), reflect users desired modes of end-states (Rokeach, 1973) and can predict or explain the acceptance and attractiveness of new technological systems or products in organisations or by masses of consumers (Isomursu et al., 2011).

PD and Values-Led PD were developed in response to managerial control of workers through developing computing systems for the workplace breaking down acts to discrete, formalised and unskilled elements to increase efficiency, sharing similar concerns to this topic. Despite some criticisms of its effectiveness (Howcroft and Wilson, 2003) and the overemphasis of the human (Foth, 2017, pp.29–30), this seems to be the most suitable approach to follow, as it is based within Socio-Technical explorations of technological systems, links closely with a PAR framework and allows for people’s experiences and values to be considered within an iterative process where designer and researcher blur (Sanders, 2002, p.19) by creating a space for co-creation and co-exploration with participants, scaffolded by working with values through their emergence, development and use in proposed designs (Leong and Iversen, 2015, p.315).

I intend to explore issues relevant to this subject, including understanding important elements of Practice, IoT attributes users and potential users find beneficial and problematic, their preferred values for this system and how to embed these along with domestic and Practice understandings in a Practice-Oriented IoT. As it appears current commercial manifestations of the IoT represent the values and disciplinary biases of developers, including participant values may support designers/developers in understanding new perspectives on the IoT, with the application of Practice-Oriented allowing tacit values to become explicated, developed, reflected on and implemented within a Practice-Oriented IoT alongside the virtues of practices. These values depend on the interaction of the user and product in a particular context, so the person perceiving it and their psychological values affect their views of purpose, function and characteristics in a certain situation, which can help understand the ethics of people to allow for designing for meaningful mediation, desirable end states and behaviours (Isomursu et al., 2011, pp.184–185).

Participants' insights in each research activity will inform the design of the research path through linking with a reflective PAR framework (Fig.18). In this iterative, research through practice model, 'Practice serves a research purpose' (Rust et al., 2007, p.11) through a flexible, constantly developing process responding to research outcomes. As knowledge of core issues evolve, the design of tools and processes can respond to focus on these new understandings and develop further insights, creating new knowledge as the process unfolds. Consideration of existing approaches, insights and practices that emerge through the process encourages new understanding and concepts, in turn impacting on the methods, tools and actions of the researcher. This understanding allows for the refinement of the research path in response to research outcomes to develop new knowledge regarding designing the IoT for the domestic space.

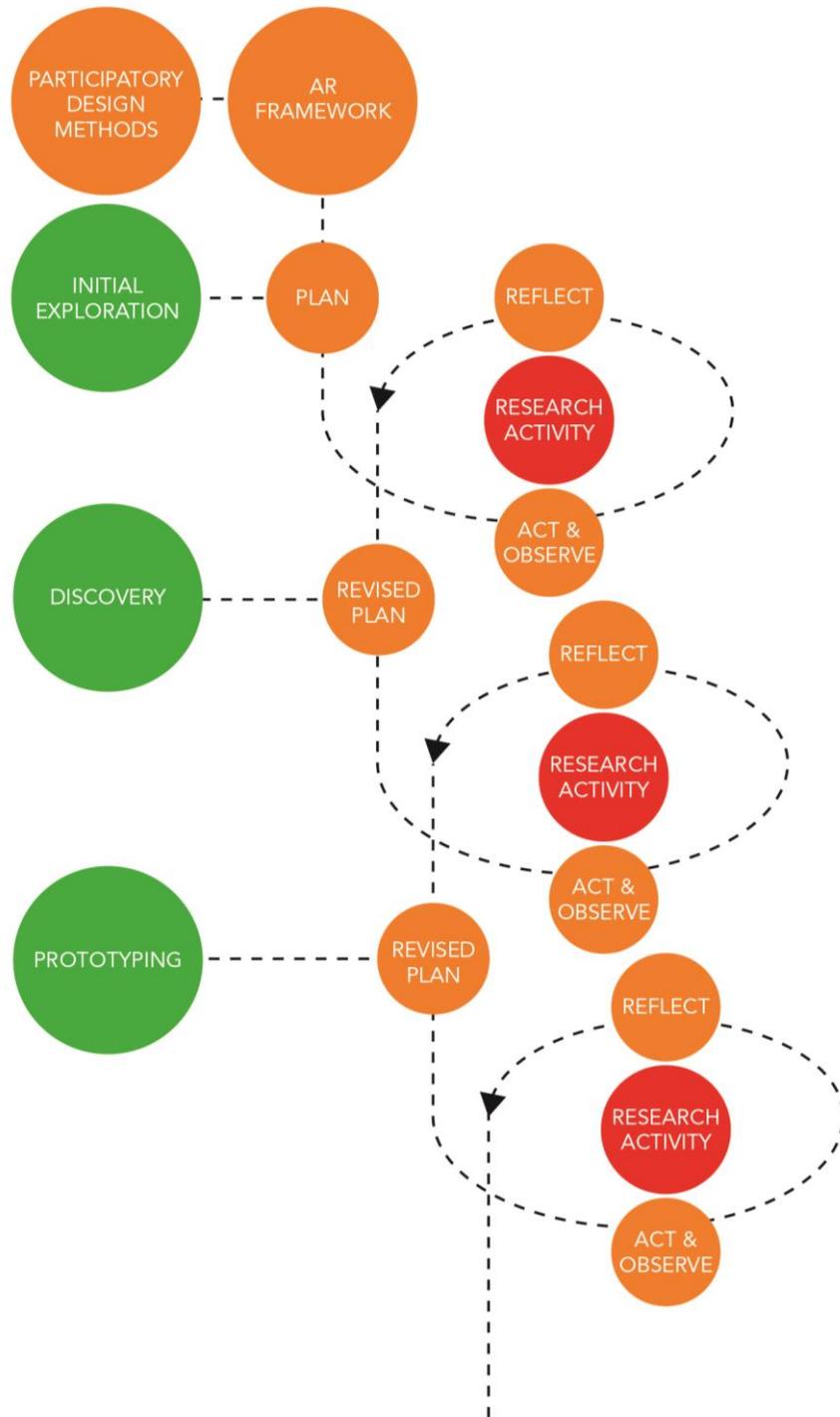


Fig.18: Proposed research path linking PD to PAR spiral

#### 4.4 Methods, Workshop and Toolkit

Throughout this project the methods discussed are applied to understand participant opinions on the IoT and their practices to inform developing the IoT. Therefore, there are two distinct areas of Practice to consider: Domestic Practices (DP) and Professional Design

Practices (PDP) for developing for the IoT. Addressing DP will involve applying concrete methods to enter the participant's world through ethnographic techniques (Kensing and Munk-Madsen, 1993, pp.80–81; Muller and Druin, 2017, p.17). PD aims to uncover participant's tacit understanding of topics (Sanders, 2002, p.20), with each stage of research tackling specific areas of a problem so that workshops are developed iteratively as responses to previous insights, refining the focus of research (Muise et al., 2008, p.1). Luck (2003, pp.525–531) describes the application of project briefing, semi-structured interviews and theming of language use to improve dialogue in PD, so tacit knowledge becomes explicit. The intention is to use insights gathered along with the creative imagination of participants and the researcher to construct preferred situations and meaning within an IoT context, foregrounding experience over technological aspects. It is likely these insights will inform the development of 'participative, entangled, meaning-making design-games' (Ehn, 2008, p.95), applied to communicate participant's practices, share the design process, designing by doing through participatory organisational games or devices used as design games. These are traditionally applied in workshops where 'people gather for specific design purposes and are supported by a specific structure (e.g. a moderator or game rules) and design tools' (Schoffelen et al., 2015, p.182).

In *Initial Exploration*, I intend to investigate user's IoT perceptions through interactive installations and questionnaires contextualised by a practice example. Following this, interviews and design workshops focusing on DP elements will support *Discovery* of practices and people's use of home, informed by methods relating to understanding the location and objects of user's DP (Crabtree and Tolmie, 2016, pp.1739–1744) and opinions on the role of the IoT (Coskun et al., 2018, pp.6–7). Comparing and analysing participant responses in interviews and questionnaires will allow for theming, an open-ended, user driven method that is strong at gathering insights and anecdotes for directing research and particularly useful for understanding intangibles (McLellan, 2000, p.62). This relates to typical ethnographic methods used in this stage of PD, such as 'observations, interviews, walkthroughs, organisational visits and examinations of artefacts', employed iteratively to construct emerging designs (Spinuzzi, 2005, p.164). The insights gathered will inform the emerging design of the research path, supporting reflection in a PAR cycle and decisions about future steps.

Further research is likely to be more directional, using design workshops centred around the use of card-based tools that communicate Practice elements and user perspectives to explore the impact this has on PDP. Existing tools support new perspectives in creative

applications, such as IDEO's methods card set (IDEO, 2003), and decks that focus specifically on IoT development (Angelini et al., 2018b; Aspiala and Deschamps-Sonsino, 2014; Luger et al., 2015; Mora et al., 2017). These will be used to explore participant IoT understandings through sharing stories of personal objects and associated practices, drawing mental models of IoT constellations and further discussion and evaluation of key concerns via product examples, with a focus on the IoT itself. This correlates with the typical methods used in the middle stages of PD processes (Muller and Druin, 2017, p.27), including 'organisational games, role playing games, organisational toolkits, future workshops, storyboarding and workflow models and interpretation sessions' (Spinuzzi, 2005, p.167). This is likely to inform both the design of the research path, with participant feedback shaping this by supporting reflection on the successes and shortcomings of Practice-Oriented, and the design of practical elements to support communication of participant feedback and IoT understandings as UGV within PDP.

*Prototyping* sessions will focus on developing a workshop process integrating these insights and feedback on the application of these methods to communicate a Practice-Oriented perspective on the IoT to PDP. A Practice-Oriented IoT model, generative decks of Practice elements, paper prototyping and assessment of concepts using design evaluation methods, combined with participant generated values relating to the attributes of the domestic and preferred domestic IoT will communicate this understanding, providing a framework for participation of not only users, but IoT developers (Brandt, 2006). Toolkit use within IoT development is relatively established (Angelini et al., 2018c; De Roeck et al., 2013; Vicini et al., 2012), indicating this is an appropriate way of integrating new understandings and IoT frameworks developed through this research and communicating this to the wider IoT community. This aims to culminate in a toolkit representing an alternative vision of the domestic IoT, reached through a PD methodology and the specific methods and tools implemented and developed through this process. This brings together the concerns of this project in a workshop process reliant on collaboration and utilising a Practice-Oriented approach, specifically situated within the domestic space and framed by DP to contextualise user understanding of the IoT.

Some potential weaknesses need to be considered; most problematic is that previous approaches to similar topics applied HCD and UCD derived research methods to form the beginning of IoT concepts that engage with practices (Fauquex et al., 2015; Vitali et al., 2017) or identify practices that are used for similar purposes (Bichard et al., 2015; Desjardins et al., 2019). These can be useful for engaging with specific user issues and

considerations, but provide too much prominence to people in IoT constellations and act as snapshots of complex Practice situations (Shove, 2005, p.3). I intend to address these issues through the use of PAR, PD and a Practice-Oriented that incorporates elements of IoT constellations, using people's experiences, understandings and concerns to inform this within PDP by positioning what could be Human-Centric perspectives within a Practice framework.

## 5 Research Projects

This chapter addresses the following research questions:

**RQ1:** What new perspectives can Practice-Orientation provide on agency and values in the context of new Internet of Things (IoT) Practices?

**RQ2:** How can the Techno-Centric nature of the IoT be integrated into the qualitative domestic experiences of people to better support Domestic Practices (DP)?

**RQ3:** How can potential user's perspectives on the IoT and Practices be constructively communicated to IoT developers within the context of Professional Design Practices (PDP)?

These were investigated using a series of research methods and activities, beginning with initial exploration of practices and ending with a toolkit that communicates key research findings on user perspectives to the wider IoT design community within PDP. This chapter specifies how each activity was conducted and responded to the research questions through seven projects comprising task analyses, an interactive installation, interviews, four workshops and three IoT-Practice toolkits.

### 5.1 Problem Framing: Initial Exploration and Discovery

Previously, the qualities of Practice when understanding the IoT was discussed, with Practice in the IoT needing 'commensurability' through physical and social contexts to develop intimacy between objects and acts in open-ended ways (Giaccardi, 2015). This considers how people's aims, goals, values, emotions and skills in motivations and innovations of practices can bring participants together in CoP (Ludwig et al., 2019), framing this as an inter-relation of materials, meaning and competencies constantly renewed and connected by human agency in an evolving, dynamic manner (Shove et al., 2012). Initial exploration aimed to build on this through two elements: firstly, a comparison of two tea making processes to understand the differences within them; secondly, an interactive installation engaged with the public to understand the perception of the IoT using a relatable practice to contextualise the IoT within everyday life.

#### 5.1.1 Goal- vs. Experientially-Focused Practices

Previous work used practices to frame and inform IoT development, with hot drink making providing familiar context (Lindley et al., 2017; Soro et al., 2015; Vaisutis et al., 2014). So, initial exploration compared two tea making processes with the aim of illustrating how Practice interactions can structure engagement with materials involved, how this impacts

on practices and how similar practices can differ in intent, process and outcome. At this stage I was interested in the experience and process of practices, in particular by comparing a routine and equivalent ritual. Two tea making processes were chosen; the first (P1) a typical goal focused tea making process; the second (P2) the rarefied Japanese tea ceremony or *Cha-No-Yu* (Sadler, 2011). These were explored to understand how Practice structures interaction with and between materials involved, with key differences between the two processes identified to support future directions. As this aimed to provide understanding of Practice the IoT was omitted at this stage.

#### 5.1.1.1 Comparing Tea Making Practices

P1 and P2 were initially detailed through Task Analyses, used to understand how human performance in systems is shaped by behaviour, environment, information and artefacts (Andrew and Shepherd, 2005, p.129). *Work or Motion and Time Studies* break tasks into discrete elements to improve understanding of specific actions and objects involved; both processes were analysed using Hierarchical Task Analysis (HTA) (Stanton, 2006), where overall goals are specified and broken into sub-goals that identify sub-operations. The overall sequence of events was described and dependencies between elements were ranked (Appendix A). While HTA does use diagrams to visualise these processes, (ibid. pp.3-5) these tend towards goal focused flow charts, so this was represented by mapping interactions between people and objects within P1 and P2.

These were developed where materials involved in Practices were represented by labels, organised into colour coded categories (Appendix B) connected by lines representing the agency of the performer. This highlighted the interdependencies of objects, resources and infrastructure, brought together by the performer to conduct Practice and representing dynamic bundles in a particular configuration that achieves these, or the assemblages of objects involved. These representations were developed further to provide greater legibility (Fig.19 and Fig.20).

### 5.1.1.2 Differences and Similarities in Tea Practices

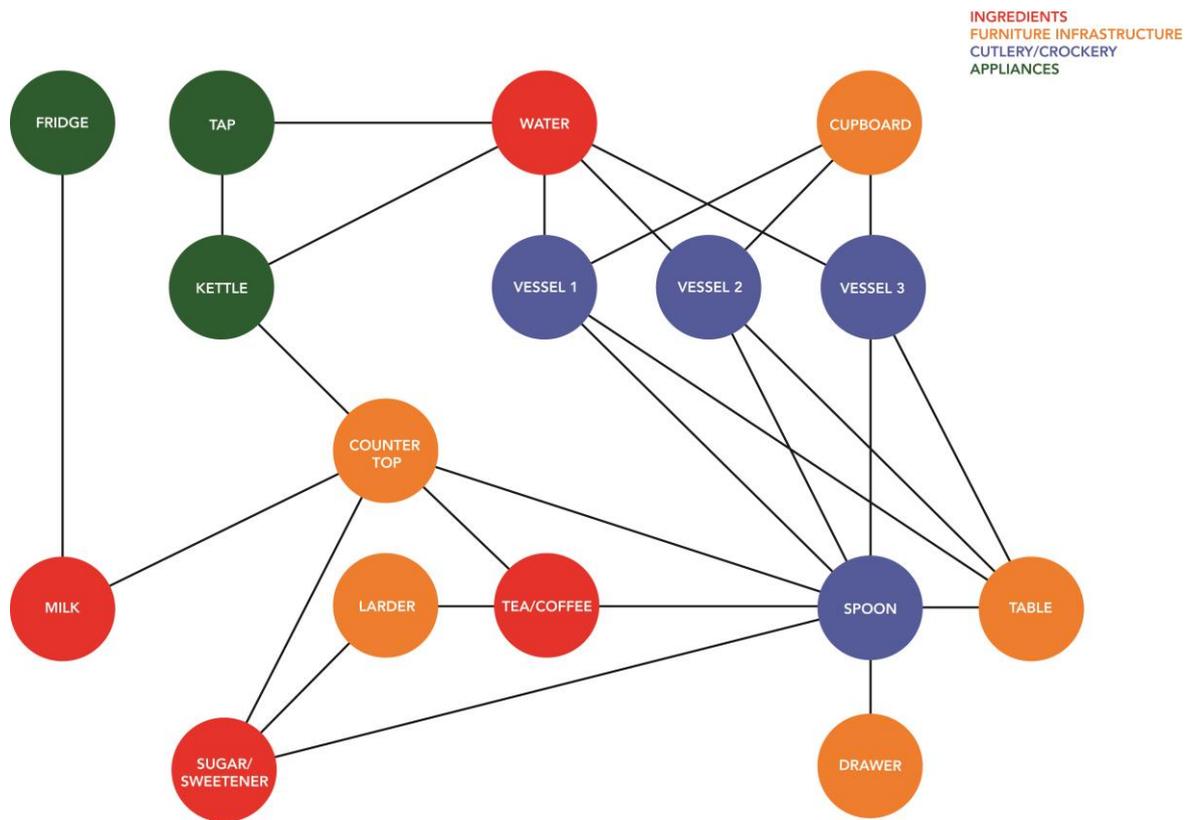


Fig.19: Diagram of P1

The HTA produced a list of actions, objects and environmental elements involved, sub-goals needed to meet the overall practice and dependencies between elements. Both practices are complex, with numerous objects and steps needing completion before continuing to the next step, which calls upon another element in the practice. In P1 this is more complex due to the choices available, involving performers selecting objects within the assemblage, with a reliance on furniture infrastructure. P2 follows a set procedure due to its fixed nature, where items with specific uses must be co-ordinated in a particular way. The physical movements and skills required to conduct P1 involve some, but relatively basic, competencies; in P2 these are complex and pre-determined, with greater importance placed on the performer's actions and skilful performance constituting part of the meaningful nature of the experience.

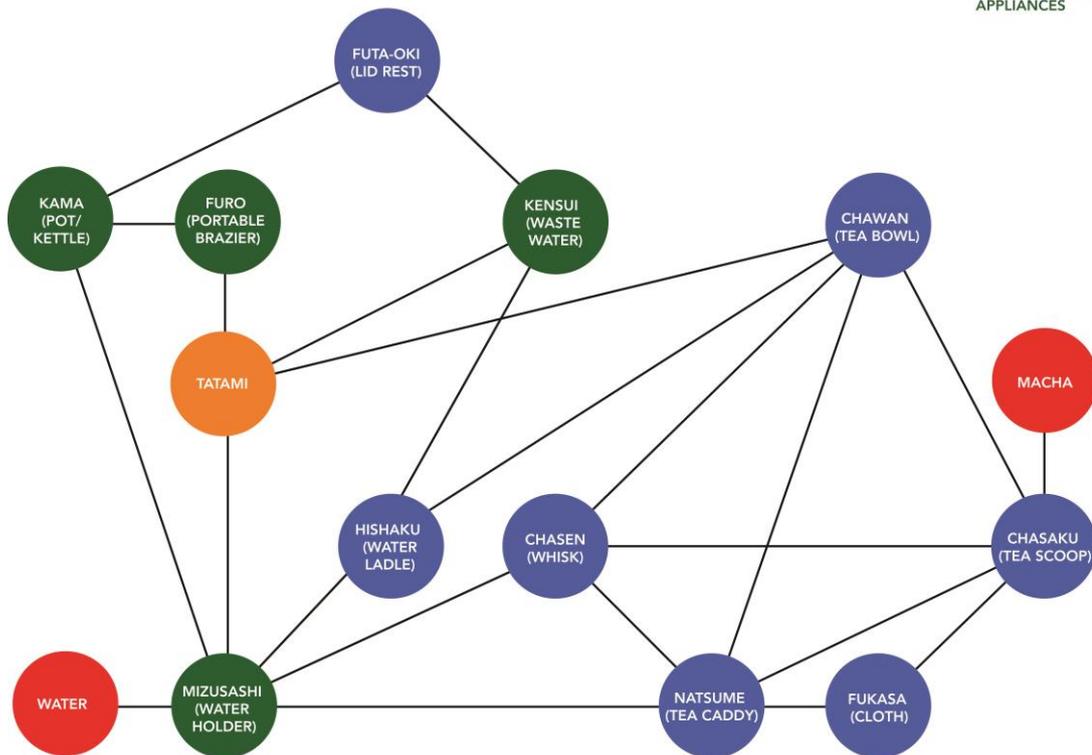


Fig.20: Diagram of P2

Visual representation illustrated the scale and scope of materials involved, which are connected by human agency within assemblages that can be seen as representative of the practice itself. These diagrams express the objects chosen, their frequency of use and interdependencies and suggest potential future Practice extensions through material linkages. P1's materials are broad, with varied appliances, furniture, cutlery and ingredients that can be used in multiple configurations depending on the practitioner's decisions. P2 materials have with functions designated to particular objects, with the Chasen, Chasaku and Chawan central and functions distributed among these to replace P1's central object of the spoon. The meaning of the practices is not clearly represented or explained by these diagrams.

This was a starting point for exploring Practice through two ostensibly similar processes; initially analysed using HTA, which proved useful for goal based analysis of systems, but not for understanding experiences or identifying meaning, which is unsurprising due to the production line origins and efficiency concerns of this technique. **Visualisation provided non-hierarchical representations of these practices that included the object assemblages linked by human agency.** However, human/non-human agency was still explored as

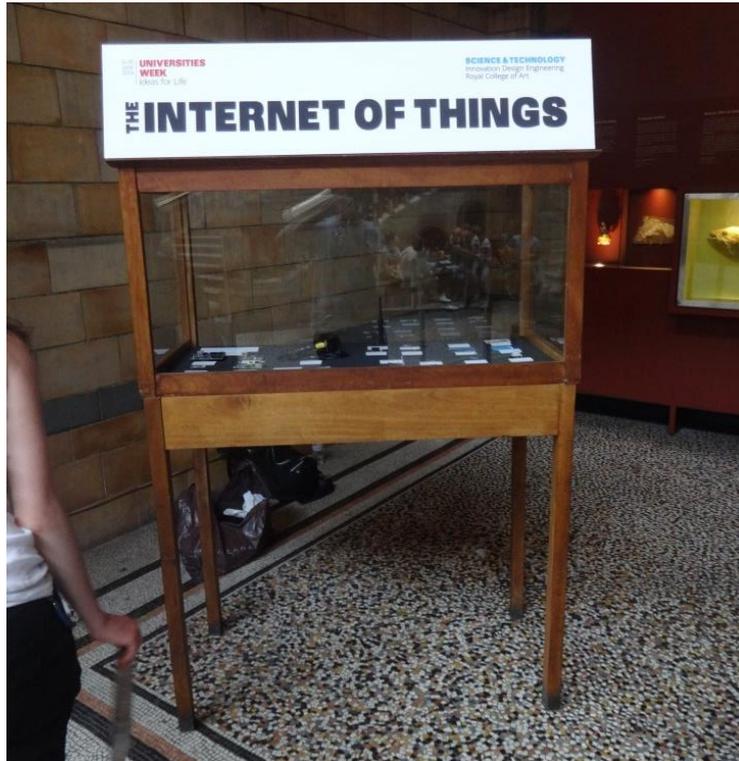
influencing the possibilities and outcomes of non-IoT practices and structuring these activities. P1 was open, dynamic and inexact, allowing for developing individual plans, processes and procedures, while performance was relatively flexible, as the end goal is more important than the process itself. P2 had significant structure and precision, providing a clearer path for interaction between objects through specific, externally determined practitioner agency, with fixed, precise actions.

The role of values/virtues relates to this: P1 allows practitioners more flexibility in making decisions to develop practices to suit their situation in an open event where each performance is always potentially new, while P2 has more skill involved due to its' pre-determined, precise nature, yet the performance is fully determined and predictable. Conversely, P2 is more focused on the internal goods of excellence in the supporting movement towards practitioners' full potential, while P1 is focused on the outcome of the process and can be understood as externally focused. However, as Practices are organised by participants' understandings of how to do things, their guiding principles and rules, and prescribed objectives and ends (Blackler and Regan, 2009, pp.162–163), P1 can be considered to follow a Practice-Oriented, while P2 is ritualistic, following external, predetermined rules of conduct, even if in an extremely skilful manner.

### 5.1.2 IoTea Time

The previous activity solely focused on comparing practices to establish a direction for future research. Now I intended to investigate people's attitudes towards the IoT by contextualising the domestic IoT through Practice, with a public engagement event at the Natural History Museum for Universities Week (National Co-ordinating Centre for Public Engagement, 2014) providing an opportunity to explore this with various participants. An installation was developed to represent a possible practice in the IoT and support participant understanding.

### 5.1.2.1 IoT, IoTea and Domestic Scenario

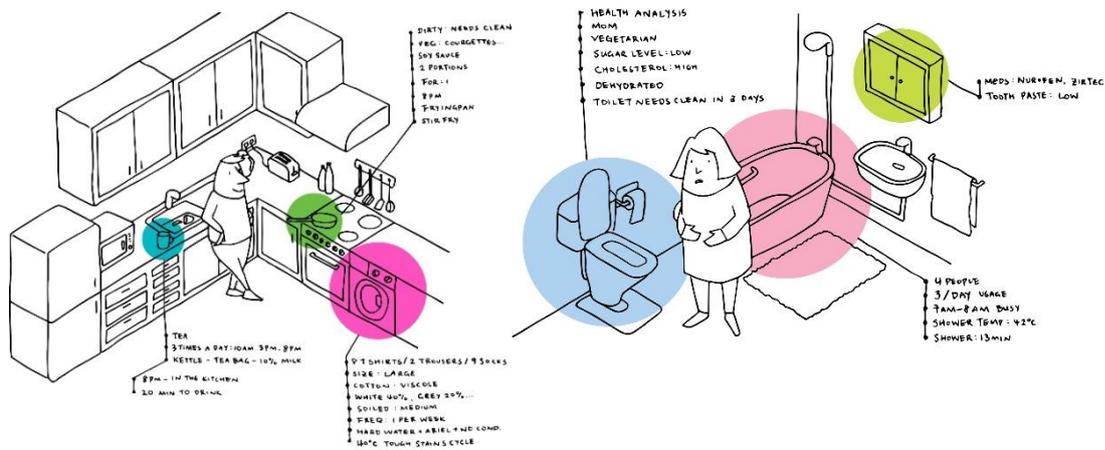


*Fig.21: Museum cabinet detailing technologies constituting the IoT*

Three elements were developed: a traditional museum cabinet showcased normally hidden IoT technologies (Fig.21); an interactive installation ‘*What your kitchen thinks it knows about you...*’ (Fig.22) contextualised the IoT through Practice by providing participants an experience of making a hot drink in the IoT, supporting reflection on daily actions through non-daily context and re-performance (Jacucci et al., 2010, p.10). Further context was provided through a series of illustrated scenarios of potential IoT interventions in different spaces in the home (Fig.23).



Fig.22: 'What your kitchen thinks it knows about you...' installation



## Kitchen

## Bathroom

Fig.23: Illustrations of IoT scenarios

The process and aims were explained to 30 participants. An interviewer-administered, mainly qualitative questionnaire with two parts and open-ended questions was used (Fig.24), resulting in detailed, informative answers on key topics, with no clear way to respond (Holyk, 2011, p.656). Before the interactive installation participants were asked Q1 and Q2; following the installation the remaining questions were asked. Finally, participants gave their opinion on sharing data in illustrated scenarios further contextualising the IoT in the kitchen, bathroom and toilet. This produced mostly open-ended data, with coding,

analysis and theme identification (Ryan and Bernard, 2003) revealing common opinions regarding IoT benefits and concerns, where participants accepted this system and how it might affect practices (Appendix C).

## THE INTERNET OF THINGS

- I agree to voluntarily participate in this research and give my consent freely.
- I understand that I can withdraw from the project at any time, without penalty and do not have to give any reason for withdrawing.
- I consent to complete an anonymous survey which will take approximately five minutes.
- I understand that all information gathered from the survey will be stored securely, my opinions will be accurately represented.

### BEFORE TAKING PART

1. Have you heard of the Internet of Things? YES/NO

2. If so, can you describe it?

---



---



---

### AFTER TAKING PART

3. Can you see any benefits or worries related to the Internet of Things?

---



---



---

4. Could you tell us two things that the Internet of Things could provide to:

a. Improve your life

---



---

b. Complicate your life

---



---

5. We are already providing a lot of personal information through the Internet. Do you think that in the future you will need more control over the information that you share?

---



---



---

6. Please look at the scenarios on the attached sheet. Would you be comfortable sharing the information that could be generated by using the space or the object described?

i. Kitchen	YES/NO	ii. Bedroom	YES/NO	iii. Bathroom	YES/NO
Kitchen	<input type="checkbox"/> <input type="checkbox"/>	Bedroom	<input type="checkbox"/> <input type="checkbox"/>	Bathroom	<input type="checkbox"/> <input type="checkbox"/>
Washing Machine	<input type="checkbox"/> <input type="checkbox"/>	Bed	<input type="checkbox"/> <input type="checkbox"/>	Toilet	<input type="checkbox"/> <input type="checkbox"/>
Mug	<input type="checkbox"/> <input type="checkbox"/>				

#### Royal College of Art

Innovation Design Engineering, PhD Researchers

Michael Kann / michael.kann@network.rca.ac.uk

Delfina Fantini van Ditmar / delfina.fantini@network.rca.ac.uk



Fig.24: Pre- and Post- interactive installation questionnaire

### 5.1.2.2 Uncovering IoT Attitudes through a Scenario Based Study

Question	Key Terms	Key Insights/Themes
Q2: Can you describe the IoT?	Connected, Network, Internet Things, Objects, Devices, Stuff Virtually, Digital, Virtual Smart, Predict, Easy, Managing, Technology, Changing Daily Experience	Internet Things Digital Management Experience
Q3: Can you see any benefits or worries related to the IoT?	Filter information; Benefits of aggregated information Bring People Together, Life easier and predictable, Save time, More efficient Privacy, Worry, Invasion of life, Unwanted deductions, Big Brother, Espionage Company Analysis; Targeted Products Control, Contrary to free will, Manipulative	Communal information Sociality Efficiency Privacy & spying Unwanted advertising Manipulation
Q4: What two things could the IoT do to: a) Improve your life b) Complicate your life	Easier; Speed up; Quick, Optimise time, Suggesting forgotten things; Shared knowledge; Remove repetitive tasks; Automation; Efficient; Management Diet & health; Health Recognition & Medicine; Elderly Care & security Enhance Dimensions; Societal benefit for data; broaden perspectives; As long as it can be disabled; Data not given to big companies; Privacy/no Privacy; Paranoid; Intrusive; Scary; Advertising; Manipulate; Leading choices & thinking; Govt. control; Free choice How does this info help?; Lots of info provided to get outcomes; Info addictions Technology; Uncontrolled tech Too attached to objects; Unnecessary Things.	Management Health & elderly care Social & society Data control Data & privacy Manipulation and power balance Over-provision of info Technological imperative Materialism

Fig.25: Table of results detailing key terms, insights and themes for Q2 to Q4

Q1 responses showed a slight split between those who had (17) and had not (13) heard of the IoT. Q2 responses described this as a union of physical and digital that was easy, data-driven, and a smart way of living within an ecosystem that provided remote interaction with devices (Fig.25). Q3 responses showed IoT benefits as efficiency, saving time or speeding up processes, making life easier through prediction to provide knowledge and help with daily actions. This was also understood as bringing people together and beneficial when using aggregated data, echoing previously identified Techno-Centric perspectives. Concerns included worries around assumptions based on data, privacy, life being mapped, espionage, company ownership, unclear data use, annoying for interacting with people and simple

things being done for you, confirming some Human-Centric and Beyond Human-Centric issues. Q4 responses relating to improvements to life discussed easier shopping processes, more decision making by people, easier access, automation of household tools and removal of repetitive tasks, sustainable daily actions, improved elderly health care, the ability to turn it off and ‘enhancing dimensions.’ Complications included marketing and ordering unwanted products, dependency on virtual objects and Things breaking down, wrong suggestions, automation lowering free will and people being controlled by technology, intrusiveness, reduced privacy, human contact and thinking.

Question	Key Terms	Key Insights/Themes
Q5: We are already providing a lot of information through the Internet. Do you think that in the future you'll need more control over the info you share?	<p>Everything Connected, Everything Shared, Some things must be personal</p> <p>Corporate control, Information Transparency</p> <p>Freedom to share or not, Personal Control, Understanding to know what to share</p> <p>Don't believe in giving information, So much data, Data protection</p>	<p>Oversharing</p> <p>Power asymmetry</p> <p>Data control &amp; education</p> <p>Data protections</p>
<p>Q6: Would you be comfortable sharing info generated by using the space or object described:</p> <p>1a) Kitchen 1b) Washing machine 1c) Mug</p> <p>2a) Bedroom 2b) Bed</p> <p>3a) Bathroom 3b) Toilet</p>	<p>a) 11 1b) 10* 1c) 11</p> <p>Fewer people are willing to share info in this space than those who aren't, both generally and specifically, with little difference between space and objects (*1 Participant refused to answer)</p> <p>2a) 1 2b) 2</p> <p>Compared to 1, far fewer are willing to share info in this space, although 1 is happy to share from the bed, but not the room</p> <p>3a) 3 3b) 3</p> <p>Slightly more favourable to sharing info in the bathroom than bedroom, but still uncomfortable. Equal split between space and object</p>	<p>1) 1/3 are comfortable sharing info from this space, possibly due to the fact it's a relatively public space in the home</p> <p>2) Nearly all are uncomfortable sharing info from this space, perhaps as it's the most private, personal space in the home.</p> <p>3) Nearly all are uncomfortable sharing info from this space, although marginally more than 2. While another very private, personal space in the home perhaps health monitoring came into consideration.</p>

Fig.26: Table of results detailing key terms, insights and themes for Q5 and Q6

Q5 responses (Fig.26) indicated data control was important to most participants, with personal control over sharing data significant. The unclear benefits of sharing data were raised, with the need for guidance discussed. Some responses stated this was already standard; control was needed, but data would be shared anyway - no-one would ask for permission and in future there would be no choice. Q6 responses showed 11 participants were comfortable sharing data from the kitchen, three with data from the bathroom and one from the bedroom. 19 participants were uncomfortable sharing data from the kitchen,

27 in the bathroom and one from the bedroom. Participants considered IoT benefits as efficiency, saving time or speeding up processes, making life easier through prediction to provide knowledge and help with daily actions. This was also understood as bringing people together and beneficial when using aggregated data, echoing previously identified Techno-Centric perspectives. The IoT was understood as a system providing convenience by making everyday life easier. Theming identified six core topics: Internet, Things, Digital, Management, Technology and Experience. The first five correspond with Techno-Centric concerns, but the consideration of experience correlates with Human-Centric and Practice-Oriented perspectives.

This indicated the perceived IoT benefits were goal focused, concentrating on the optimisation of actions against goals for the sake of something else as external goods of effectiveness. However, responses indicated concerns around the potential negative impact on human engagement and agency, perhaps due to concerns about privacy, data sharing and changing experiences by supplanting human decision making and thinking. This suggests concerns regarding user decision making, engagement, quality of experience, sociality and ability to affect IoT outcomes, indicating Techno-Centric perspectives that prioritise efficiency are considered positively by potential users, but are also deeply problematic. After the interactive installation, responses shifted towards a Practice-Oriented position, with suggestions the IoT could improve life by supporting people's actions by making them easier through optional automation, while other benefits included sociality and society. However, beneficial automation was also a worry, with complications including marketing and ordering unwanted products, dependency on virtual objects and Things breaking down, wrong suggestions, automation lowering free will and people being controlled by technology, intrusiveness, reduced privacy, human contact and thinking. Techno-Centric perspectives tend towards external goods of effectiveness where something is done for the sake of something else, in this instance promoting utility through optimisation of actions against goals. However, providing non-human agency to automate utility with minimal legibility limits people's ability to pursue the internal goods of excellence in Practice through actions and thought to create new possibilities, leading to predictability and dependency on the IoT system, an issue that Practice-Oriented may address.

This contextualised the IoT through structured participant engagement and re-performance of a practice within a representation of the IoT, supporting reflection on this process and topic. *Problem Framing: Initial Exploration and Discovery* provided insights into two similar

practices with different intents and people's IoT understandings through scenario based Practice-Oriented. This indicated the value of Practice in contextualising the IoT, informing participant understanding by illustrating the potential impact of the IoT on practices, highlighting tensions between perceived IoT benefits and concerns around supplanting Practice engagement and sociality in the domestic IoT. Further knowledge of people's specific practice elements and experiences would provide explicit insights into tacit opinions on human/non-human agency, values and virtues, supporting future research activities and for later communication of a potential Practice-Oriented within PDP.

## 5.2 Discovering Domestic Practices

Participatory Action Research (PAR) supports shared deliberation of key future issues by opening communicative space in social, cultural, material, economic or personal spheres to understand and transform the situation (Kemmis, 2006, pp.471-474). Previous outcomes suggested detailed exploration of Practice examples would support understanding the range and constituent elements of these activities. Discovering these would support collaboration between designers and participants to determine User Generated Values (UGV) (Spinuzzi, 2005, p.167), with Values-Led Participatory Design's (PD) dialogical processes utilising concrete, ethnographic methods to enter the user's world and support emergent Practice insights. Two elements were developed: semi-structured interviews and a design workshop with some of the same participants, with both activities aiming to understand Practices by exploring human/non-human agency and values in the use of materials, development of meaning and engagement with competencies. Outcomes informed the research path within this PAR process and provided concrete examples for use as UGV within this Values-Led PD approach.

### 5.2.1 Focusing on Domestic Practices

Interviews aimed to explore specific practices and constituent elements for future application in a PD process, including participant's motivation, role in domestic life, practices no longer performed and important materials involved. Analysis identified key themes and terms to uncover what participants considered important to Practice.

#### 5.2.1.1 Practice Understandings through Interviews

This built on *Problem Framing: Initial Exploration and Discovery's* identification of potentially negative IoT impacts on Practice, exploring specific examples to understand how materials, meaning and competencies are important to maintaining and developing these.

Six participants (five men, one woman) were recruited through word-of-mouth and social networking, ranging between mid-twenty and mid-forty and working across administration, design, medicine, charity and higher education. The aims and process were discussed before participants signed a PCS and took part in an approximately 30 minute, standardised, open-ended interview supporting participant free expression. Simple questions provided background information, followed by questions relating to Practices, the use of important objects and any meanings attributed (Appendix D). Probing follow-up questions (Turner III, 2010, pp.754–756) gathered detailed information of participant understandings. Interviews were recorded and transcribed; summaries supported initial identification of commonalities and differences (Fig.27), while further analysis allowed for identification of emergent themes and terms (Fig.28, Fig.29 and Appendix E).

	Q1) Can you tell me about your home practices?	Q2) Why do you do these?	Q3) How do these impact on your life?	Q4) Can you tell me about practices you don't do anymore?	Q5) What objects are important to these?
A	Morning tea; Washing; Checking emails; Checking fridge; Lighting fire; Read before bed; Constantly washing up; Organising desk.	Cooking is a family tradition; Reading is a cultural thing; Desk - not sure, but a control centre?	Feel a bit off if there isn't a decent pan to cook in.	Adjusting the lights on bespoke walnuts shelves - when coming home tweak lighting intensity to bounce of book spines.	Desk; knives, pots & pans; lighting. It helps for the ritual to be witnessed, to share it.
B	Morning coffee & water; Emails & admin; Piano practice and miso soup - the timing of a particular piece is the length of prep; Jogging 3 times per week.	To help establish routines and sleep patterns; Social connections; Leaving the house to avoid feeling cooped up.	Being in a comfortable space; Needing coffee & gives time to prepare for the day; If I don't touch a piano I feel nervous.	Special coffee with girlfriend who just moved out; Stovetop espresso, cafetiere, foamed milk, sugar. Feels romanticised, but also varied a lot.	Chair in room as control centre; piano; Bedroom shrine to display 1st edition books from father, Buddha, collection of personal objects - done for themselves.
C	None apart from cleaning; Use of key bowl; Making the bookcase look nice; Putting children to bed; Listening to records in the evening.	Too easy to lose keys and lots of clutter; Necessity; Winding down; Make the space around me satisfactory; Provides solace & emotional satisfaction.	If not done I feel irritated, unhappy, disconnecting.	My family are the least routine people & as a child nothing was on routine, dinner was always at different times.	Key bowl; Vinyl player.
D	Shared house, so timings of bathroom use, dinner times, when to turn music down; Coffee in the morning; Friday night missed phone call with mum.	So other housemates can use the bathroom and have hot water; When a housemate isn't there the TV stays loud later.	Connections to housemates, friends & family; Constants to create anchors as life is less routine than the past.	Letters, telegrams or expensive phone calls to family in Argentina have been replaced by Skype, which provides stronger familial bonds.	Cafetiere; Mobile phone; Shoes off, slippers on, kettle on.
E	Waking, bathroom, brushing teeth; Taking ad hoc curtains down - climb on bed, remove cloth; making coffee; Annual automatic drawing & artwork in general.	Daily things are necessities; Time to pause; Delaying the working process; Emptying the mind; Devoting self to art.	I'm now ready for the world! The light comes in my rooms and I'm beginning my day; Having time to reflect & calm down.	Meditation; Family meals in HK, set up by grandfather so everyone still knows each other, but everyone moved countries.	Pens are important to drawing, making drawings is transference of energy through these pens, so gets attached.
F	Get son, relax in bed, put in high chair, make coffee, feed son, tidy house; Skype with family in Spain & Israel; Annual religious events; Evening looking at photo's with wife.	Religious traditions are meaningful, but doesn't subscribe to religion; Abstract from daily life; Community & family; Automatised processes give space to think.	If I can't make coffee in the normal way, it throws off the timing of the day a little; If I don't do Shabbat then reflects on it - missing out has an emotional impact.	Cigarettes with coffee in the morning.	Cafetiere, green coffee tin, particular scoop; religious items & heirlooms.

Fig.27: Table of key insights into interview questions

Theme 1 - Food & Drink Preparation			Theme 2 - Sharing the Practice			Theme 3 - Adjusting the domestic			Theme 4 - Use of media			Theme 5 - Emotional content			Theme 6 - Reflection & Space to Pause		
TERM	OCC. / 135	EOV. %AGE	TERM	OCC. / 95	EOV. %AGE	TERM	OCC. / 70	EOV. %AGE	TERM	OCC. / 69	EOV. %AGE	TERM	OCC. / 90	EOV. %AGE	TERM	OCC. / 81	EOV. %AGE
coffee	23	17	thing	12	12.6	room	8	11.4	read	7	10.1	thing	14	15.6	think	12	14.8
make	18	13.3	son	9	9.5	think	8	11.4	years	6	8.7	make	11	12.2	time	8	9.9
cup	13	9.6	same	8	8.4	thing	7	10	thing	6	8.7	think	10	11.1	doing	7	8.6
eat	10	7.4	out	7	7.4	feel	6	8.6	bed	6	8.7	ritual	7	7.8	make	6	7.4
particular	8	5.9	family	7	7.4	time	5	7.1	room	6	8.7	more	6	6.7	work	6	7.4
time	7	5.2	doing	7	7.4	day	5	5.7	phone	5	7.2	routine	5	5.6	feel	6	7.4
use	7	5.2	eat	7	7.4	bed	4	5.7	call	5	7.2	time	5	5.6	life	5	6.2
cafetiere	7	5.2	bed	7	7.4	bookcase	4	5.7	skype	4	5.8	doing	4	4.4	down	5	6.2
put	7	5.2	room	5	5.3	screen	4	5.7	eat	4	5.8	feel	4	4.4	coffee	4	4.9
always	6	4.4	years	5	5.3	important	4	5.7	first	4	5.8	need	4	4.4	used	4	4.9
thing	6	4.4	coffee	5	5.3	object	3	4.3	around	4	5.8	myself	4	4.4	being	4	4.9
dinner	6	4.4	together	4	4.2	use	3	4.3	family	3	4.3	through	4	4.4	before	4	4.9
first	6	4.4	living	4	4.2	light	3	4.3	stuff	3	4.3	religious	4	4.4	bed	4	4.9
routine	6	4.4	put	4	4.2	curtain	3	4.3	important	3	4.3	work	4	4.4	process	3	3.7
sit	5	3.7	ritual	4	4.2	easier	3	4.3	doing	3	4.3	two	4	4.4	space	3	3.7

Fig.28: Analysis of top terms within themes, raw occurrences and equivalent percentages

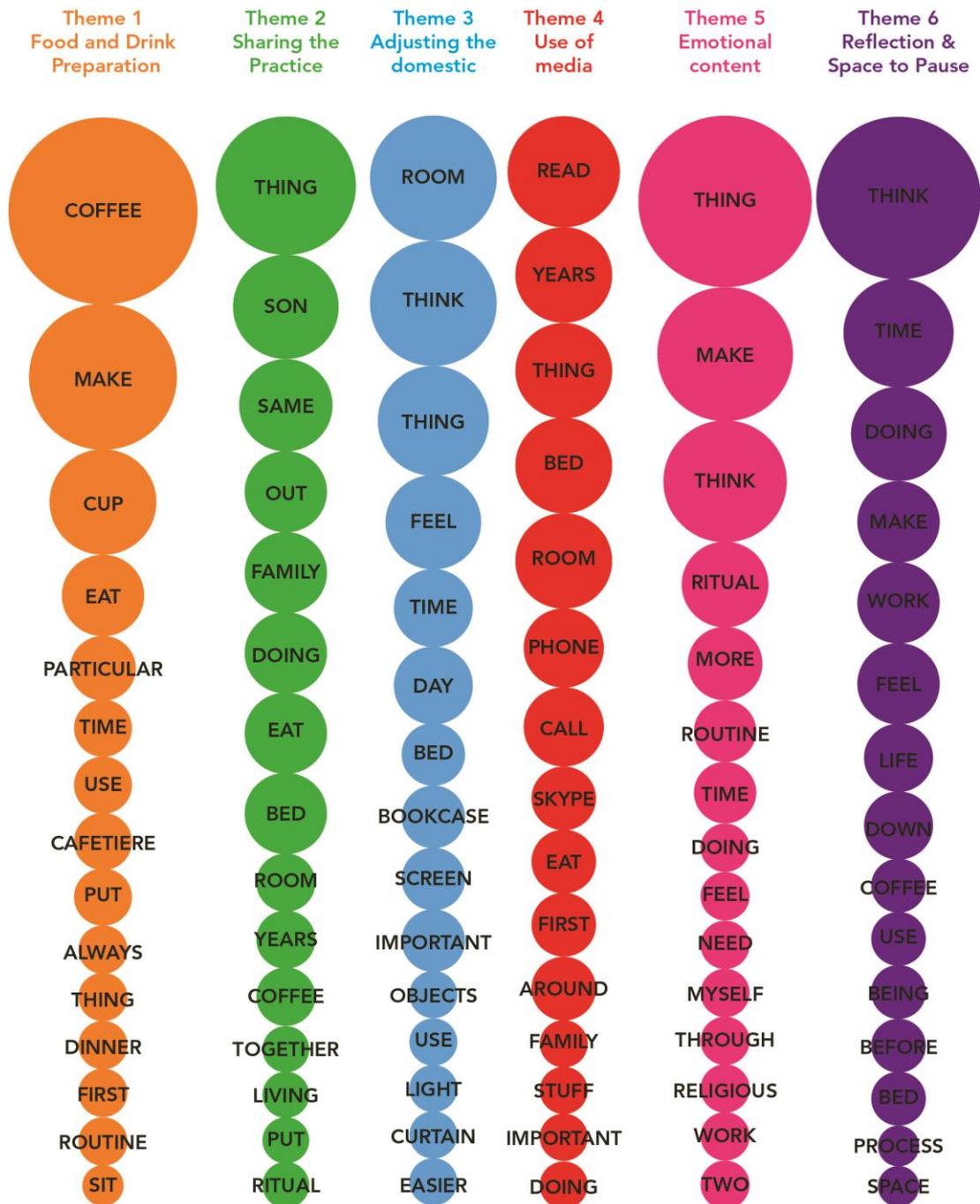


Fig.29: Visual representation of top 15 occurring terms within themes

### 5.2.1.2 Understanding Practices: Themes and Terms

Through this process examples of practices, insights into the motivations of performance, their impact on daily life, past practices and important objects were gathered, while analysis identified six themes: *Food and Drink Preparation* (T1); *Sharing Practices* (T2); *Adjusting the Domestic* (T3); *Use of Media* (T4); *Emotional Content* (T5); and *Reflection and Space to Pause* (T6). Further analysis identified time and space recurred across themes, while consumption and digital aspects were less frequently considered, indicating digital concerns

are rarely involved in practices, but can promote new ones, for example, Skype supporting more frequent communication with distant family. Other practices included morning tea and coffee, washing and cleaning, communicating with others and organising space to suit particular moods. This extends previous understandings of people's experience and engagement with material, social, emotional and cultural aspects of Practice, indicating motivations, competencies, materials and meaning in particular, self-developed, dynamic practices form home and order domestic life through long and short-term planning. This also provides novel, specific examples of objects involved in practices and how they act with non-human agency when understood as part of the assemblages facilitating and constituting Practice. Important objects included desks, knives, pots and pans, personal mementos, key bowls, cafetieres, pens and heirlooms, all of which afforded or provided action or engagement with practices; participants were uncomfortable if certain objects were unavailable and irritated if practices weren't conducted. This suggests human/non-human agency arranged in time and space allows people to shape the domestic both pragmatically (key bowls & organisation) and meaningfully (special coffee) by developing a household vocabulary.

While the values/virtues relating to Practice did describe convenience, this was not a core concern; instead, sharing self-developed practices, providing a sense of control and space to reflect are more important, supporting physical and mental engagement with individual elements and overarching concerns. Participants in *IoT Tea Time* felt these could be negatively impacted by an automated, convenience based IoT, suggesting moving the IoT from a system skewing towards technically interested men at the expense of the home as living Practice is critical, as the envisioned efficient and automated IoT conflicts with participant understandings around effective experience, meaning and engagement with the home. Instead, family traditions, control, establishing routines, social connections, organisation, emotional satisfaction, consideration of others, avoiding work, religious connotations and having time to think were more important, all of which can be considered as internal values of Practice, or virtues that support development of self. This indicated the benefits of exploring a Practice-Oriented IoT could include recognising the value of understanding people's practices in the domestic space to challenge existing notions of this system, supporting focus on the internal goods and virtues of Practice while recognising the agency of humans/non-humans in a flat ontology. This also provided explicit examples of normally tacit practices, where specific aspects could act as UGV to narrow communicative

gaps and serve as guiding principles to design technologies to fit into an existing practice's tacit knowledge.

## 5.2.2 Exploring Practice

Previously, practices were explored generally with themes identified and elements ranked. Some were discussed in detail, but exploring specificities structured by previous insights in a workshop using tailored tools would support deeper understanding. Participant selected objects acted as 'indicators pointing our way to something else' (Polanyi and Prosch, 1977, p.71) or focal points contextualising practices, similarly to previous PD methods exploring artefacts to understand experiences (Bowen and Petrelli, 2011).

### 5.2.2.1 Workshop: Deconstructing Practices

Workshops are a traditional setting for PD research, supported by a structured approach and design tools (Schoffelen et al., 2015, p.182). For objects, a postcard was developed with an image of a participant selected object on the front and space for a message on the back; for space a grid allowed participants to interpret this as a room, floor plan or wider viewpoint, following similar research (Crabtree and Tolmie, 2016, p.1744; Lingel, 2016, p.819); for time, a circle with twelve sections was used without stating whether this was a clock or another way of organising time (Fig.30). Finally, five sizes of tokens per category of acts, objects, spaces, times and mindset were allowed participants to rank their importance to Practice.

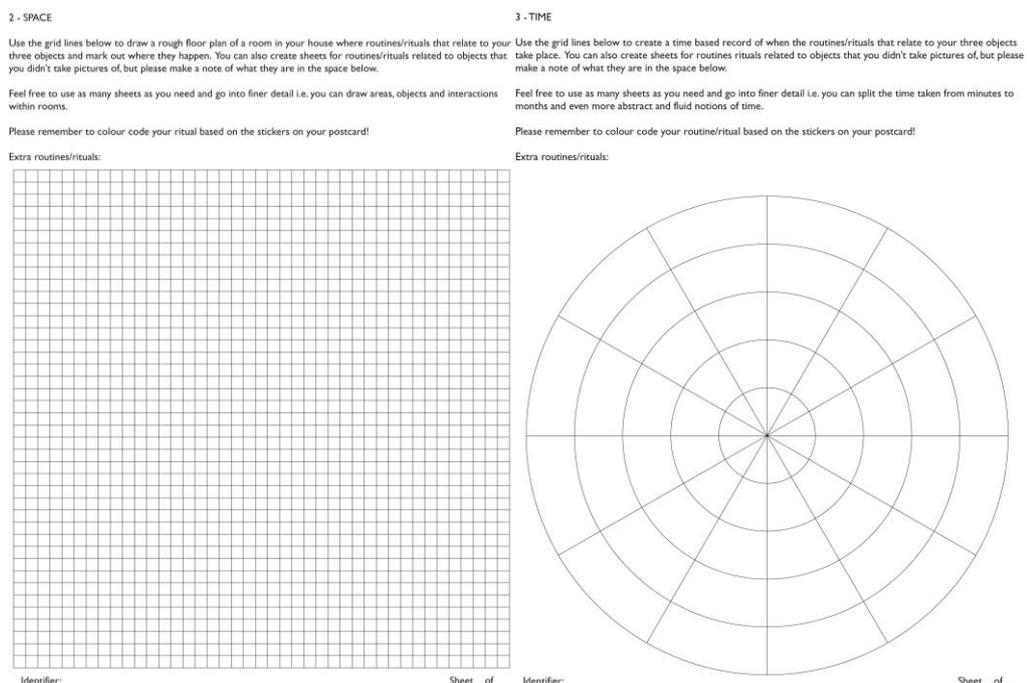
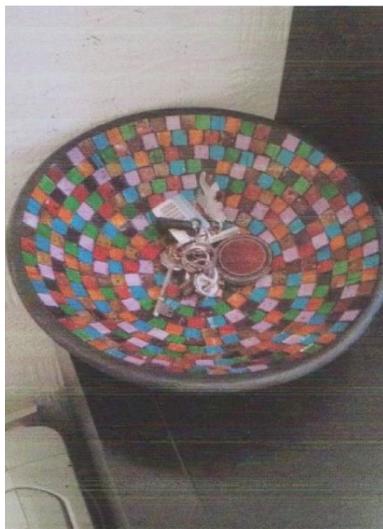


Fig.30: Space (l) and Time Worksheets(r)

Focusing on Domestic Practices participants were invited back, with three returning and two new participants recruited. All participants (three men and two women) completed a PCS after explanation and were asked to photograph and email three objects important to their practices. These became postcards given to the same participant at the workshop's start with instructions to write a short message about its function and meaning (Fig.31). Each postcard was colour coded for identification in following activities.



To You,  
 This is a bowl that sits in my hall way. It was given to us for our wedding. Slowly it became part of our daily routine in that it is ~~what~~ where I leave my keys in the afternoon when I arrive from work. It means I know where important items are (wallet + phone end up there too). It is ~~was~~ a symbol of my life ~~as in~~ with ~~do~~.

Fig.31: Postcard of a keybowl, one of PA's chosen objects/practices.

The second part focused on the spaces of these practices, with the worksheet used to indicate position, use and interactions between objects and people (Fig.32).

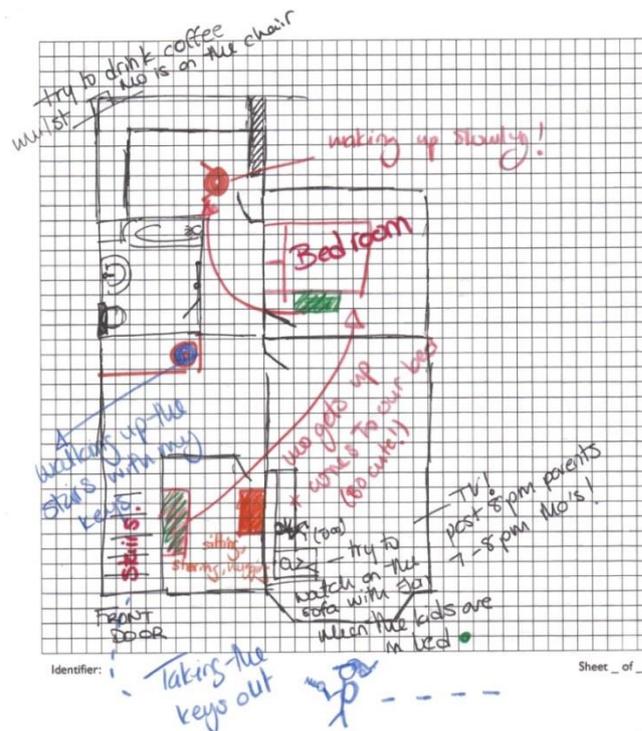


Fig.32: Mapping PA's chosen practices with the keybowl indicated by a blue dot

The third stage investigated times and duration of object interactions using the worksheet (Fig.33); participants placed coloured stickers to indicate these and wrote short explanations.

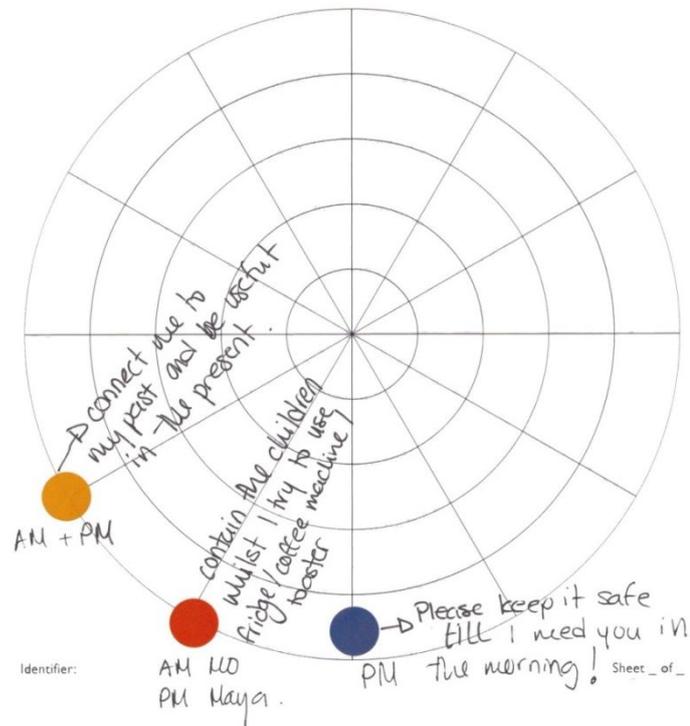


Fig.33: Charting times of PA's chosen Practices

Finally, the importance of five elements relating to Practice were ranked (Fig.34), documenting participant understanding of Practice relating to their objects, how these co-constituted Practice and clarifying the validity of these adapted categories in interrogating practices (all workshop tools Appendix F; all results Appendix G).

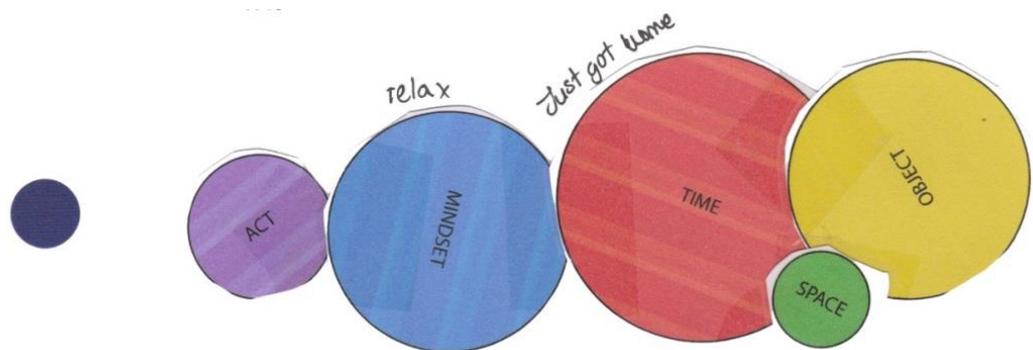


Fig.34: Ranking Practice elements of one of PA's chosen practices

### 5.2.2.3 Workshop: Practice Understandings

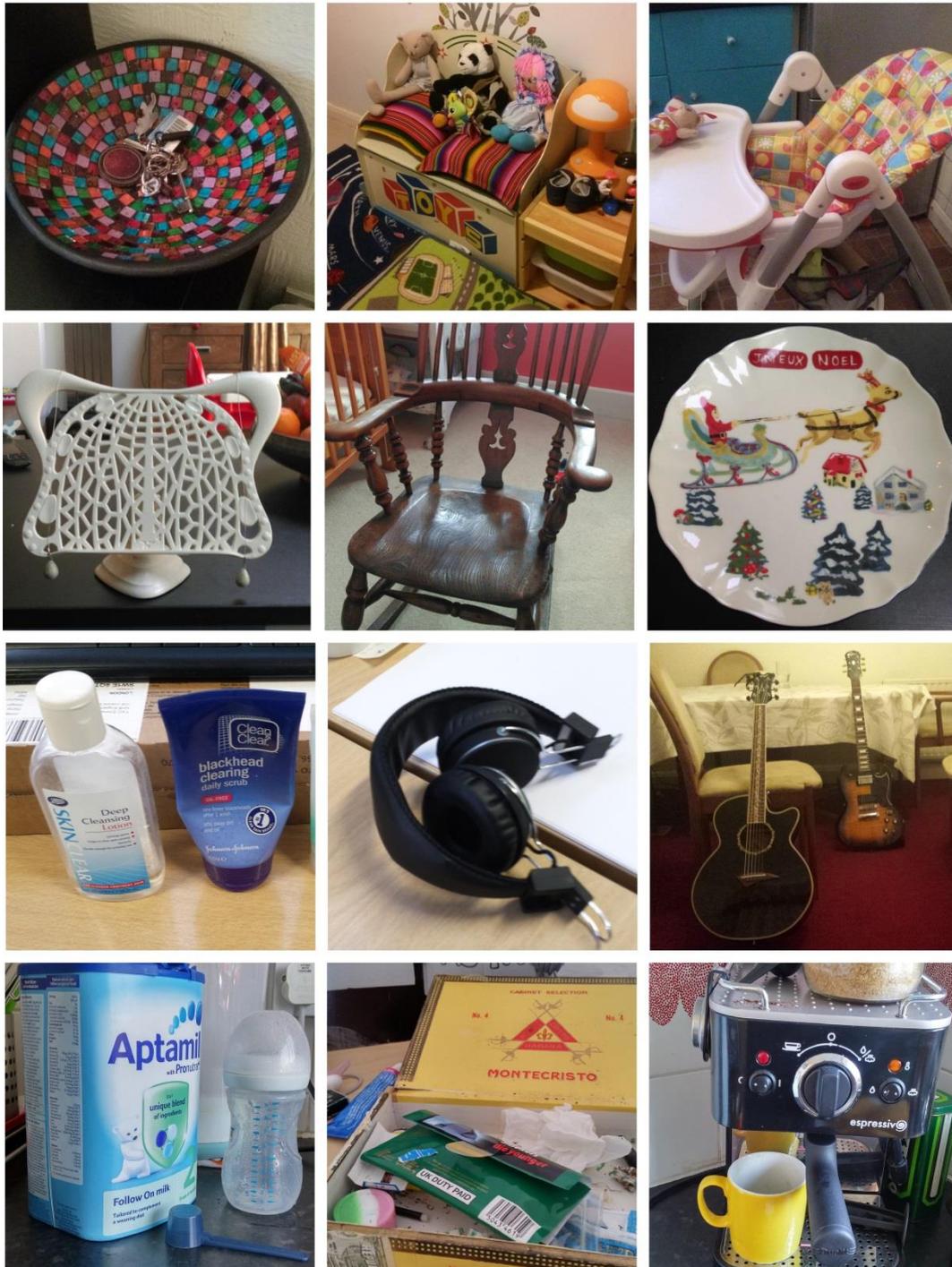


Fig.35: Participant's selected objects, PA (top row) to PD (bottom row), PE's object is missing due to this being sketched rather than photographed.

This activity provided deeper understanding of practices associated with thirteen objects (Fig.35), providing focus to the workshop and, by using specifically developed tools, supported participant exploration and documentation of the associated acts, time, space and mindset of practices for further analysis (Fig.36).

	Object	Space	Time	Meaning	Practice
A	Key bowl	Hallway; Upstairs; Out the house	6pm; 'Please keep it safe until I need you in the morning'	Wedding gift; Symbol of married life	Slowly became part of daily routine; Storing keys & wallet
	Toy chest	Child's bedroom	Connect to the past and useful in the present	A connection to the past	Prop when dressing children; Feeding 2nd child while reading to 1st.
	High chair	Kitchen	7am, 1st child; 7pm, 2nd child.	Reminds them of their children	Child wakes up slowly; Dumping ground for things to distract children
B	Book-stand	Kitchen	At weekend as long as children can be ignored; Waiting to be used during the week.	Makes them happy smile & salivate	Baking; Thinking about what to bake
	Rocking chair	Child's bedroom	Every evening, from 6.30-7pm; Past & present	Belonged to grandfather as part of his evening routine	Sat in while reading to child
	Place	By the fireplace, wherever we are	Once a year - Christmas, before children go to bed. Peak of excitement.	'A new addition to routine, but completely ours'. Represents Christmas	Leaving out biscuits for Father Christmas.
C	Face-wash	Bathroom; Bedroom	Twice a day, morning & night.	Feel refreshed & on track	Routine of exercise & cleanliness
	Head-phones	Bedroom; Practice room; Kitchen; Bathroom.	Everyday, commute or breakfast; While cooking; evening	Intimacy of sound; Inform, educate, entertain	Listening to podcasts & music when running or cooking
	Guitars/piano	Practice room; Bedroom	Late pm to evening, teaching	If not used, feels anxious & restless	Improvisation, composition, practice; Uses piano to time cooking
D	Formula	Kitchen	5 Times a day: 5am, 10am, 2pm, 6pm, 8pm.	Important part of day; Emotional connotations	Making 2nd child's milk
	Stash box	Living room	At least daily; 8.30 pm	Given by a close friend; Emotional attachment	Storage of paraphernalia
	Espresso Machine	Kitchen	Everyday, 6am; 'More whenever I can'	I love it; The act of using it helps me wake up	Making coffee
E	Record player	Living room	8pm - 10pm	Defines emotional state; Defies consumerist society; Brings solace; Creates own environment	Playing vinyl records in ritualistic way; Listen, absorb, reflect, change mood, drink

Fig.36: Table detailing participant responses to each workshop section

A central aim was to explore concrete Practice details with meaningful objects acting as tangible focal points for participant exploration of intangibles. Thirteen specific practices were gathered for use as UGV and further analysis, providing understanding of Practice element's contribution to their construction. These were framed by objects used in specific acts, located in space and time and imbued with meaning; analysis indicated these

structured domestic life and supported subjective, personal and shared understandings and associated memories.

Participant authored practices developed dynamically, with specific processes developing new traditions, imbuing objects with future meaning to locate them within new practices. Objects were used for organisation, family care, marking special occasions, self-improvement, self-expression, consumption and mood alteration, with some objects fitting across categories. Time prompted participants to reflect on the past, present and future, providing meaning to objects through memories, current situations or future plans. Spaces varied between and within practices, object category and context: organisational objects were in the hallway, children's bedroom, kitchen or living room; family objects were in children's bedrooms, kitchens, by the fireplace or wherever the family was; self-improvement/expression was in the kitchen, bathroom, bedroom, practice and living rooms; consumption ranged from the kitchen to the living room. A range of times and duration of use were identified, including regular and occasional practices lasting long, short and undefined amounts of time. Practices happened numerous times across the day; in the morning and night; only once a day, week and year. These were sometimes contingent on external factors, where time helped to structure immediate practices, plan future practices and connect with the past through practices. Meanings varied, but fit within previously identified themes, including meal preparation, use of media, space to think and reflect and emotional content, such as memory and family, with symbolic significance relating to important occasions and people. Important practices included child rearing, baking, practicing instruments or listening to music, which involved human agency to engage with processes of developing competency, self-improvement and personal goals. The use of specific objects relates to materials, with clear assemblages emerging as selected objects were only part of larger material Practice assemblages. Non-human agency can be considered the effects or outcomes of use (storage, seating, music, food and drink) as part of these assemblages in conducting and connecting practices. However, PB mentions their book stand makes them happy, while PC discusses their anxiety if musical instruments aren't available, so these objects may have emotional as well as physical agency.

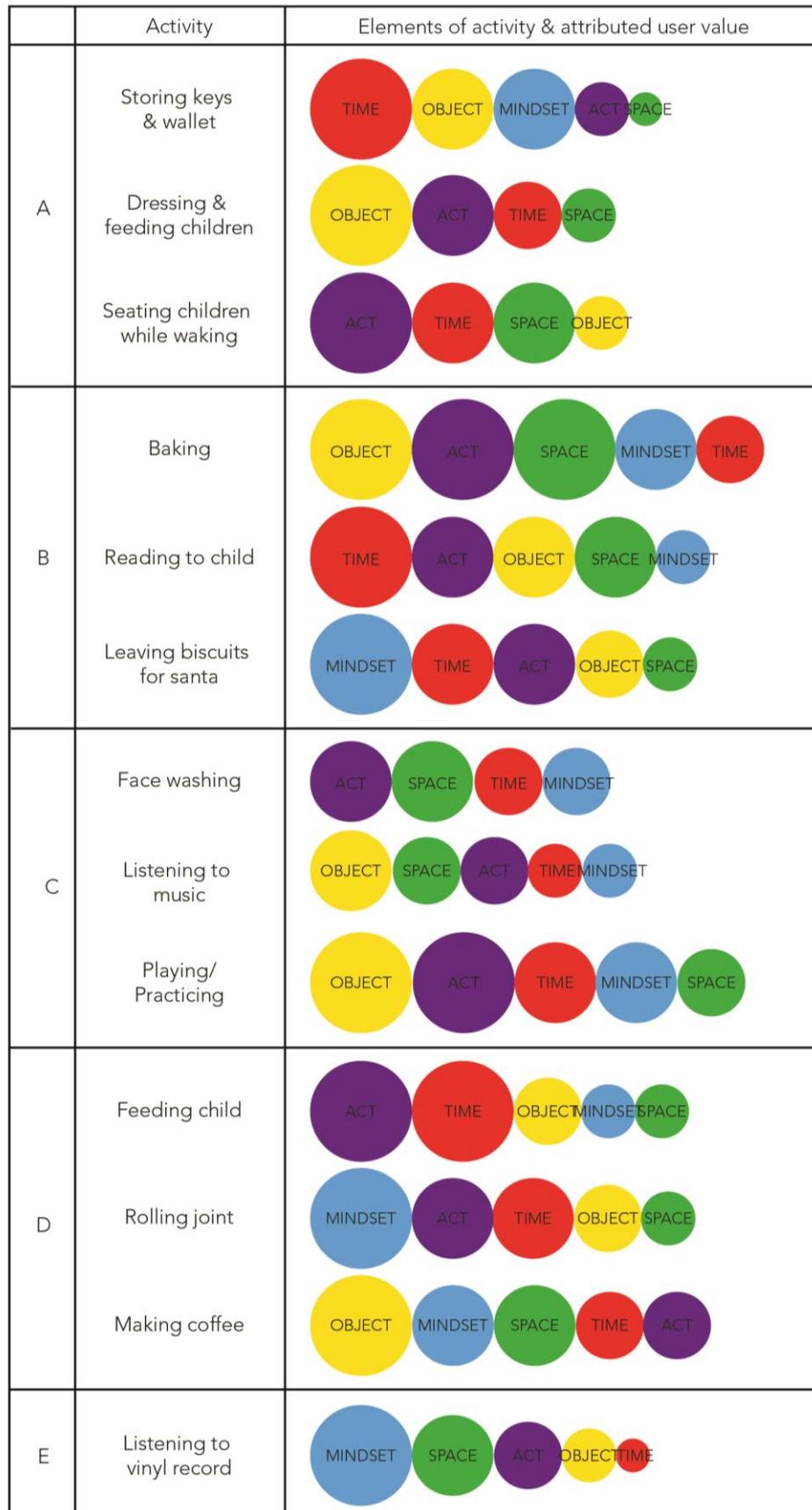


Fig.37: Participant ranking of Practice elements importance to specific practices

The values associated with these practices had little concern for efficiency and convenience across selected objects, suggesting the goods of excellence, such as loving relationships, playing or listening to music or intellectual stimulation, are more important. These are represented in meaning through history, being a gift, representing participant's goals, so that associated memories, social history, biography and improvement in practices and self are developed through Practice engagement. Although the importance of Practice elements varied, rankings (Fig.37) indicated using particular objects generally ranked first, mindset second, act third, time fourth and space last. Participants ranked similar practices differently: 'Dressing and Feeding Children' and 'Feeding Child' show different rankings of aspects between participants; 'Listening to Music' places mindset last, but 'Listening to Vinyl Record' ranks this first, possibly due to the physical engagement with the medium. These practices are unlikely to benefit from application of Techno-Centric IoT concerns, as the experience and involvement in conducting them is important to participants, suggesting human agency is linked to the development of internal goods.

This workshop gathered further examples of specific practices and elements for inclusion as UGV to guide PDP and confirmed the value of using these to explore Practice through discrete elements. Practices not only focus on goal orientated outcomes, but structure domestic meaning through interpretation, the objects involved, the ability to conduct practices well and sharing these elements with other household members. This corroborates that Practice-Oriented towards the domestic space can support understanding of the core elements of domestic experience, where continual engagement with Practice competencies through materials extends meaning through specific spatiality and temporality in dynamic, developing practices with emotional, social and symbolic value. Integrating these with user's IoT understanding and concerns may support the development of an infrastructure incorporating both technical and Practice considerations, extending understanding of this topic as an underlying conceptual framework.

### 5.3 Discovery of User IoT and Practices, Prototyping through Application

This stage applied Practice details to understand attitudes to the IoT, integrating these through tools where user perceptions and feelings are equally important as technical specifications (Howcroft and Wilson, 2003, p.4). Additionally, this would explore the effectiveness of communicating Practice-Oriented to workshop participants, an initial

Practice-Oriented IoT model and cards that communicated Domestic Practice User Generated Values (DPUGV). This aimed to encourage development by communicating previous participant knowledge, opinions and understandings (Spinuzzi, 2005, p.166), simultaneously gathering participant IoT understandings for later communication as Internet of Things User Generated Values (IoTUGV) in PDP.

### **5.3.1 User Understanding and IoT/Practice Synthesis**

Design workshops are useful during PD *Discovery*, revealing tacit and explicit understandings of topics (Muller and Kuhn, 1993, p.27; Sanders, 2002, pp.2–3) and helping focus projects, explain situations and drive learning (Muise et al., 2008). Theoretical and practical workshop tools were developed: a model using Practice elements as IoT inputs detailed technical considerations (Fig.38), proposing a Practice-Oriented IoT incorporating Practice elements through physical/digital Smart Objects, where IoT Intentionality supported practices by witnessing them, informing practitioner’s dynamic development.

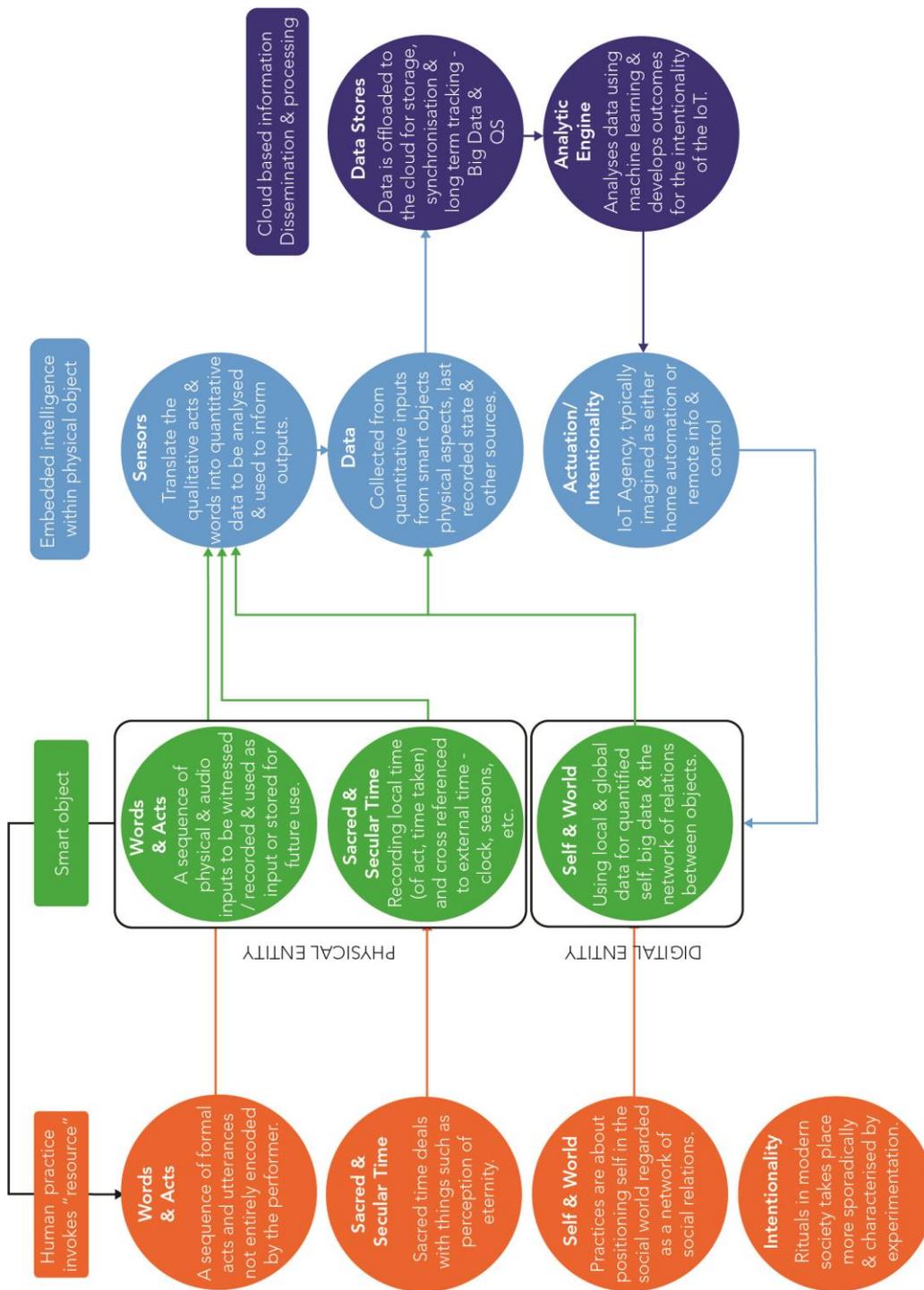


Fig.38: Mapping Practice within the IoT, synthesising Practice and technical considerations

A Practice-Oriented deck was developed to communicate UGV from *Discovering Domestic Practices* (Fig.39), helping participants build practices engaging with the IoT. In relation to communication in RQ2 the use of cards follows examples including *Method Cards* (IDEO, 2003), *Artefact Cards* (Willshire, 2012) and *Instant Archetypes* (Jain, 2017). IoT toolkits support technical understanding through KnowCards (Aspiala and Deschamps-Sonsino,

2014), IoT tangibility or legal frameworks (Angelini et al., 2018b; Luger et al., 2015) and concept generation (Mora et al., 2017) based on context (De Roeck, 2016).

Object	Space	Time	Acts
Coffee/Tea Set; Shelves; Newspaper; Bed; Tableware; Chair; Cookware	Hallway; Bathroom; Living Room; Back Garden; Kitchen; Children's Room; Bedroom; Toilet	Sunset; Friday; Evening; Spring; Winter; Weekend; Breakfast; Birthday	Sharing a drink; Leaving a note; Adjusting lighting; Putting keys away; Cooking for guests; Listening to music; Opening the curtains; Doing housework

Fig.39: List of Practice-Oriented Cards

These Practice-Oriented tools (Appendix H) included a card deck incorporating images and text to explain Practice elements to participants, allowing them to contextualise, inform or curate practices (Fig.40).

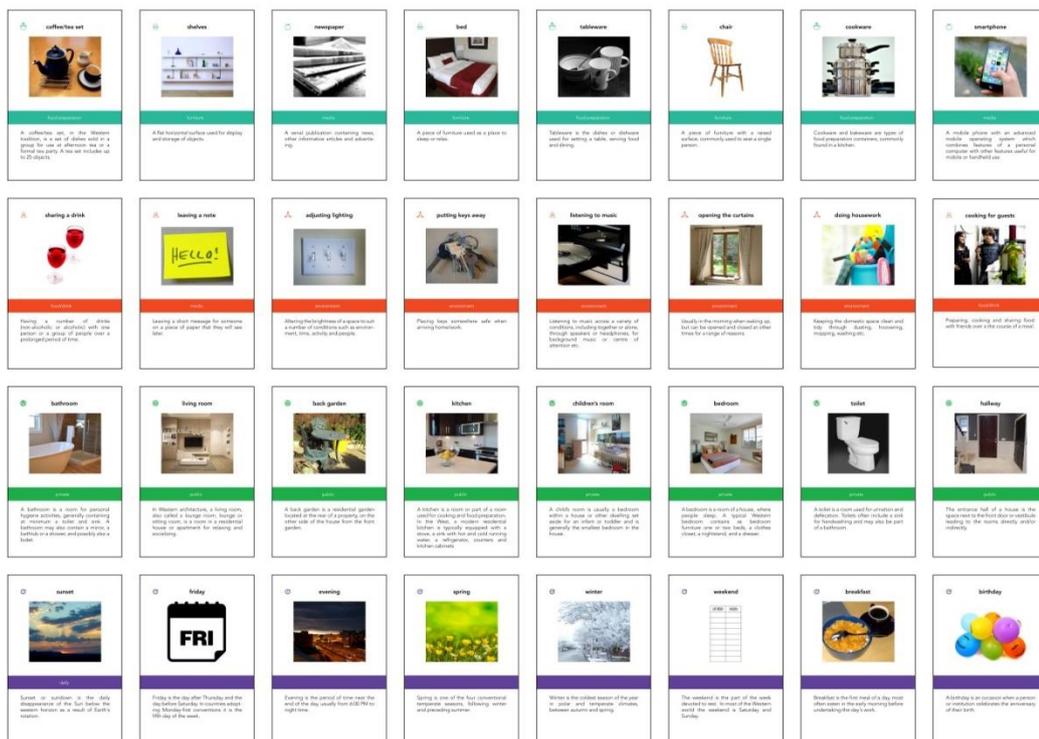


Fig.40: Practice-Oriented Deck

Two workshops were arranged: the first (WSI) was held at SPACE studios, which ‘provides a test ground and critical exchange platform for artists and thinkers whose work engages with technology’ (“space,” 2020). Seven participants (three men and four women) were recruited through the organisation’s website and mailing list – most were involved in design, had previous IoT interests and were well informed about related topics (responses Appendix I; analysis Appendix J). The second workshop (WSII) was held at the Royal College

of Art and recruited participants without a design background due to overrepresentation in WSI (responses Appendix K; analysis Appendix L). Three participants were recruited through social media; two men interested in technology without a design background, one woman with an interest in design. Before both workshops activities were explained and participants completed a PCS. While this was a small sample, the level of detail developed through rich exploration meaningfully informed understanding of the IoT and the impact of Practice-Oriented.

#### **5.3.1.1 Discovering IoT UGV**

Participant objects varied, with six intimate - two toothbrushes, a ring, ear-bud headphones, a cushion, and a diary (Fig.41). PB's ring was deeply personal with a rich history and meaning; PF's diary was more generic, but still personal with an organisational focus on the future; earphones related to entertainment, cushions to comfort or toothbrushes to hygiene and self-improvement. Physical engagement was important, with PB stating they enjoyed using the object and felt its absence if it was missing. The exception was a standard 4-gang socket extension cable, with PE interested in their domestic electricity use.

	Object & Practice	IoT Concept	Model Elements	Benefits	Negatives
A	Toothbrush; 15 mins twice per day	Smart Toothbrush	Objects, person, data, internet, business.	Detect bacteria & feedback on dental health; Track data; Recommend when to go to dentist and toothpaste.	Influence on daily routines; Capable of modifying habits; Control over data produced; Acts as authority & dis-empowers.
B	Ring; No function, but if missing feels weird; Napoleonic era, from mother	Smart Ring	Needs, adverts, 'problems' to person; IoT connection from person, selling to capital, driving 'needs' to person; IoT solution drives adaptation.	Temperature: Reflexology; Oyster payments Light; Drinking; Music Control; Sports Tracker; Colour Change; Hands-free, but for what?; Collecting information without needing to communicate	Believe apps more than self; Individualistic social interactions; Data advertising; Sense of loss if forgotten.
C	Toothbrush; The only constant practice through lots of travelling.	Smart Toothbrush	Human; Computer advertising; Interface collecting data from 'host'; Google, Satellite Dog, Whale, Plant.	Collect data of caries, bacteria, potential cavities, pH levels; Reminds to floss; Suggests changes to routine to increase health; Warns if has germs on.	Data collection for manufacturer & probably gives false info; If company owned by shareholders, made in ways to make people buy more.
D	Earbuds: Everyday on computer to listen to music - sometimes no music.	Smart Earbuds	Sensing environment, when used & location; Info collection from human behaviour; Learn through activity & object more humanised	Reduce volume/stop playing when on road in dangerous situation or conversation; When to take a break to protect hearing; Adjusts to emotional state.	Dependent on it & locked into ecosystem.
E	Plug & cable; Standardised & integral to daily life for so long.	Smart Socket	What product + Smart Socket; WiFi; Information, usage; Choices; Lifestyle & routine; Industry; Me	Greater scientific knowledge & understanding.	Analysis of human interaction to remove it; info directed to made new unneeded products.
F	Diary; Use to organise everyday & future; Budget long & short term.	Smart Diary	Person; PC/Tablet; Servers; Money; Industrialists	Automatically linking data from schedule, emails etc; Automatically deleting duplications.	Lack of control if decision to delete is incorrect; Unable to turn and page or cross out completed items; Lack of personal choice/style
G	Cushion; 2 functions - decorative and practical.	Smart Cushion	Me; Human interaction, remove or rely on; Information, habits, routine, desire; Tech Big Data, Big Business; Money; Adverts; Apparent Problems; Efficiency.	Wants cushions to be used; Sharing hugs; Alarm; Connected to bring people close & send emotion.	N/A

Fig.41: Table detailing participant objects, IoT model, concept and benefits and negative of concepts, WSI

Feedback on IoT products tending towards Techno-Centricity (Fig.42) was mainly negative, with concerns around data collection and ownership, especially if user generated data, which participants described as the 'product' IoT companies want, was sold to third parties. In some circumstances data collection was acceptable, for example, if this wasn't too personal and benefitted humanity's shared knowledge. Further issues included continuing

subscription models, barriers to quitting, security, surveillance, hacking of devices for burglary and built-in obsolescence through hardware and software updates. Criticism described *Amazon's Dash* as an example of 'efficiency gone mad', with worries it could encourage spending through targeted adverts based on usage; *Nest's Learning Thermostat* was considered unnecessary; the *Goodnight Lamp*, despite being the most social and moving away from Techno-Centric concerns encouraged unidirectional, hollow and 'creepy' social experiences.

Goodnight Lamp	Nest Smart Thermostat	Amazon Dash Button
<p>Creepy - not like being with them;                      Skype to watch girlfriend sleeping;                      Text me when you're home - but you forget to turn it on;                      Trying to bring in the human element without humans;                      Where to put the second one?                      Would it wake up someone across the world?                      Press &amp; data pings out the house;                      Similar to 'I'm online';                      Control? One way.</p>	<p>What happens if it breaks?                      Is it a subscription model?                      What are the digital rights considerations?                      Another thing to control via phone;                      What happens to the info collected - targeting new electricity suppliers or adverts?                      Data sharing;                      Hacked when not there &amp; burglary issues?                      Google owned - not good people;                      An interface to harbour our data?;                      Traded as big data - hollowing;                      Bad idea - why does the house need to be controlled? To save money on heating?</p>	<p>Connected to WiFi;                      Knows your passwords and 1 click ordering;                      Limit 1 press &amp; 1 product per press;                      Ordering 10 or 1 x 10 - wasteful;                      Amazon cancel;                      Human efficiency gone mad;                      Is it worth the material made from?                      Physical spam;                      Advertisements all day everyday;                      Worries about spending;                      Arguments about incorrect orders;                      Privacy &amp; associated products &amp; who you are;                      Messages at night - insomnia orders and targets you;                      What if someone else gets it?</p>

Fig.42: Participant feedback on IoT products

In group discussions participants described IoT benefits as convenience, saving resources and making life easier, but were ambivalent about a completely automated IoT that regulated life. 'Families' of IoT objects were considered more useful than standalone ones, as they could provide context and support long distance relationships, but social elements needed sensitive implementation. Listing and voting revealed positive and negative IoT attributes (Fig.43): Convenience, automation and advancing human knowledge were most positively received, with three votes each. The biggest concerns were potentially decreased human interactions, potential negative impact on privacy and social stratification through inequitable IoT access. The benefits of sharing data, the potential negative impact on human interactions and societal equity indicate a broader perspective on the consequences of the IoT.

Positive Themes	Negative Themes
<p>Convenience (3)</p> <p>Advance science &amp; knowledge through data collection; Patterns we don't realise; How people influence environment &amp; how it responds (3)</p> <p>Automation (3)</p> <p>Accessibility &amp; control (2)</p> <p>Saving time (2)</p> <p>Wallace &amp; Gromit (1)</p> <p>Speed</p> <p>Objects are more interactive &amp; nicer</p> <p>More free time</p> <p>Saving money</p> <p>Communicating passively</p> <p>Makes new objects - inspires innovation</p> <p>Improve experience of life in the home</p> <p>Improve safety of objects</p>	<p>Decrease human interactions (5)</p> <p>Privacy (4)</p> <p>Access to tech - regulated - further stratification &amp; inequality (3)</p> <p>Individuality within know the consequences in the world (2)</p> <p>Mining of minerals &amp; raw materials (1)</p> <p>As time consuming as it is saving(1)</p> <p>Failure - can't fix it</p> <p>Fast obsolescence</p> <p>Going off grid is harder</p> <p>Subscriptions &amp; endless payments</p> <p>Data</p> <p>Security</p> <p>Power/electricity usage</p> <p>How the next generation learns about the world - just accept its all been prepared &amp; settled</p> <p>Becomes so ingrained in society you can't escape from it</p> <p>Disposal and 'recycling' of current &amp; future outdated technologies</p>

*Fig.43: Results of discussion and voting of IoT benefits and concerns*

Developing concepts around participant objects helped situate personal practices through real life contexts, yet outcomes were predominantly shallow 'Smart' versions of these objects, including Smart toothbrushes, rings and cushions. Most IoT models contained *Person, Object, Data, Internet, Servers, Business/Capital* and *Advertising*, which correlate with the external goods of effectiveness within Techno-Centric paradigms. However, outliers included animals and plants, as in PC's model (Fig.41), which, while inaccurate in places, had parallels to other mappings exploring Beyond Human-Centricity.

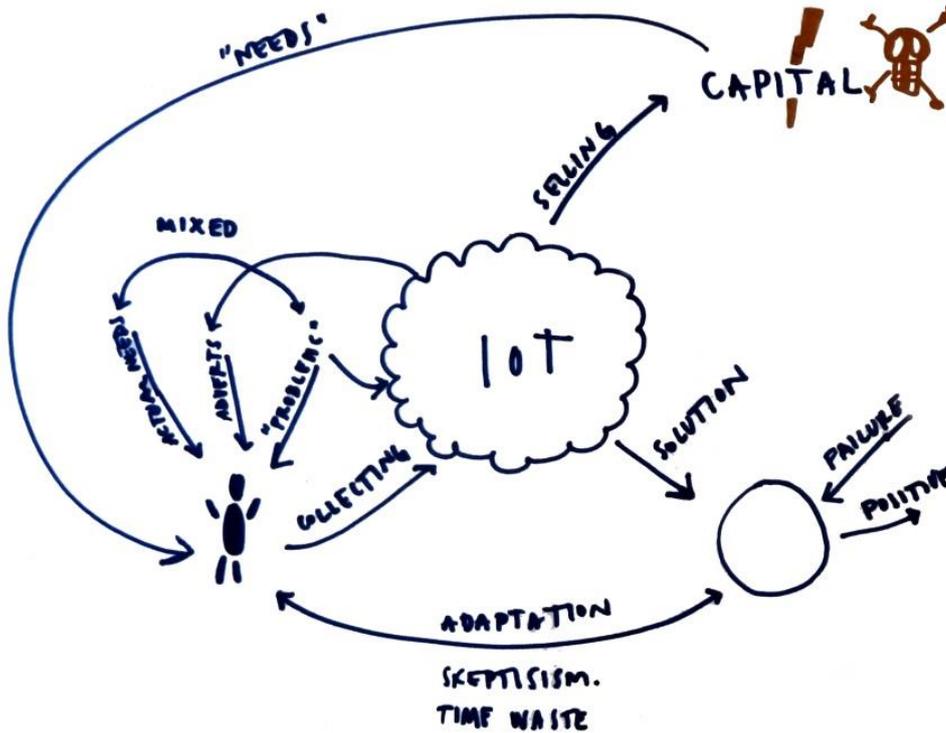


Fig.44: PB's IoT model relating to Smart Ring Concept

This provided further detail of participant's IoT understandings, considering business elements and not just functionality. These insights show the possible effects of Techno-Centric biases on practices within IoT; for example, in PB's model (Fig.44) the IoT is driven by data collected from the person, providing feedback of 'needs' driven by capital, driving unnecessary consumption. This again links with external goods of effectiveness linked to utility, exploiting people by mis-educating them to believe their worth as derived from acquisition of goods as consumers. As attention to ethical dimensions of value moves from consideration of objects to acts (Lambek, 2008, p.134), further criticism describes possible negative impacts on people's behaviour and minimisation of engagement; PE's model labels the link between the person and object as 'analysis of human interaction to remove it' (Fig.45), echoing this.

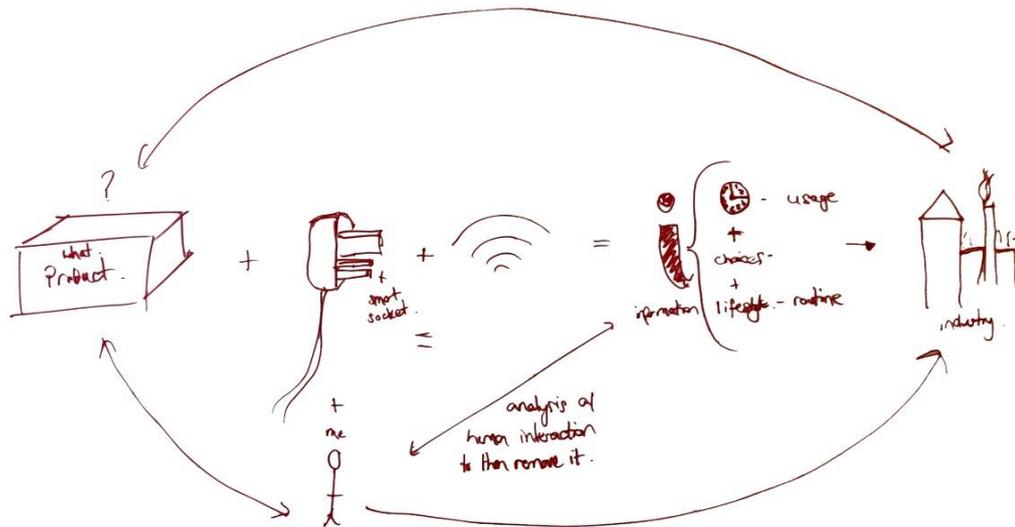


Fig.45: PE's IoT model relating to Smart Socket Concept

Lists of positive and negative attributes were collated through group discussions of concepts (Fig.46), revealing participant understandings through the lens of personal objects and practices. Positive themes included easy, intuitive, automated and assistive, but emotion and social were also revealed. It is important to note the distinction between automated, suggesting reduction or removal of human agency and assistive, suggesting guidance in conducting practices. Negative themes echo previous negative rankings, with concerns including dependence, referring to reliance on the IoT to mediate life and physical interaction, and changing practices, where methods are imposed upon the user, rather than the system changing for users. These values contain contradictions, with the positive theme of automation placing all agency in non-human elements of IoT constellations, yet there is also a negative perception of loss of social/physical interaction. This indicates that positive themes express current Techno-Centric externalities, while negative themes focus on their impact on internal values, moving towards the virtues of what kind of IoT participants want.

Positive Themes	Negative Themes
Assistive (13)	Exploitation (9)
Automation (8)	Dependence (9)
Intuitive (4)	Security/data ownership (8)
Social (4)	Changing practices (7)
Emotion (3)	Loss of social/physical interaction (6)
Easy (3)	

Fig.46: Positive and Negative themes derived from concepts

### 5.3.1.2 Exploring Practice-Oriented Application

Participant objects related to consumption, organisation and the day's first act: initial concepts rolled cigarettes, made coffee and organised the day, suggesting automation and convenience are central to the IoT. However, these were automated acts prompted by inputs; e.g., standing on a bedside rug embedded with pressure sensors signalled PA was up, starting the cigarette rolling machine. This lowered physical interaction, minimising user control and Practice engagement; however, this was considered beneficial because of not having to roll a cigarette due to a lack of dexterity first thing in the morning (Fig.47). PA & PB's concepts aimed to make this practice easier through automation, although PB was keen on retaining control through direct input and alerts once the product was ready rather than an entirely automated process. Participant models were less well-defined than in WSI, with each including a person as the input to or beneficiary of the IoT. Discussion prompted exploration of data use, including automated maintenance cycles, transmitting caffeine levels or supplying rolling machine consumables.

	Object & Practice	IoT Concept	Model Elements	Know Cards	Practice Cards
A	Lighter; Used in the morning every single day to light cigarette.	Automatic cigarette rolling machine	Me & phone; Music service; Device - Sonos; Cloud radio.	Pressure sensor; Motion sensor; Battery; Wall AC; Buzzer; Servo motor; Bluetooth; Wire.	Self-written: Rolling cigarette; Cigarette.  Standard: Coffee/tea set; Newspaper; Bed; Kitchen; Back garden.
B	Mug, used all day for different liquids - coffee, water, milk, juice, tea. Also for measuring.	Smart mug/coffee machine	Mug; Person; Bed; Coffee machine; Fridge; Milk; Teabag; Kettle.	WiFi; Switch; Buzzer; Character display; Button.	Self written: Planning/prepare for day; Watch TV; Working.  Standard: Sharing a drink; Breakfast; Coffee/tea set; Newspaper; Kitchen; Living room; Bedroom; Bathroom; Back garden.
C	Diary; Used every day, likes to have interaction with a physical object.	Physical/digital diary	Diary; Software; Person; Screen.	Monitor or screen; Motion sensor; USB; Solar; Standard battery; WiFi	Self written: Planning day; Diary, Any time.  Standard: Evening; Friday; Weekend; Winter; Kitchen; Living room.

Fig.47: Participant objects, concept, model and cards used, WSI

The Practice-Oriented deck helped break down practices, allowing participants to understand which aspects an IoT system could detect and informing concept development. Participants completed at least one blank card across all categories, suggesting the examples could not cover all eventualities. Participant curated Practice-Oriented cards were

situated within an existing IoT system model more accurately, indicating better integration than their own models (Fig.48). However, these didn't support Practice synthesis with the IoT, with PB focusing on efficiency and convenience to develop a concept that made coffee remotely at the touch of a button.

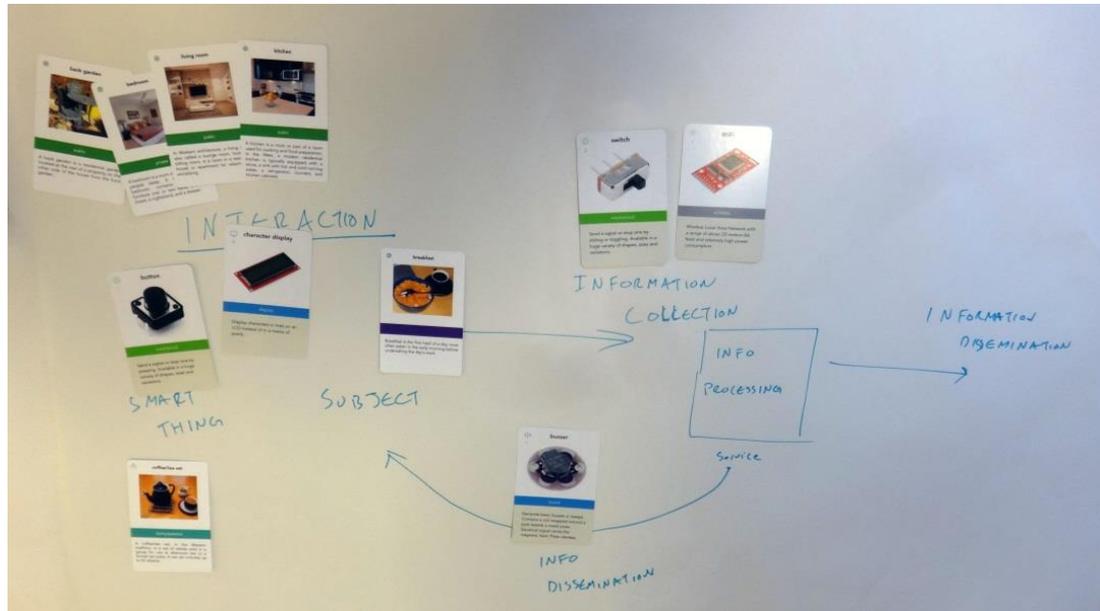


Fig.48: PB's mapping of Technical and Practice cards to chosen Techno-Centric model

The following stage used the Practice-Oriented model to accurately and creatively communicate the integration of Practice and technological elements, shifting participant IoT understanding from automated to intuitively assistive, with system agency informed by data generated from practices and external data. This supported PB in situating Practice elements in automated coffee making (Fig.49), leading them to consider how space, times of occurrences or environmental influences, including weather, could impact making and consumption. This expanded their concept by foregrounding the impact of Practice elements on automated decision making, stating 'perhaps in the morning it makes a normal coffee...at lunch it makes a café latte... if the weather is miserable it makes hot chocolate.' This suggests Practice elements can inform IoT decision making, but PB was keen to retain control of outcomes and sensing, so user engagement was minimised.



Fig.49: PB's mapping of Technical and Practice cards to Practice-Oriented model

These workshops aimed to explore knowledge relating to people's understandings of existing IoT devices and systems and their experience of the domestic space through Practice. Participants described the core IoT benefits as developing efficiency through automation and assistiveness to provide convenience, echoing Techno-Centric perspectives. However, concerns around agency and decreased human interaction, which can be thought of as the competencies involved in conducting practices, explored assessment of acceptable levels of automation and desirable IoT engagement and user experience. Furthermore, concerns surrounding the values and meaning of Practice and whether the IoT can conduct meaningful acts were raised. Human agency and control remained important, as participants wanted to devolve some of their activities to an automated system, yet retain the option to undertake the process themselves, showing the tension within Techno-Centric IoT approaches and the value of applying Practice-Oriented to highlight these issues. While participants considered the IoT as supporting automation and efficiency, concepts failed to engage with practices, but distinction between automation and assistiveness continued. Considering loss of control and interaction were recurring concerns this suggests participants valued the convenience of the IoT through automation to save time and provide accessibility and control, while contradictorily rejecting a decrease in human

interaction and privacy. Analysis of participant system models identified emotion and sociality were important to relating the IoT and personal practices, with concerns about system dependence reducing physical and social interaction. While existing IoT models provided clarity participants felt these models diminished human involvement and lacked emotional elements, showing a contradiction between the existing IoT conceptualisations and its inherent systemic values and people's practices. This can also be seen, as entirely local systems were developed due to participant uncertainty surrounding integrating data into their limited models and fears of external transmission.

This process applied Practice-Oriented to the IoT to support participants in developing new system understandings. Instead of equating automation with convenience, participants recognised this could nurture dependence and needed boundaries, while concepts proposed an IoT supported by physical engagement and social interaction, recognising interrelations between objects and systemic understanding of practices within the IoT. Participants stated many current IoT products are solutions for non-existent problems, and instead should integrate people's needs and actions by supporting, rather than directing, users. User experience was considered central to effective IoT product implementation, with automated practices acceptable if the sensorial experiences remained and the engagement suited the space, while suspicions continued regarding data control and ownership. Participants were still interested in IoT resource management, but were aware this could be expressive, representing use of spaces and objects or creating new forms of interactivity. The Practice-Oriented model's detail was useful in communicating greater complexity and how emotional content can be driven by Practice, but participants wanted clarity on how the IoT and Practice meshed. The Practice-Oriented cards and model helped communicate Practice's interactional impact within concepts to reframe the IoT - rather than simple, automated systems this could be intuitive, expressive and supportive. However, there was some confusion in the position of Practice elements in the model, suggesting this would benefit from further refinement, while moving away from focal objects may help avoid 'smartification.'

### 5.3.2 Prototyping Professional IoT/Practice Synthesis

*User Understanding and IoT/Practice Synthesis* used design workshops framed by Practice-Oriented, resulting in key observations regarding user's opinions on the IoT for future use as UGV; examples of meaningful objects and practices and participant concepts and models demonstrating understanding of IoT systems. IoT Practice-Oriented supported participant

IoT understanding and its relation to Practice, leading to concepts more sympathetic towards Practice issues.

*Discovering Domestic Practices and User Understanding and IoT/Practice Synthesis* used exploratory workshops in the *Discovery Stage* of a PD process ‘to clarify...users goals and values and to agree on the desired outcome of the project’ (Spinuzzi, 2005, p.167) in relation to the IoT and Practice. Integrating *Discovery* goals and values in the workshop structure and tools positions this within Values-Led PD, where ‘emerging values’ surface through a ‘dialogical process between stakeholders and designers’ (Iversen and Leong, 2012, p.94). Developing values are refined and ‘appropriate methods and processes... help stakeholders to reimagine and re-engage with their values’ (ibid. p.96). However, as grounding values ‘only occurs if the ‘developed values’ are...comfortably integrated and exist in equilibrium with stakeholders’ current practice’ (ibid. p.100), this also aimed to *Discover* how to best communicate these within PDP for later *Prototyping*. While this wouldn’t follow Values-Led models precisely as participants differed from *Discovery*, I anticipated participants would relate to the outcomes of *User Understanding and IoT/Practice Synthesis*. These emergent modes of participation in PD placed this approach in a Collaborative, or designer driven, understanding, where Socio-Technical resources support development beyond the initial design scope and possibly includes participants not present in earlier stages (Dantec and DiSalvo, 2013, p.247).

### 5.3.2.1 Professional Practice-Oriented Concept Development

Four male participants were recruited through networking, social media and calls via the IoT Council (“IoT Council,” n.d): PA, a design consultant with experience at Samsung and IoT product development; PB, a design Professor with a research focus on the IoT; PC, a self-described Socio-Technical designer and educator with 20 years’ experience; and PD, an IoT start-up CEO with experience as Head of Product in the technology sector. Again, this was a small number of participants, but the high level of expertise provided familiarity with key IoT concepts, providing meaningful engagement and feedback. Before all workshops participants were briefed on the activities and completed a PCS.

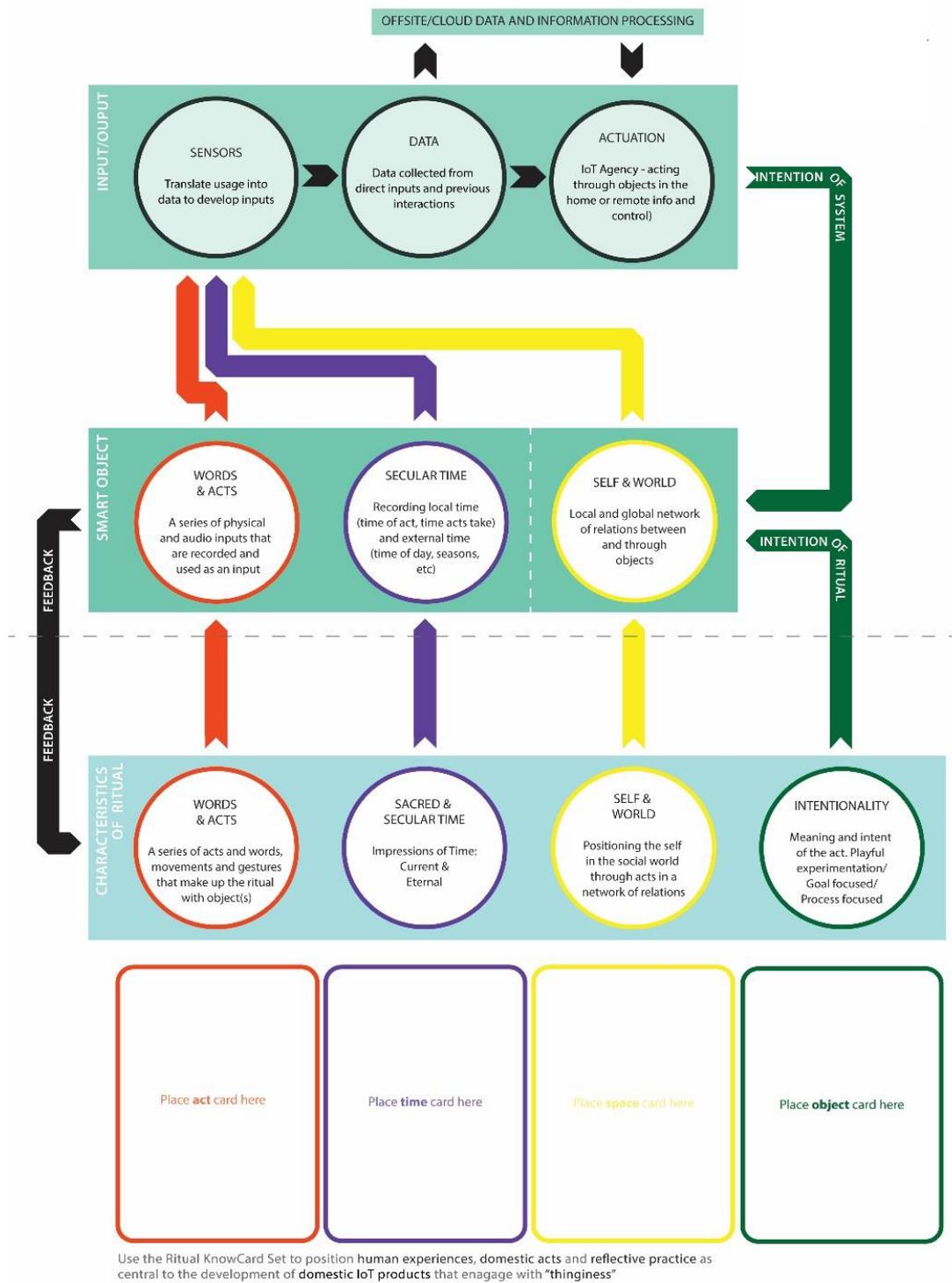


Fig.50: Mapping Practice into the IoT; the dotted line delineates Practice and IoT sections

As the previous toolkit only partially communicated a Practice-Oriented refinement was necessary, with improvements including a more legible model delineating Practice and IoT, communicating interaction and reciprocal impact (Fig.50). Spaces for cards were provided to clarify previously unclear positions, while a dotted, folded section concealed technical elements until later in the workshop, prioritising IoT Practice-Oriented by participants developing coherent practices.

DSPUGV Objects	DSPUGV Acts
Toy chest;	
Art pens;	
Photos;	
Desk;	Shaving;
Knife;	Dressing
Bookcase;	Brushing teeth;
Piano;	Washing;
Key bowl;	Making a hot drink;
Laptop;	Checking emails on mobile;
Record player;	Looking in the fridge;
Cafetiere;	Lighting a fire;
Stove-top coffee;	Reading a book / e-reader;
Tablespoon;	Listening to the radio / records;
Mug;	Washing up;
Rocking chair;	Playing an instrument;
High chair;	Leaving / returning home;
Curtains;	Looking at bookshelves;
Religious objects;	Watering plants;
Book stand;	Taking out the bins;
Face scrub;	Adjusting TV volume;
Guitar;	Putting children to bed;
Headphones;	Calling relatives;
Formula & bottle;	Meditating;
Toothbrush;	Having a family meal;
Ring;	Going through photos
Extension plug;	
Cushion;	
Diary;	
Lighter	

Fig.51: DPUGV Objects and Acts based on participant examples

Two supplementary DPUGV decks of objects and acts were developed (Fig.51) based on participant examples from *Focusing on Domestic Practices*, *Exploring Practice* and *User Understanding and IoT/Practice Synthesis*. These visually matched previous decks and participant anecdotes relating to practices were included to provide further inspirational information (Fig.52 and Fig.53) and improve authenticity (Sleeswijk Visser et al., 2007, p.37).



Fig.52: DPUGV Act Cards

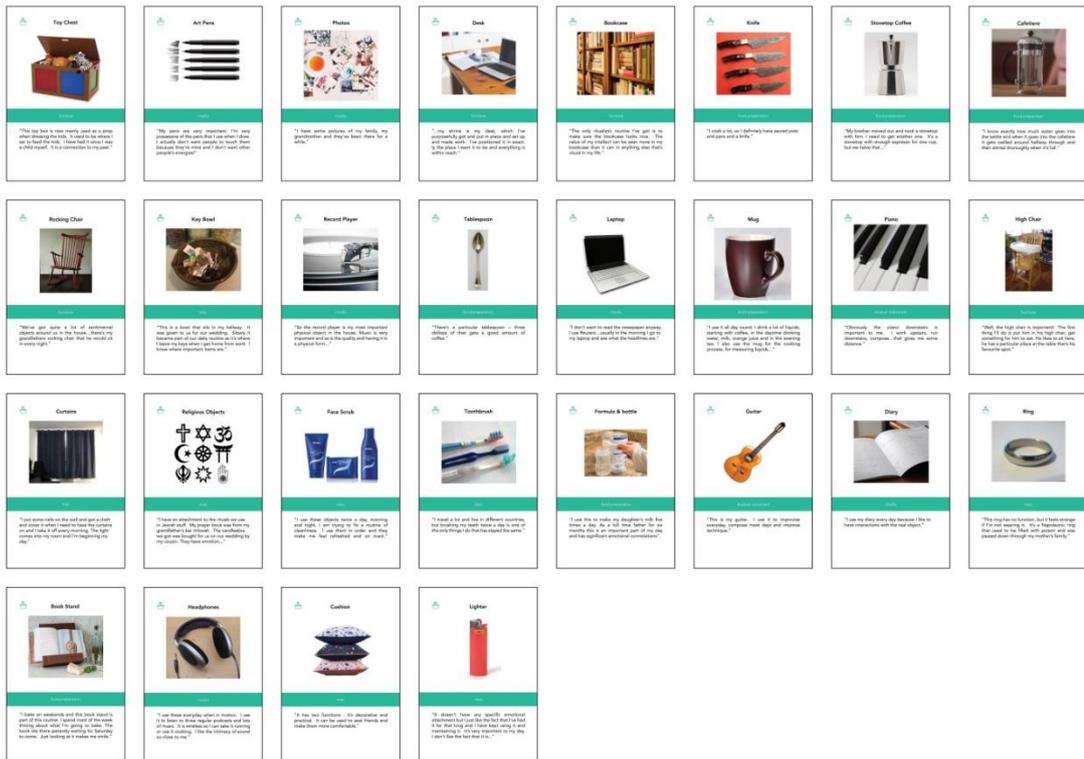


Fig.53: DPUGV Object Cards

IoTUGV from *User Understanding and IoT/Practice Synthesis* were included as Specification sheets, positively or negatively colour-coded and including quotes from participants (Fig.54). The workshop structure supplemented participant's existing knowledge by communicating UGV and systemic Practice-Oriented to support concept development and evaluation by focusing on practices using the IoT-Practice model, IoTUGV and DPUGV.

## LOSS OF SOCIAL & PHYSICAL INTERACTION

Analysis of human interaction could be to remove it!

Can't turn a page or cross through things – important interaction

Capable of modifying habits

Has an influence on your daily routines

Individualistic - doesn't encourage social interaction

Information provided may be directed towards making new products that we don't need

You might start to believe the apps more than yourself

## SOCIAL

Can provide a greater scientific understanding of the human element of this

Connected to IoT - can bring people closer together and send emotions

Provides more choices and information into our life-styles and routines

Shared across mobile devices

## INTUITIVE

Changes "X" depending on environment (working out, walking, working)

Tracks your data

Uses monitor to understand emotions and change "X" to suit it

## EASY

Convenient

Easy

Quicker to "X" than "Y"

Fig.54: Example Positive and Negative IoTUGV specification sheets

In the first run, participants chose from the three products in *Discovering IoTUGV* as a starting point for developing an IoT product. Practice-Oriented cards were chosen, with a card per category used to develop a practice, although if elements contradicted replacements were chosen. These were placed in the model's spaces, prioritising these within development of domestic IoT concepts (Fig.55), following which the model's upper section was revealed to support integrating both, while feedback channels demonstrated continual interaction representative of dynamic, long-term engagement.

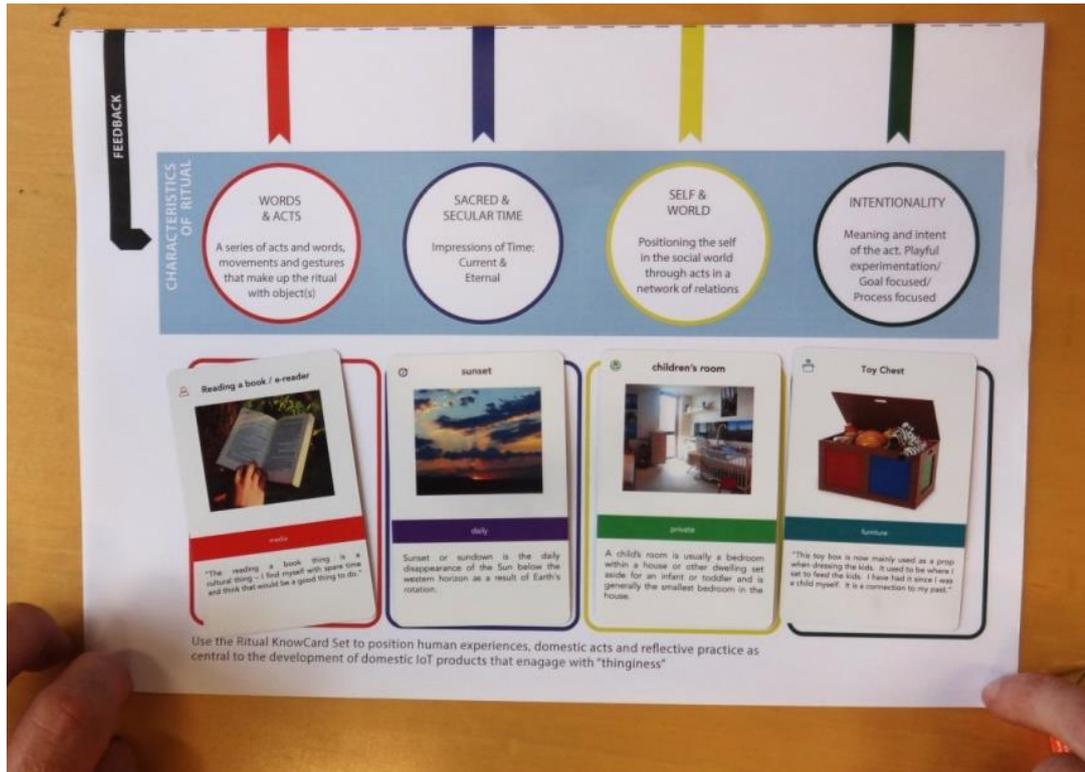


Fig.55: PA's hand of reading a book, sunset, children's room & toy chest in the lower half of the system map

Participants developed a second concept by choosing Practice-Oriented cards to curate practices. This supported concept development by considering IoT-Practices and questioning current IoT approaches. Participants evaluated their outcomes, supporting reflection on and comparison of concepts. Radar Charts, a tool for comparing variables (Green et al., 2012, p.3), used positive and negative IoTUGV as Desirable and Undesirable IoT attributes, allowing participants to assess their concepts and the impact of Practice-Orientation (Fig.56).



	Example product	Cards	IoT concept	Positives	Negatives
A	Goodnight Lamp	Toy chest; Reading a book; Sunset; Children's room.	Toybox that encourages child to tidy.	Acts as a mediator between child & parent; Some parents could find it stressful to ask children to tidy; Layering up of functionality on passive device; Helps child develop responsibility.	Difficulty increases could be frustrating for tired children; Could be exploitative and issues around security & children; Interrupts parent's ability to interact with child? Not massively assistive for child; Pre-landfill.
B	Nest Learning Thermostat	Bed; Reading a book; Winter; Hallway.	Bed, heating and lighting adjust to support reading	Activity detection to adjust temperature.	Reading is static, so might get cold if not moving around; If children are active you might not want the temperature as high; How to get nuance from a sensory reading & adjust from personal to shared practice?
C	Nest Learning Thermostat	Adjusting the lighting; Evening; Hallway; Tableware.	Lighting system with tableware, schedule & ambient light affecting lighting levels; Secondary 'Candlestick' lighting controller based on proximity	Changes environment in a magical way; Initially more fun to play with; Situational object vs. devolved control; Could have special features for special occasions; Theatricality of use; Shared object - not associated to user account.	Initial configuration; Disillusionment after repeat use; Putting out of reach of children.
D	Goodnight Lamp	Opening curtains; Sunset; Weekend; Bedroom; Toilet; Kitchen; Back garden; Bedroom; Bed; Curtain; Cafetiere.	Automated curtains for privacy, sleep hygiene. Night light to reassure insomniacs. Light responds to quality of sunset & brings into home based on location.	Responds to motion when dark; 'Plays a ritual' that corresponds to the sunset & sunrise; Signpost for other domestic practices.	Unless it's working it's 'meh'; No commercial service provision.

*Fig.57: Participants' first round of concept development*

The second round of concepts included an IoT enabled bookshelf; conversation inspiring drinking vessels, a chair acting as a message relaying device; a digital/physical music centre and a connected dog lead (Fig.58).

	Cards	IoT Concept	Positives	Negatives
A	Toy chest; Reading a book; Sunset; Children's room.	Connected Storytelling.	Telepresence of distant family; Educational with increasing difficulty; Storytelling - relating to Toys in box, turning child to director; Assists in tracking last book read; Continuation of broken chain.	Telepresence of distant family; Educational with increasing difficulty; Storytelling - relating to Toys in box, turning child to director; Assists in tracking last book read.
B	Evening; Family meal; Leaving a note; Mug; Chair; Kids room - swapped for toilet; Family room; Hallway	Mug/cup to encourage conversation by displaying timeline of the day.	Encourages social interaction & discussion; part of existing ritual of meal; Could lead to more reflection; Highlight social conventions; Shows link to outside world.	Not particularly home oriented; Long term value is hard to envisage; Display of daily activities is hard to communicate; Lacks business case.
		Chair Messaging Device.	Come in, sit down, message plays; Acts as mini social network of The family; chair initiates something happening; notion of visibility & awareness of message when entering the home; Value of shared recognition rather than actual content.	Possibly too specific a goal to get a message across; A message is private & hallways are public spaces; Voice messages/hubs may be more useful than physical indication/note/interaction
C	Evening; Sunday; Winter; Table; Spoons; Blank; Dining room; Living room; Washing; Listening to music; Record player	Physical interaction point for digital collection of music; Displays album artwork; Links directly to artists & music festivals.	Tactility & interaction/ focal point; Mementoes & history of use; Makes listening to music deliberate; Economically fairer to musicians; Provides more curation to musicians; Controls volume/ bass levels depending on time to consider neighbours; Volume and speakers change to follow activities.	Is this something that people want to return to?; Connecting to WiFi & music sources could be awkward; Searching for physical media; Control could be fiddly.
D	Dog lead; Bedroom; Bathroom; Hallway; Sunset; Sunrise; Evening; Friday; Playing an instrument	Dog lead that reminds owner to take for walks; Sets the pace of walks; Tracks walks & time; Device to help singles meet; Dog friend tracker & alarm system.	Encourages social interaction; Animal health tracking; Opportunity for connection & reconnection.	Fad gadget with little long term use; Creepy undertones in singles context & knowing someone else is taking their dog for a walk; Doesn't make the experience hugely better.

Fig.58: Participants' second round of concept development

The second round concepts were more positively evaluated as meeting desirable IoTUGV (Fig.59), with participants describing them as linking to each other, other objects and the outside world. These were far more social and marginally more emotional, slightly less assistive and provided the same or lower levels of automation. Ease of use and intuitiveness differed between concepts: PB's second concept was far easier and similarly intuitive, but

PD's second concept was less so. PC was the only participant to differentiate between difficulty in setup and usage and physical/digital aspects.

	Concept	Desirable IoT qualities (1-10)					
		Social	Assistive	Automated	Easy	Emotion	Intuitive
A	IoT Reading Shelf	9.5	7.5	4.5	3.5	9.5	7.5
B	IoT Library Shelf	5	9	3	6	8	9
	Conversation Cup	9	9	2	9	9	9
C	IoT Lighting Candle	5	2	8	Setup 1	7	Setup 2
					Use 8		Use 9
	Physical Digital Music Centre	Phys 9	4	4	8	9	5.5
Digi 7							
D	Sunrise Nightlight	6	9	8	8	7-10	7
	Connected Dog Lead	9	7	8	5.5	4	4

Fig.59: Evaluation of all concepts, measured against desirable IoT qualities

Evaluation against undesirable IoT qualities (Fig.60) shows security/data was evaluated negatively, with participants suggesting risks could only be minimised by using Global Positioning Satellite services or on-site data processing. Concepts were assessed as not necessarily negatively impacting on practices, as enabling users to reflect on and adapt practices provided agency and control, values previously highly rated and related to Practice competency and dynamism. This suggests considering changing practices as purely negative in the IoT is not entirely useful; this could be a positive development informed by non-human agency. The negative assessment of data and security was discussed as minimising privacy, perhaps causing lower engagement due to user reluctance to provide data to be used in unclear ways.

	Concept	Undesirable IoT qualities (1-10)			
		Exploitation	Changing practices	Loss of Interaction	Security/Data
A	IoT Reading Shelf	3.5	6.5	1.5	3.5
B	IoT Library Shelf	3.5	6.5	1.5	3.5
	Conversation Cup	4	4	2	8
C	IoT Lighting Candle	Phys 10	Phys 5	Phys 1	Digi 1
		Digi 9		Digi 2	
	Physical Digital Music Centre	Phys 10	Mid-Age 2.5	Phys 2.5	Digi 8
		Digi 9	Millen 6	Digi 6.5	
D	Sunrise Nightlight	4	8	4	6
	Connected Dog Lead	9	3	3	6

Fig.60. Evaluation of all concepts, measured against undesirable IoT qualities

After four workshops final evaluation was conducted. Concepts based on existing IoT products tended towards Techno-Centric IoT values, automating aspects of home and replacing human agency to increase efficiency. Concepts developed using the Practice-Oriented toolkit tended towards physical and social interaction, community involvement, quality of experience and assistiveness. These prompted conversations, considered their impact on those sharing the space and allowed users to refine their object use and associated practices. Despite this, concepts developed in the first round were evaluated predominantly positively in relation to physical use, quality and experience of interaction and intuitiveness. Participants felt these met some IoTUGV, especially assistiveness and intuitiveness, although this changed in relation to setup or usage. Automatic decision making removed understanding and agency; participants suggested this, a lack of reasoning and user understanding of connected items led to them feeling manipulated by a system they did not understand. Second concepts engaged more with the concerns of a Practice-Oriented IoT, showing the impact of the toolkit in communicating Practice and IoTUGV within PDP. For example, the connected storytelling concept allowed distant relatives to become involved; the drinking vessels conveyed people's daily events to others through use in a group meal; the music system provided engagement with non-tangible music streaming services and displayed historic use, but also applied automation to control volume after certain times to consider neighbours; while the dog lead supported connection and reconnection with pets. Negative impact on changing practices was another concern, with the IoT bookshelf criticised for potentially minimising serendipity

and reinforcing tastes, possibly leading to users reading similar books. These outcomes suggest a Practice-Oriented influence on the recognition of assemblages of objects, connections with other practices and the implications of IoT constellations on people's agency.

These also suggest a change in the application and reasoning behind the IoT, with the majority of concepts providing greater opportunities for developing internal goods. The conversation cup and messaging chair recognised the sociality of the domestic space, while the music centre promoted physical engagement with non-tangible services. Some concepts, such as the connected dog lead, were considered more social, but less assistive, easy, emotional and intuitive than the sunset night light. This was also more exploitative, but less impactful on negatively changing Practices and with lower impact on reducing social interaction. Issues around security/data and exploitation were a concern, with three areas emerging relating to the IoT's external commercial aspects: data mining as a key element of IoT business models exploiting users; sensing usage and occupancy to determine the opportune times to break into homes and user fixation on system feedback, leading to obsessive behaviours. However, the majority of concepts moved from applying automation to manage and provide goods and services in an externally motivated paradigm, instead focusing on supporting goods of excellence in loving relationships, playing or listening to music or intellectual stimulation.

Feedback to a Practice-Oriented IoT approach was relatively positive: PA had not considered using cards covering these topics, felt it was innovative and that including predefined activities was helpful. PB felt they helped contextualise and focus on interactions, specifically to re-enact their behaviour in equivalent spaces. PD stated they had been feeling towards the idea of Practice, so this was extremely useful and the highlight of the session. However, some cards were too specific: Friday expanded possibilities in one of PD's concepts, but there was a challenge to justify this 'as a reason to do something that you wouldn't normally do.' On occasions the same term was interpreted differently: sunset was used by PD as a mutable time to prompt practices, but PA interpreted this as bedtime. PA stated that while this was an excellent tool more cards were needed across categories to 'encompass all the possibilities' and avoid limiting outcomes. IoTUGV were mostly regarded positively, communicating features users wanted: PA stated it was like they were speaking directly with users to provide an alternative lens when developing concepts. However, PD felt these resembled workshop outcomes rather than user directed outputs and were open to misinterpretation. These also led to concepts where users had to do more, or replaced

functional solutions with less effective, fad 'smart' products. Participants were mainly positive about the IoT-Practice model which helped contextualise the domestic IoT. PD stated this made sense and allowed them to quickly map their ideas into the home; PA criticised the limits of interaction as momentarily interesting, but needing extra elements to maintain emotional investment; while PD criticised the lack of business and data elements as obscuring conflicts between user and business interests. However, this improved understanding of the relationship between people, Practice and the IoT, with PC describing these as 'conversational...your interactions here are in conversation with the interaction it provides.'

## 5.4 Professional Prototyping of Practice-Oriented IoT

A *Prototyping* design workshop was the culmination of this PD pathway, where concepts that fit into environments discussed in *Discovery* (Spinuzzi, 2005, p.167) are developed. Within Values-Led PD emerging values are revealed through a dialogical process between stakeholders and designers. These are 'trans-situational goals, varying in importance, that serve as guiding principles in the life of a person or group' (Schwartz et al., 2012, p.664) which reflected user's desired modes of end-states, helping develop outcomes that '*fit into* the existing web of tacit knowledge, workflow and work tools, rather than just doing away with them' (Spinuzzi, 2005, pp.165–166), both in the domestic IoT and in communicating an IoT-Practice position in PDP. This applied previously gathered insights to communicate participant opinions of Practice and the IoT to inform concept development and professional feedback on the Practice-Oriented toolkit to support refinement. This aimed to clearly communicate a Practice-Oriented position towards the domestic IoT through exploring UGV, applying Practice-Oriented and understanding how this changes IoT concepts through a structured workshop. Reflection in a PAR pathway identified this as a convergent end point of both PD processes – applying participant values and experiences relating to Practices and the IoT and developing a Practice-Oriented IoT workshop, informed by previous feedback.

Following previous iterations of IoT-Practice models, a model with further detail was developed (Fig.61); unlike *Prototyping Professional IoT/Practice Synthesis* this was not shown in the workshop, instead acting as an underlying model to structure this Practice-Oriented process. The toolkit was redeveloped to overview and detail, supporting exploration through ready-to-use materials matching creative design practices (Sleeswijk Visser et al., 2007) (all materials, Appendix O). The workshop was developed with the IoT

only considered after focusing on domesticity and Practice, supporting participant exploration of emergent values. These were integrated as cards within ideation and evaluation phases, supporting understanding values grounded in user practices (Iversen et al., 2010, p.3) to drive ideation and evaluation towards meaningful alternatives to current processes and conceptions (Leong and Iversen, 2015). This provided a collaborative workshop following 'landscape' games, 'stories about persons, their doings, behaviour, interests and relations to involve the surroundings' (Brandt, 2006, p.59).

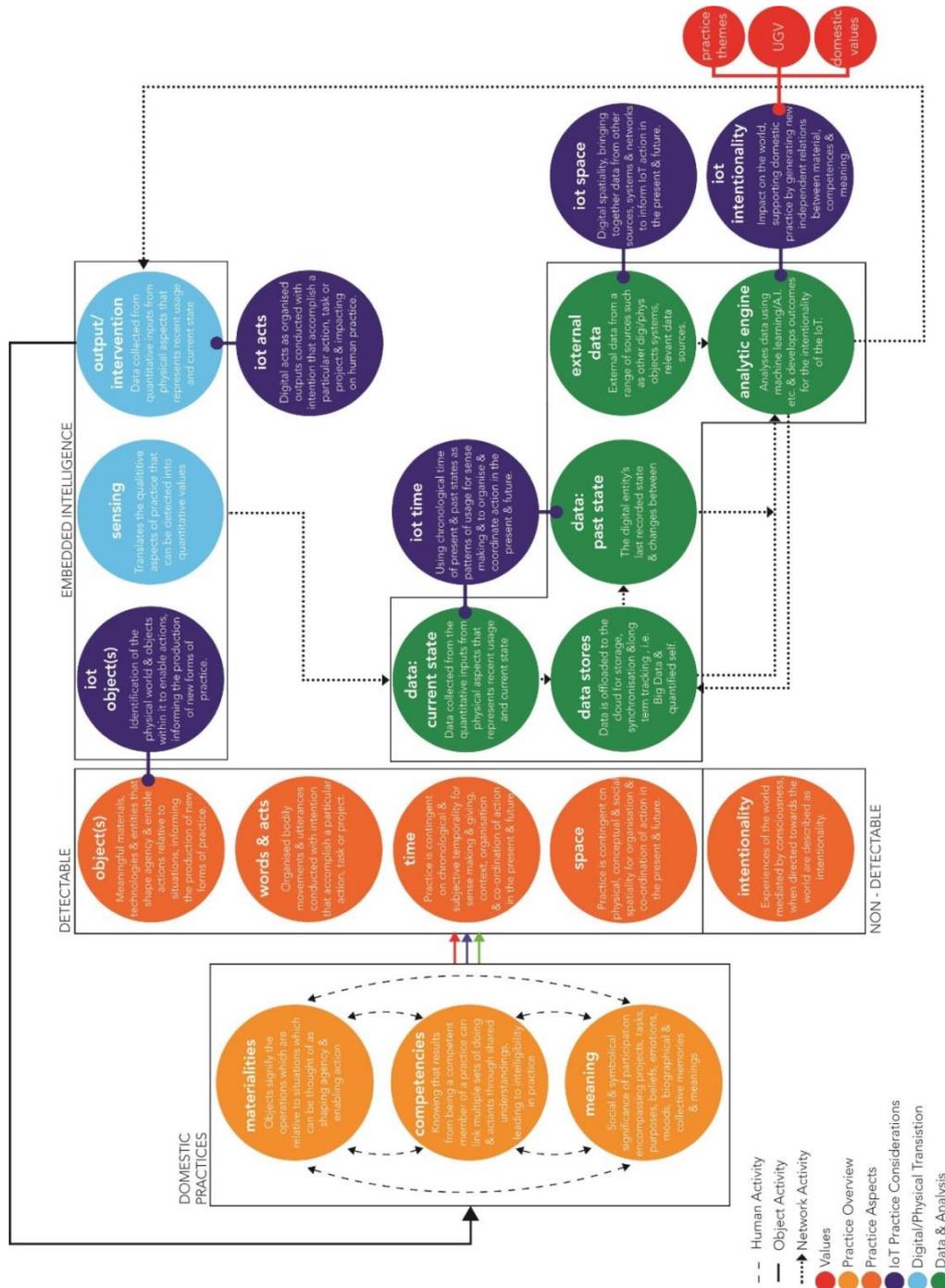


Fig.61:

IoT model integrating Practice elements, themes, UGV and DV

### 5.4.1 Professional Workshop

A PDP team focusing on developing IoT products for the domestic space was recruited from a multinational kitchen equipment company, a good match as the design expertise of participants, the company's global profile and growing interest in the IoT allowed for meaningful testing, with shared concerns around Practice Themes of *Food and Drink Preparation* and *Sharing Practices*. Four participants (three men, one woman) with differing IoT expertise took part: PA, a product manager focusing on cookers, the company's only connected product range; PB, a designer in the Innovation Team, applying new technologies to kitchen machines; PC, an engineering focused team leader of New Product Development with little IoT experience; and PD, head of IoT, focused on improving consumer experience, predominantly in kitchen machines. While a small team, the range of expertise, the suitability of the company's focus and the desire to innovate in the IoT supported evaluating the effectiveness of this approach. Prior to starting the workshop the process and intent was explained; all participants completed a PCS (all results, Appendix P; analysis, Appendix Q).

#### Establishing the Domestic: Domestic Development, Initial Practice and Ideation



Fig.62: Example Domestic Tiles

Domestic space was previously included through space cards in the Practice-Oriented deck, but this only provided a narrow context (i.e. one room). Instead, a team exercise constructed a simplified floor plan of a home, gradually building context for the following activities (Fig.62). This followed the use of floor plans in other PD approaches, which 'encouraged projections of the patterns of...daily existence into the space' (Lee, 2008, p.42) and supported group conversation.

People	Age	Career	Traits	Interests
Hugo	4	Primary School	Adventurous, Bossy, Gregarious	Exploring, Dinosaurs, Insects
Raph	15	Secondary School	Arrogant, Fearless, Persistent	Mountain biking, Piano, Squash
Robbie	19	Student	Imaginative, Impulsive, Keen	Climbing, Photography, Poker
Steve	24	Tradesman	Charming, Conscientious, Vulgar	Football, Socialising, Videogames
Moses	32	Librarian	Bossy, Cultured, Meticulous	Gardening, Reading, Yoga
Charlie	44	Bus Driver	Dependable, Observant, Picky	Bod building, Martial Arts, NFL
Dennis	60	Heating Engineer	Helpful, Reliable, Stingy	Hiking, Fishkeeping, Singing
Albert	74	Retired	Conscientious, Independent, Pompous	Golf, Stamp Collecting, Woodwork
Maisie	4	Pre-School	Exuberant, Fearless, Stubborn	Baking, Ballet, Singing
Beth	14	Secondary School	Affable, Discreet, Keen	Animals, Basketball, Coding
Sasha	19	Bank Clerk	Fair, Finicky, Optimistic	Cooking, Dancing, Socialising
Katie	26	IT Consultant	Imaginative, Meticulous, Unfocused	Meditation, Painting, Knitting
Julia	35	Dentist	Charming, Precise, Self-Centred	Online Classes, Reading, Swimming
Yasmin	44	Police Officer	Dutiful, Sarcastic, Valiant	Mountain biking, Running, Comedy
Grace	58	Councillor	Capable, Humble, Quarrelsome	Crosswords, Gardening, Pottery
Penny	74	Retired	Encouraging, Fair, Impulsive	Childcare, Jigsaws, Volunteering

Fig.63: People Card details

People cards were developed (Fig.63) so participants could consider other’s behaviours and construct meaningful scenarios (Grudin and Pruitt, 2002, p.4). Participants selected two DPUGV and two People cards (Fig.64), with practices contextualised by People cards and previously established domestic space. This supported initial concept development by applying practices from previous activities, associating these with fictional users and establishing where these take place. This was followed by a brief ideation session to develop initial ideas to be informed by following activities.

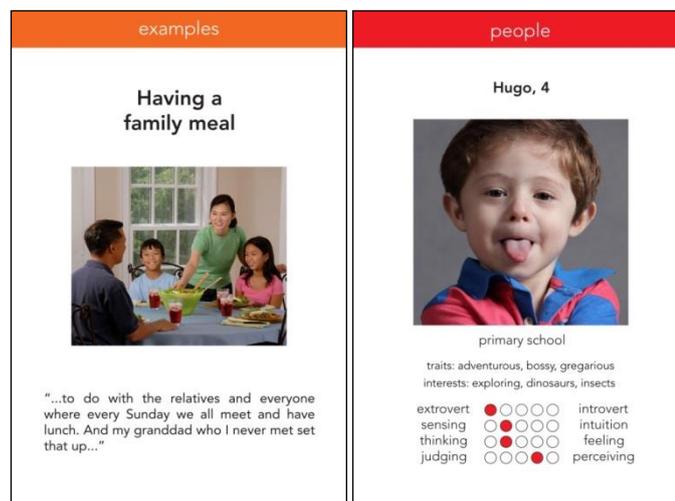


Fig.64: Examples of DPUGV & People cards

### Establishing the Domestic: Domestic Values

Rank	Value	Further Info
1	Happiness	The experience of happy events & general feelings of happiness are an integral part of home
2	Belonging	Comfort, relaxation & familiarity contribute to a sense of belonging to home
3	Responsibility	Stability arising from ownership & responsibility for the home
4	Self-Expression	Behaviour in & manipulation of the place are closely tied to ideas of home. At home you can do what you want & personalisation allows expression of self identity
5	Critical Experiences	Learning to be independent, formative experiences, living through a stressful period are formative of deep associations with home
6	Permanence	The continuity of home
7	Privacy	Privacy here refers to micro-interpersonal boundary regulation
8	Time Perspective	Places exists as home whether in the past, present or future
9	Meaningful Places	Because of specific, but not necessarily, critical events taking place there
10	Knowledge	Tied to familiarity, this aspect emphasises physical & social knowledge
11	Preference to Return	In terms of a locus in space
12	Type of Relationship	Type of relationship & personal choice over being with particular people is the essential focus of this category
13	Quality of Relationship	The quality of relationships
14	Friends & Entertainment	People visiting who form the core of social entertainment in the home
15	Emotional Environment	A place where there is love often signifies a home
16	Physical Structures	Enduring physical characteristics
17	Extent of services	Lighting, heating, household equipment, garden, telecommunications etc. are sometimes seen as a necessary part of home
18	Architectural Style	Some homes are meaningful because of their architectural style
19	Work Environment	Working at home is sometimes a defining aspect, i.e.. students often have no division between work & living places. Work is part of home because this is the only quiet place available to them.
20	Spatiality	Spatial properties & the activities that those spaces allow, as well as their location, are important aspects of home for some people

*Fig.65: Domestic Value card details*

Participants selected two or more Domestic Value (DV) cards which included a value, ranking and further explanation (Fig.65 and Fig.66). Cards were chosen to support or challenge previous developments and increased understanding of domestic qualities, adding to previously established domestic space, individual and collective inhabitants and Practices. This intended to integrate use, understanding and meaning of the domestic and how this could change between users, with a following ideation session to develop earlier concepts applying this.



Fig.66: Example DV Card, Happiness

### Exploring Domestic Practice: Practice Expansion - Overview and Detail, Ideation

Practice as constituted by materials, meanings and competencies was explained to participants, supported by explanatory tokens for reference (Fig.67). Participants analysed their selected practices and used these categories to explore and expand these elements in their concepts.



Fig.67: Tokens explaining materials, meaning and competencies

Further exploration was structured through a deck of blank Practice Cards comprising words and acts, objects, time, space and intentionality. This expanded the range of possibilities considered, including the times or spaces concepts were situated in, the possible objects involved, the intentionality of human/non-human actants and any words and acts involved. Participants completed these to understand how these construct Practice and may be considered as inputs within a Practice-Oriented IoT.

## Integrating Practice & the IoT: IoT Practice Overview, Detail and UGV, Ideation

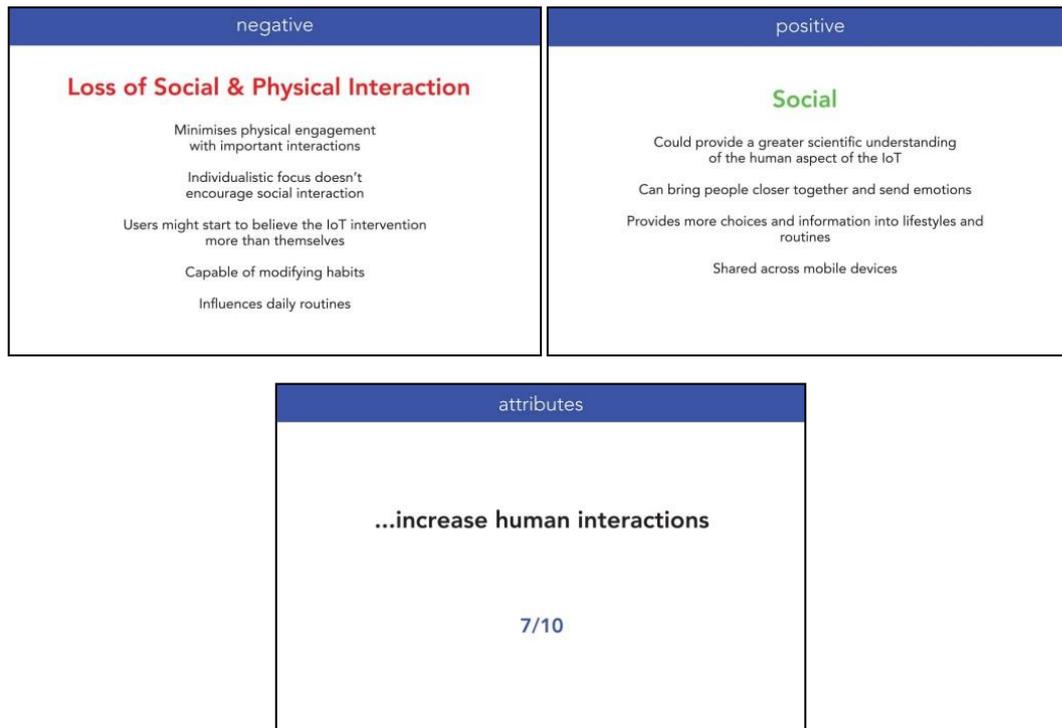


Fig.68: Example IoTUGV cards of positive, negative and desired attributes

Participants chose IoTUGV cards (Fig.68 and Fig.69) detailing positive and negative attributes derived from previous participant opinions to guide concept development for the domestic IoT. Participants were supported in further exploration of IoT-Practice elements through a set of IoT-Practice cards mirroring the Practice cards. This intended integrate these aspects into the IoT so participants could understand how this system may act to develop practices.

Positive IoTUGV		Negative IoTUGV	
Social	Could provide a greater scientific understanding of the human aspects of the IoT; Can bring people closer together & send emotion; Provides more choices & information into lifestyles & routines; Shared across mobile devices	Loss of Physical & Social Interaction	Minimises physical engagement with important interactions; Individualistic focus doesn't encourage social interaction; Users might start to believe the IoT intervention more than themselves; Capable of modifying habits
Easy	Quicker to do X than Y; Convenient; Easy	Changing Practices	Automation when the system thinks it's correct would be bad - users want control; Minimises physical engagement with important interactions; Analysis of human interaction could be to remove it; If the systems does things in a way described by others; Users would have to be organised to use it and could become dependent on it; Influences daily routines
Intuitive	Changes X depending on environment; Monitors to understand emotion & changes X to suit it; Tracks your data	Security & Data Ownership	IoT product/systems have control over types and volume of data gathered; Data collected is for the company & might provide inaccurate information; Data gathered may be used to develop unnecessary new products; Data can be sold for personalised advertising; Data breaches
Automated	Collects info without the need to communicate explicitly; Automatically sets appropriate sound/light/etc. levels; Monitors to understand emotion & changes X to suit it; Changes X depending on environment; Warns if there are unwanted elements in IoT product/service; Can wake you up; Tracks your data	Dependence	Users might start to believe the IoT intervention more than themselves; Analysis of human interaction could be to remove it; A sense of loss if device is forgotten or lost; If the systems does things in a way described by others; User could become dependent on it; Objects may fail
Assistive	Collects info without the need to communicate explicitly; Can bring people closer together & send emotion; Provides more choices & information into lifestyles & routines; Monitors to understand emotion & changes X to suit it; It can analyse the products that people use & give feedback; Suggests changes to your routine to increase your health; Recommends specific products; Reminds you to X	Exploitation	Analysis of human interaction could be to remove it; Data can be sold for personalised advertising; Data collected is for the company & might provide inaccurate information; Products may be made unsustainably to lower production costs; If the systems does things in a way described by others; Data gathered may be used to develop unnecessary new products; IoT product/systems have control over types & volume of data gathered; Drives social stratification by limiting access to selected consumers; Users locked in manufacturers eco-systems.
Emotion	Can be removed if user doesn't like it or the object/system doesn't learn properly; Monitors to understand emotion & change X to suit it; Can bring people closer together & send emotion; Easy		

Fig.69: Positive and negative IoTUGV cards with descriptive attributes

## Final Ideation

Participants developed final concepts within a Practice-Oriented IoT, reflective of the values of the home, framed by Practice elements and the impact of modelling these within the IoT. This was supported by all previous stages of the workshop, building an



Participants collaboratively developed a home with two floors (Fig.71 and Fig.72) and discussed a range of People and their imagined relationships: Albert and Penny were Maisie’s grandparents; Maisie was the child of Katie’s first marriage to Charlie; Moses was her stepfather and pre-school teacher. Participants described this as a multigenerational family interacting in one home, representing a broad spectrum of their market.

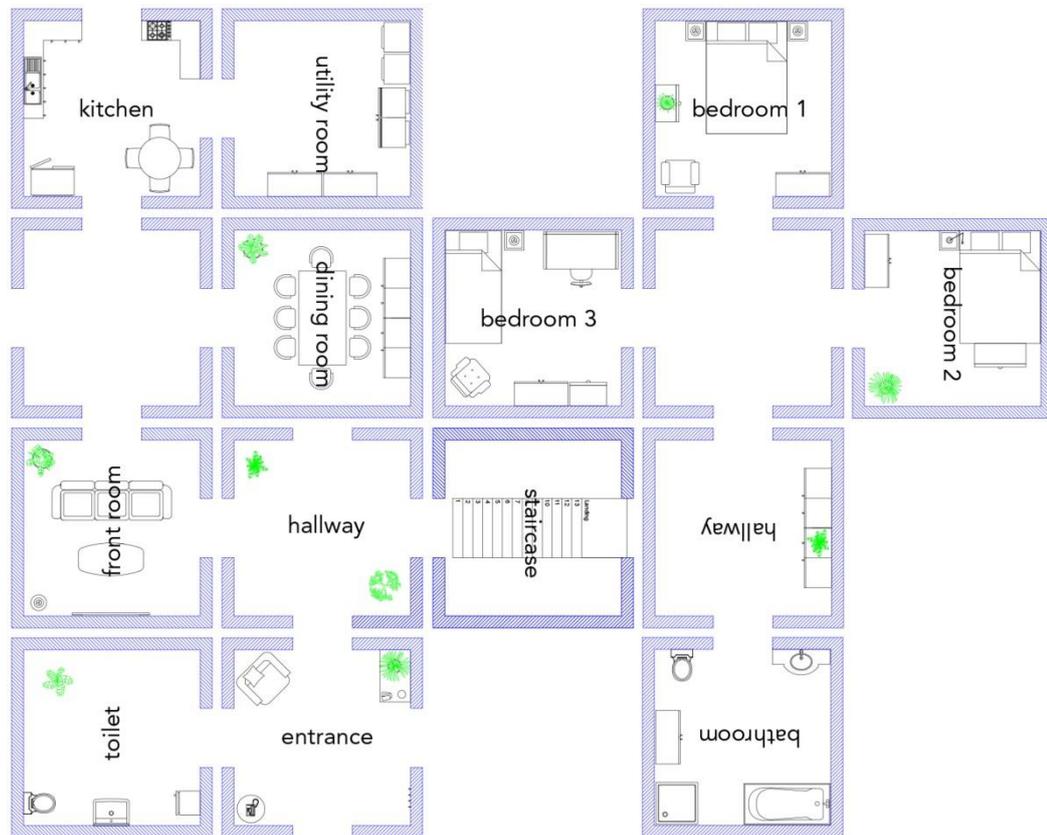


Fig.72: Digital version of floor plan, GF (l) linked to first floor (r) via staircase

### Establishing the Domestic: Practice, People and Initial Ideation

Participants selected DPUGV and People: PA chose Maisie, Moses and Making a Hot Drink; PB Moses and Looking in the Fridge; PC Listening to Music and Katie and Moses. PD chose three DPUGV: Having a Family Meal, Cooking for Guests and Washing Up and Albert as the Person. PD was influenced in this choice by a DPUGV card, quoting: ‘...a family meal with relatives...every Sunday we all meet and have lunch and my granddad...set that up.’

Initial concepts were closely related to DPUGV and user motivations: PA developed a product to automatically prepare green tea while Moses undertook other activities, including yoga. This could also dispense warm milk for Maisie into a ‘special cup,’ providing independence so her parents could do other activities. PB’s concept allowed users to check their fridge contents via their phone, with weekly shops imported through scanned receipts.

This was used to encourage cooking experimentation by suggesting recipes and prioritise items based on use by date. However, PB recognised users would need to check ingredients rather than completely trust the system. PC's concept for shared mealtimes set an ambience, suggested a playlist and communicated with other IoT devices to curate the environment (Fig.73). PD proposed an inter-generational family meal organisational IoT, ordering shopping based on suggested themes and dietary requirements gathered via shared data, selected recipes and expected numbers, scheduling supplies to arrive the prior evening. This was considered a technological means to remove the hidden barriers of arranging this event based on shared information.



Fig.73: PC initial concept development

## Establishing the Domestic: Domestic Values

	People & DPUGV	Domestic Values	Initial Concepts
A	Maisie & Moses - Making a hot drink	Quality of relationships; Responsibility Supplanting parental responsibility?	Digital recipe book; Green tea preparation while Moses is busy with yoga; Warm milk dispenser for Maisie to provide independence
B	Moses - Looking in the fridge	Emotional environment; Self-expression Fits with cooking & emotive family experience; perhaps prompts used to make a cake if ingredients are available	Remote fridge contents checking; Imported from weekly shopping receipt/app; Can suggest ingredient pairings and recipes Tracks use by date but suggests users check rather than trust system
C	Katie & Moses - Listening to music	Meaningful places; Friends & Entertainment; Architectural Style Inform development of an environment that supports concepts	Suggested music playlist based on recipes; Music for dining? Music to cook/bake to? Guided audio? Suggested recipes based on films?
D	Albert - Having a family meal, Cooking for guests, Washing up	Happiness; Preference to return; Time perspective Supports the development of concept	Digital ecosystem to remove hidden barriers or arranging a family meal; Driven by grandfather to support meals with children & grandchildren; Sharing dietary requirements, attendance details etc.

*Fig.74: Participant concepts informed by DV*

Participants chose DV to inform development (Fig.74): PA selected DV contradicting their concept, prompting consideration of how pressing a button for warm milk could supplant parental responsibility. PB selected DV important in making products emotive, not purely logical. PD selected values suiting their concept, where the intent was to make a happy event, taking place in the same space, either physically or symbolically in following this family tradition, perhaps even after the grandfather had passed away.

## Exploring Domestic Practice: Practice Expansion - Overview and Detail, Ideation

	MMC			Practice Elements				
	Meaning	Materials	Competency	Words & Acts	Objects	Time	Space	Intentionality
A	Wanting drink; providing for others; Lessons in independence, gratification, responsibility OR lack of interest/care?	Appliance, which is setup; Cup; Wall & electricity Notification when appliance needs adult intervention - running low/milk drunk	Using the appliance - is it full of milk? Is the correct cup in place? Reliant on parents for some of the above	Removes action of asking permission; Automation reveal of typical words and actions	Phone access to app, cups, milk	Daytime only - limits access?	Kitchen is a safe space	Desire/Thirst; Removal of responsibility?
B	Keeping order in life; Balanced diet; Planning for family	Shopping list on phone/fridge; Import shopping list/receipt to fridge/phone; Supermarket can provide dates/list/digital receipt	Need to remember the list & be organised enough	Reading lists - digital & physical; Stocking/visiting fridge apps to get info; Cooking & prepping food in the home	Utensils & equipment; Technologies that records & remember purchases as well as knowledge of cooking & users	Meal times or any time due to shopping, planning	Kitchen mainly; social space to have friends over vs. not. This fills the space of needing to know in advance	Shopping, planning cooking for family; Visiting fridge could be conscious/unconscious
C	Creation of an environment to enhance food & create deeper connections	Tablet, connection audio, light, projection, TV, cutlery, crockery, temperature	Knowledge of environment; Use of equipment; Desire to explore; Initial room set up	Positioning of lighting, plates on table, dishes between courses, pour drinks, select playlist, talk/discuss	Plates, tables, glassware, phone/tablet, cutlery table linen, walls, flooring, ceiling, lights, ingredients	Primarily evening, although could be used in the morning as a wake up - Lights sounds at weekends?	Adaptable environment, Social time for use	Set the scene; To have an enjoyable experience; Create memories, conversations
D	Tradition; Social; Being together as a family; Bonding; Happiness	Smart phone; Meal planning app WhatsApp Dishwasher tech enabling you to know people's preferences & schedule; Link to online ordering	Knowing people's tastes, preferences & schedule; Making everyone feel a family	Planning, ordering, co-ordination, preparation, cooking, washing up	'Are these the material elements?' Smart phone; WhatsApp; Meal planning app; Dishwasher; technology enabling knowing people's preferences & schedules; Links to online ordering & cooking process	Every week Sunday 'lunch'	Kitchen, dining rooms, Virtual digital space	Making best meal for family; Creating a bonding environment; Learning more about family member interests, likes, dislikes, preferences

Fig.75: Participant exploration of Material, Meaning, Competencies and Practice Elements

Participant exploration of Practice elements prompted various considerations (Fig.75): PA considered time, perhaps limiting Maisie’s access to milk to daytime. The space could be anywhere, but the kitchen was safe and suitable for a child. The objects were the dispensing device; a phone to access an app and set permissions; cups, which needed washing and locating, meaning the process wasn’t entirely automated; and milk, the supply and temperature of which could be recorded. PB felt users would always be shopping or planning meals, except at night; the physical space was the kitchen; objects extended to those previously mentioned, including utensils or equipment; intentionality considered shopping habits and cooking methods, while words and acts included writing shopping lists.

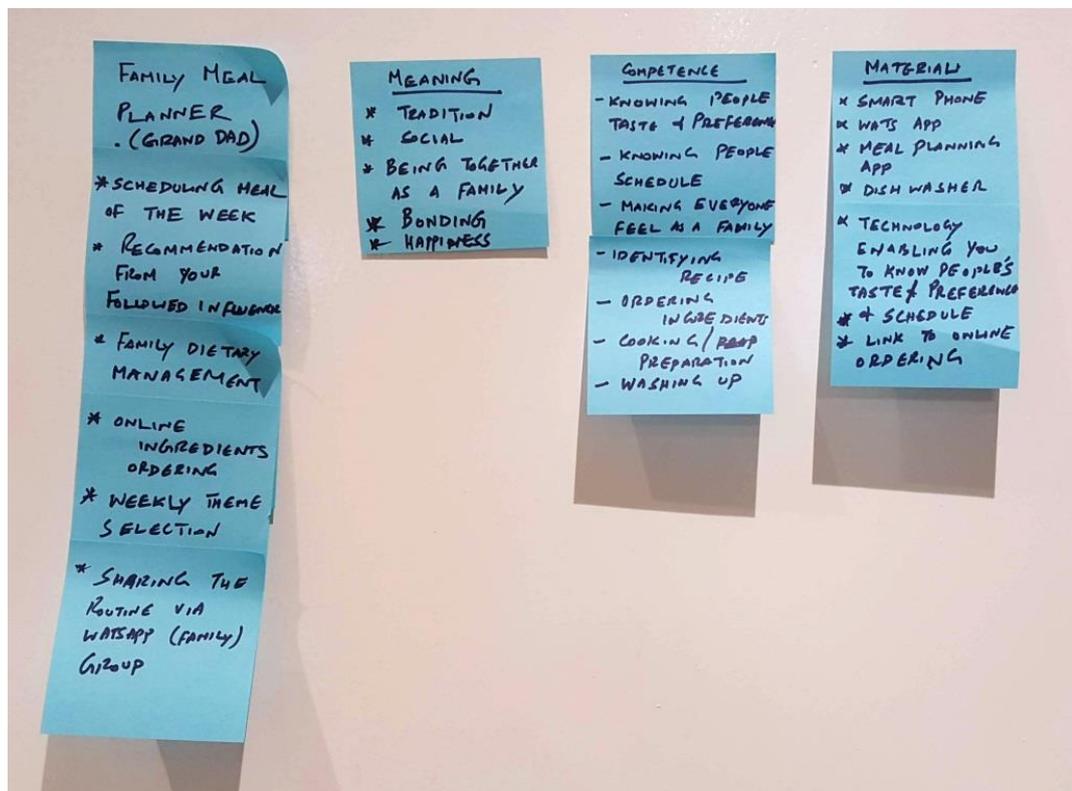


Fig.76: PD’s Materials, meaning and competency analysis

PC’s concept would probably be used in the evening and involve plates, tables and glassware. Words and acts considered object placement on the table, monitoring changes to recognise different courses and changing the environment to meet the intentionality of scene-setting and creating memories. PD (Fig.76) identified meaning as tradition, sociality and familial closeness, bonding and bringing happiness. Competencies included knowing guest’s tastes, schedules, identifying recipes and ordering ingredients; materials involved smart phones, apps, technology enabling knowledge of other’s tastes and schedules, all linked to an online ordering system. Through further analysis using Practice elements, PD identified intentionality as bonding and happiness created by bringing family together,

while time focused on this happening every Sunday, with further suggestions of delivering ingredients, knowing the fridge's contents, coordinating meal-times, preheating ovens and switching on dishwashers (Fig.77).

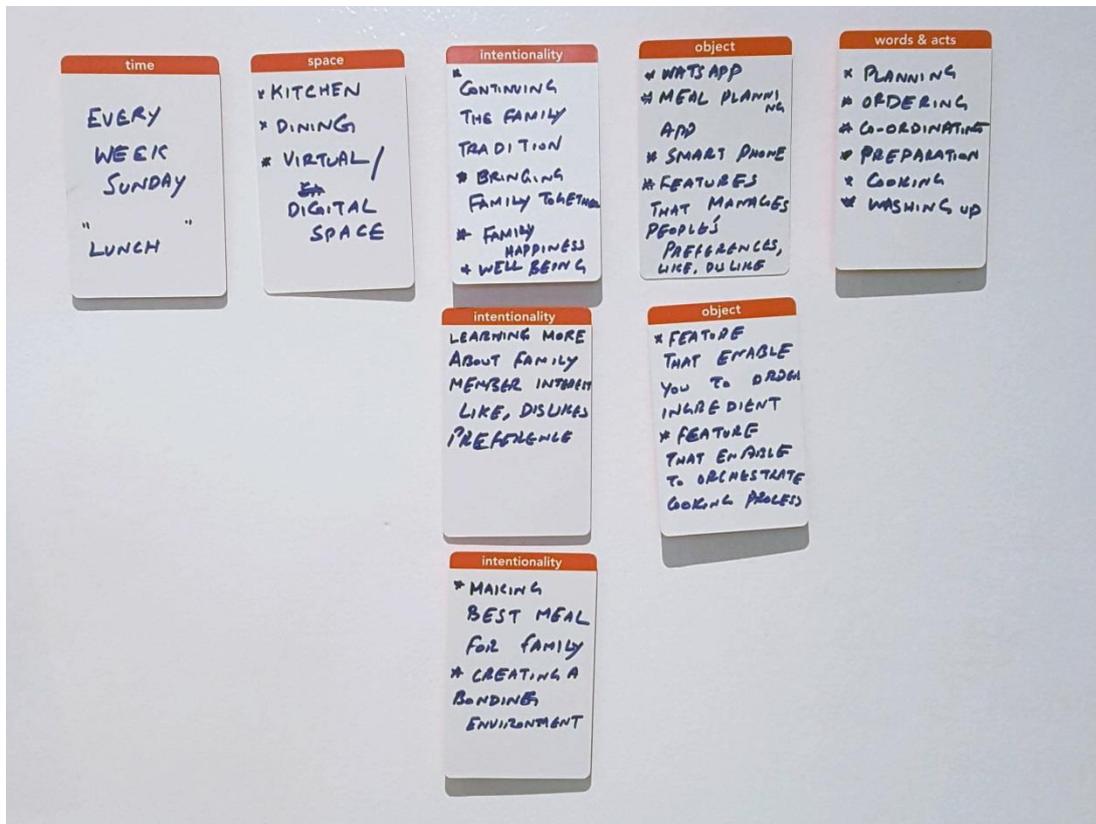


Fig.77: PD's analysis of practices within their concept.

This stage's impact differed between participants: PA's consideration of words and acts helped them understand their concept would remove asking permission, with automation removing typical words and acts with possible negative impacts on future practices. Shifting responsibility for milk consumption from parent to child complemented the described intentionality of thirst, lessons in independence or removal of responsibility. This had little influence on PC - even after explanation they focused on the materials, meaning and competencies needed to achieve their concept, rather than those in the practice itself. Further breakdown supported clarity of Practice elements within their concept, supporting identification of how these could inform development; however words and acts remained unclear.

Integrating Practice & the IoT: IoT Practice Overview, Detail and UGV

IoT Practice						
IoTUGV	Words & Acts	Objects	Time	Space	Intentionality	
A	Loss of Social & Physical Interaction; Convenience	Movement of responsibility of decision making within limitation as restriction set by a parental app; Development of routine as specified by child	IoT appliance - coffee milk dispenser; Maisie mug - cup which is non-spill & changes colour to depict temperature of liquid; Can be located with app in case left elsewhere	Runs 6am-6pm; Probably limit time further if wanted between 8 and 3 could adjust time frame parameters	Appliance remains in communal kitchen space. additional info on appliance - time of dispensing, milk levels & temp via app; looks to extend ecosystem - milk gets ordered when low.	Teach Maisie about responsibility; Provision to access only twice - teach ability to wait?; Understanding limited access; Encourage decision making/delayed gratification
B	Minimal impact on the environment & resources; Countering Dependency	Knowing lists (digital & physical); Stocking/visiting fridge apps to get info; Cooking & prepping food in the home	Technologies that record & remember past purchases as well as knowledge of food, cooking & it's uses	Kitchen mainly; Social space having friends over, this fills the space of having to know in advance	Kitchen mainly; Social space having friends over, this fills in the space of having to know in advance	Shopping/planning; Providing & cooking for family; Visiting fridge could be conscious or unconscious.
C	Positive Human Interaction; Assistive	None	None	None	None	None
D	Having no failure states; Promoting Sociality	Same as before	Same as before	Delivery of ingredients of time; Knowing what's in the fridge; Scheduled meal time; Informing appliance as & when required, e.g. pre-heating oven & switching on dishwasher; Reminder to family on day & time.	Dining table is all set; Intuitive meal planning app; Easy way to capture family memories, likes & dislikes; Monitoring of available ingredients & ordering one that is unavailable Parking space for family member; Space fro after meal activity; WhatsApp Group (Space for messaging)	Reliability; Socialness; Intuitive; Confidence; Convenience

Fig.78: Participant inclusion of IoT Practice elements within concepts

Participants chose IoTUGV to support development of concepts that considered how Practice elements could be integrated within the IoT to act upon the original Practice, supported by a set of blank IoT-Practice cards which they completed (Fig.78). PA's choices encouraged Maisie's daily routine and marketed the device as nurturing life skills. Removing seeking permission through automation was considered as meeting convenience, with continued use and maintenance of the dispenser and cup meaning complete loss of physical interaction was unlikely; however, this reinforced previous issues of weakened social relationships. PB's choices fitted with encouraging cooking with ingredients close to spoiling, prompting consideration of the possible negative impact on creativity in cooking. PC considered having no subscriptions or continued payments, exploring IoT business perspectives to sell physical products such as an Italian food pack that created a connection between food and environment; however they eventually abandoned this IoTUGV. PD chose values that supported the overall practice, which were seen as paramount to prevent failing the family in this important event. Following this, participants were asked to consider the IoT-Practice elements as the IoT-Times, IoT-Spaces and IoT-Objects this could act upon through IoT-Words and Acts (Fig.79), informed by IoT-Intentionality, which was used to drive the final stage of ideation.

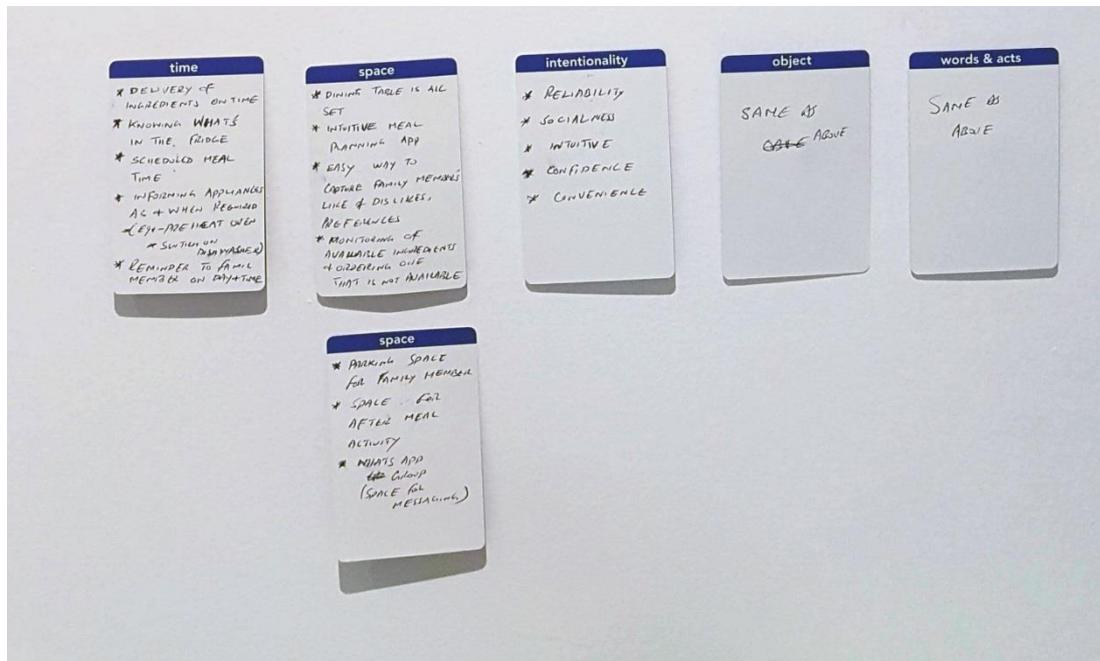


Fig.79: PD's analysis of IoT-Practice elements

### Final Ideation

PA's concept developed to provide Maisie more responsibility for getting milk, with Practice and IoT aspects supporting detail: time considered availability, initially 6am to 6pm,

although this could be adjusted via an app; space considered the location of the dispensing device, with the kitchen the most suitable place; objects considered the supply of beverages to the dispenser, the cup and locating this through an app. PA considered the implications of a wider assemblage of objects to heat milk on a hob, understanding simply pressing a button on a dispenser could lower cooking competencies and limit future creativity. PA felt words and acts removed asking parents for permission, but were unsure if this was positive or negative as it could result in lower social and physical interaction as interaction was mediated by the dispenser, rather than directly between child and parent. Positives regarding intentionality included teaching Maisie responsibility and decision making by limiting milk availability to twice daily. While this was initially judged positively reflection through this process led to PA understanding this may have negative implications due to decreasing social interaction.

PB's final concept suggested recipes through contextual information including shopping lists, cooking habits, online recipes and supermarket offers. Two important elements were maintaining creativity in exploring cooking and reducing food waste, both of which could be addressed by more frequent cooking and ingredient use. Words and acts included making lists, preparing ingredients and cooking meals, shopping habits and cooking methods. Objects included foods and utensils, which could influence suggested recipes. Times influenced planning meals, with different suggestions for alternative times of meals or preparation, for example cooking for children. A key consideration was that systemic intentionality should suggest new recipes to challenge user preferences - PB observed many IoT systems learn user preferences and offer similar options. Similarly, this could minimise experimentation with ingredients, as users could buy similar ones knowing a range of options would be suggested - to prevent this, dishes that used new ingredients could be recommended.

PC's final concept aimed to create 'an environment to enhance food and create deeper experiences,' increasing human interaction by scene setting, changing between courses by using place settings as inputs; e.g., removing a plate suggests the next course is happening, cueing the next experience. This was supported by recognising times of use - predominantly the evening; specifically, the weekend, with the possibility of working in the morning for breakfast and setting the ambience to prepare for the day. This could synchronise with calendars to organise events or alter lighting levels to encourage guests to leave, collecting information without explicit communication to bring people together and communicate emotions.

PD's final concept focused on family meal planning with the grandfather as primary user. Sociality, bringing the family together to bond and creating happiness by maintaining tradition now and in the future were emphasised. The grandfather was a technological novice, so it was important to have no failure states as he would be unable to fix any problems, ruining the weekly meal. Time focused on practicalities including arranging shopping deliveries and reminding guests of details; however, the time after the meal was important to sociality, as 'You are not going to just walk in there and have your lunch and walk away...' Space considered the physical environment's setup, with furniture position important in supporting social interaction. The fridge and ingredients were also discussed, while spaces outside the home were considered, including parking spaces. Objects beyond those previously discussed considered digital elements, including group chat applications, e.g. WhatsApp. Words and acts involved planning, ordering, preparing, finishing meals, dishwashing and the event's end. System intentionality was to be intuitive, reliable and give confidence to users, becoming clearer and more seamless for guests and continuously improving by automatically detecting preferences.

### Evaluation

	Domestic Values (1-10)		IoTUGV Themes or Attributes (1-10)		
A	Quality of Relationships	Responsibility		Convenience	Loss of Social & Physical Interaction
	2 - 4 / 5	8		5 - 8	8
B	Self Expression	Emotional Environment		Minimal Impact on Env. & Resources	Negative Dependency
	2 or 8	6		9	9
C	Friends & Entertainment	Arch. Style	Meaningful Env.	Positive Human Interaction	Assistive
	8	6	3	7	8
D	Happiness	Preference to Return	Time Perspective	Having No Failure States	Promoting Sociality
	8	7	4 - 6	6 - 7	8

*Fig.80: All participants' concepts evaluated*

Group discussions were used to evaluate concepts (Fig.80). PA's concept's Quality of Relationships was scored neutrally to poorly, but comments suggested this was a good method of learning about deferred gratification and could be Convenient if Maisie often asked for milk. Loss of Social and Physical Interaction was evaluated neutrally by PC; PD disagreed, arguing the dispenser enabled an act which was similar to Maisie learning to get milk from the fridge without this device (Fig.81). However, PA felt this caused atrophy in this category.

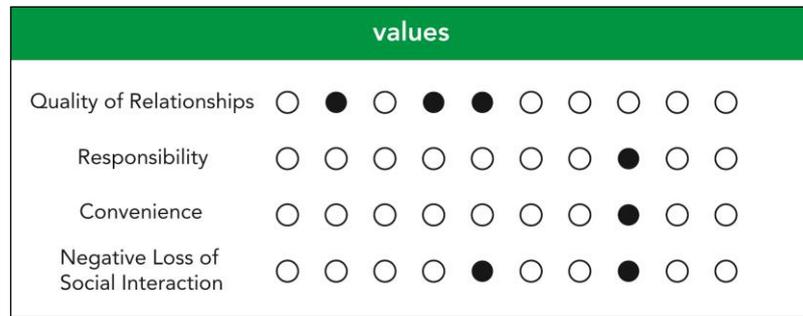


Fig.81: Evaluation of PA's concept.

PB felt their concept met all DV well, depending on implementation – in its raw form there is no self-expression, but if these elements were incorporated in a usable way this would be better than neutral. PA felt this depended on user desire to use the system in this manner, while PD evaluated self-expression as low because the user was given a recipe. Emotional environment was evaluated positively, with PD arguing this was more emotionally charged than buying pre-prepared food as the engagement, effort and time spent on the process make this inherently emotional, even following step-by-step recipes. Dependency was evaluated poorly, with PA stating people would become dependent on this helpful concept, as looking through recipes and trying new things is hard and this would be easier. PC felt this was contingent on users, who would depend on it if they wanted; PB felt this was a more convenient version of current practices involving online recipes. This was regarded positively in terms of minimal environmental impact, specifically relating to food waste (Fig.82).

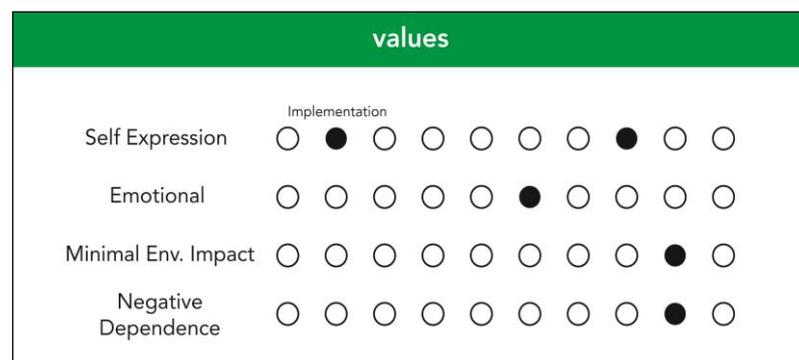


Fig.82: Evaluation of PB's concept

In PC's concept the DV of friends and entertainment were judged to have been met extremely well by PA. The home's architectural style was not addressed; when prompted participants misunderstood, discussing which elements would have to be considered for the table to recognise plates were being removed. PA felt this was not meaningful due to technological focus supplanting social interaction, suggesting this was a gimmick; however, PC argued this could spark conversation - perhaps an Italian meal and ambience could

prompt guests to discuss past holidays. PD felt this depended on the overall objective; if this brought people together for an event out of their everyday routine this could support meaningful interaction, but if the focus was for guests to listen to music and see lights changing it would be a gimmick. PB felt this was on a sliding scale, either assisting users in activities they already do, or a fully experiential process which would lose its novelty, but only happen occasionally (Fig.83).

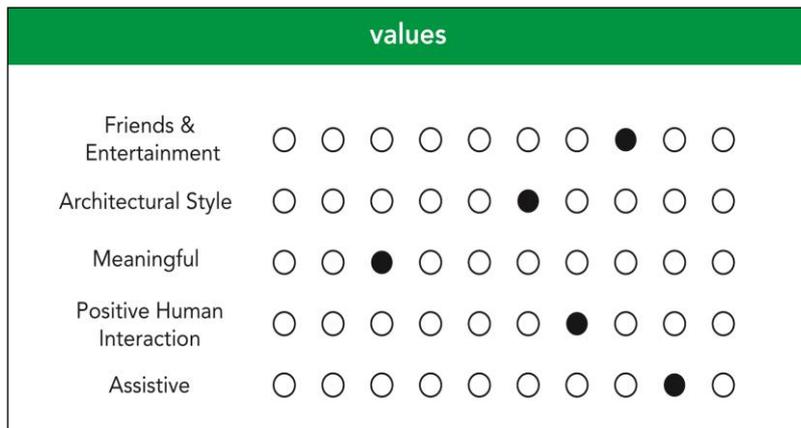


Fig.83: Evaluation of PC's concept

In PD's concept no failure states was described as theoretically possible, but not dealt with in the concept itself. PB commented that if the system considered everything including parking or public transport this may not fail, but in reality there is no such thing as fail-safe. Sociality was positively judged by PA and PC, while PB felt it was very happiness oriented. It provided preference to return and had a time perspective, with PA commenting this considered the future through focusing on what had already been done, in particular food preferences. PD stated this was directed towards maintaining the legacy of the family dinner; however, this was not identified by other participants (Fig.84).

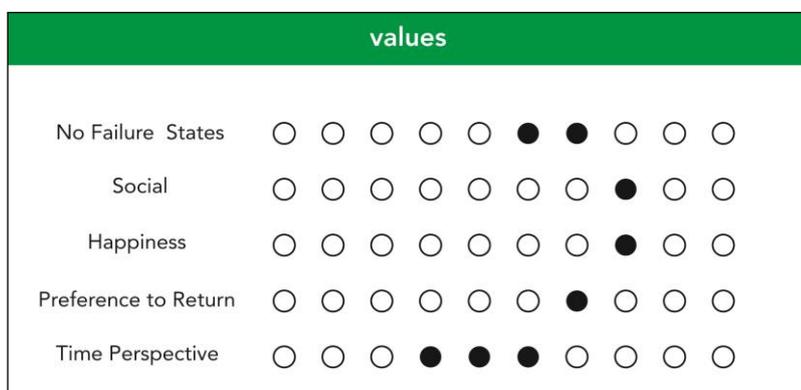


Fig.84: Evaluation of PD's concept

As this took place within a design innovation team in a company with previously identified Practice-Oriented thematic commonalities it was expected the concepts developed would

be less focused on Techno-Centric concerns. This was correct to an extent: PA's concept began as a hot drink dispenser for Moses to get green tea, quickly moving to a milk dispenser for Maisie, providing her independence while allowing her parents to do other activities. PB's concept began as a typical IoT concept of object identification and management, allowing users to check their fridge's contents remotely using imported information from shopping lists, but considered human agency in educating people to check ingredients rather than completely trusting the system. PC's concept managed the environment during dinner for a couple, while PD's concept was a system that supported an IoT novice in organising a family meal. There was still an element of Techno-Centricity within these starting points, using non-human agency to automate decisions and action in the domestic space, but, possibly due to the design perspective of this team, these leant towards Human-Centricity in concerns relating to incorporating human agency and improving human experience.

The design innovation team's biases led to a greater balance between technological possibilities, human experiences and, to a certain extent, Practice. For example, while an IoT enabled drink dispenser, PA's concept still considered sociality, engagement and learning responsibility; PB's concept relied upon machine decision making and suggestions, but supported people's cooking practices. PC's concept was completely automated and focused on the business case, but aimed to improve the atmosphere during a meal. PD developed a mainly screen based concept that again focused on the social experience of a large family meal; however, possibly due to their expertise they considered the large physical/digital assemblages/constellations involved with more depth than the other participants. Participants with a design background (A, B, D) placed the role of people in these concepts at the foreground to provide them with some agency in engaging with their chosen practices, while PC's concept predominantly focused on the role of non-human agency.

The manifestation and inclusion of values within the IoT was explicitly promoted through the use of DV, Practice & IoTUGV, which were intended to support participant understanding of these issues. Values manifested within the concepts throughout due to this inclusion, but the largest impact was in concept evaluation. PA's early positive evaluation changed, as they recognised the dispenser was a social intermediary between child and parents and may damage this future relationship. PB attempted to support emotional interactions as cooking is emotive and meaningful, meaning user decision making should be informed through suggestions instead of being supplanted by systemic

agency. PC's concept addressed meaning, positive human interaction and provided assistiveness; however, the concept focused on business and technological aspects and was mostly considered a gimmick that failed to truly support these. PD was more focused on maintaining traditions in the present and future, inclusivity of meals and ingredients and supporting social interactions through an intuitive, reliable and continuously developing system.

Through this process the internal goods or virtues of Practice started to emerge. PA recognised the importance of engaging with these, rejecting the convenience of their initial concept. Although this provided short-term benefits the competencies and materials associated with warming milk on a hob would suffer, with possible long-term negative impact on engagement with cooking. PB recognised relying on suggested recipes could minimise experimentation and limit creativity, so no new dishes would be created – in the case of Practice-Oriented, this would minimise authorship and dynamism. PD is particularly interesting – as the most data driven example, it would have been easy to conflict with Practice by limiting the ability to get things done through fewer opportunities for user agency. However, the outcomes instead suggest that IoT enabled Practice can automate future knowledge of preferences to support people in developing events that incorporate belonging, sociality and tradition. This is achieved through systemic virtues of improvement over time and Practice virtues of demonstrating and applying skill in hosting the event. Most interesting is the consideration of No-Failure States to support a digital novice – having no failures is nearly impossible, so a Practice-Oriented may have supported the virtue of skill development in engaging with the IoT to enable growing expertise.

This workshop supported the application of Practice-Oriented to the IoT, raising questions about the long-term impact of design decisions, supporting understanding of user motivations and influencing participant understanding of the topic, as demonstrated through concept development and evaluation throughout the workshop. Practice considerations informed practical development, but more importantly influenced understanding of concept's potential implications. In PA's case these included replacing parental permission for a drink, changing responsibility for milk consumption from parent to child and the effect automation might have in removing engagement with this practice on future cooking activity competence. For PB, Practice elements led to tweaks to their initial concept of a recipe suggestion system, which instead challenged user preferences, supporting exploration and creativity. PC aimed to create an environment that supported

deeper experiences, but focused on applying Practice elements to more effectively deliver their initial concept, rather than interrogating it, shown by their failure to complete a single IoT-Practice card. PD most deeply considered the Practice elements involved, leading to consideration of continuous improvement through repeated usage and developing a digital legacy through an IoT enabled tradition, even after the organiser passed away.

The outcomes of and feedback to the workshop and toolkit indicate that a Practice-Oriented Orientation, supported by UGV derived from real-life, concrete examples of people's practices and IoTUGV, contextualised by People and the domestic space communicates an alternative IoT-Practice perspective within PDP. This can engender a change in attitudes relating to IoT application in PDP, shifting focus from efficiency to more closely correlate with the experiences of home. Concepts still had elements focusing on efficiency, resource management and data collection and collation in the service of supporting meaningful practices, especially in the initial development stages. However, through this communicative process participants' were made aware of issues relating to the IoT's impact on DP. This included the interrelations between things, which was described as helpful and what the IoT is about, correlating with the IoT and the material assemblages of Practice; the meaning of these practices: for example, describing the goal of 'having a cake at the end of baking' as 'the least important bit for me' or the importance of the social aspects and tradition in a weekly Sunday lunch; and the ways competencies afford the ability to utilise these systems and how focusing on non-human agency highlighted how much remained for users to complete, all of which made participants consider the negative impact of automation. While participants could not describe Practice in detail, this supported participant understanding of the domestic as an experienced space with differing concerns to Techno-Centric IoT perspectives through the communication of Practice elements, DPUGV, IoTUGV and an underlying Practice-Oriented Orientation that engaged with the IoT.

## 6 Discussion

Following a Practice-Oriented in relation to the Internet of Things (IoT) using Participatory Action Research (PAR)/Participatory Design (PD) has identified several findings correlating with and building upon previous work. Practice-Oriented has proved useful in contextualising the IoT and communicating engagement and meaning making within this system. Participant attitudes towards Practice, the IoT and its application to the home have identified concerns informing the development of a Practice-Oriented IoT model. Embedding these within Practice-Oriented design workshops and toolkits supported developing concepts considering this understanding of the IoT. Through reflecting on this process and outcomes, I have identified successes, failures and possible improvements.

### 6.1 Understanding Practice-Oriented IoT using PAR Framework and PD methodology

*Participatory Action Research* discussed the suitability of PAR in this process, applying knowledge obtained democratically and collaboratively (Hayes, 2011, pp.15:2) with groups in open-ended, iterative ways where evolving theoretical understandings inform developments to measure new proposal's effectiveness. *Participatory Design* detailed the effectiveness of PD in developing new technologies, objects and large systems (Heitlinger et al., 2018; Simonsen and Hertzum, 2008) using Socio-Technical perspectives questioning systems values and biases (Forlano and Mathew, 2014, p.20) and contextually exploring domestic technology impact (Baillie and Benyon, 2008). Furthermore, Values-Led PD can reveal tacit knowledge (Spinuzzi, 2005, pp.164–165) of social aspects, power relations, alternative technology visions and understanding actions in actual settings (Greenbaum and Loi, 2012, p.82), shaping local solutions through community engagement and collaboration to generate new knowledge (Hayes, 2011, pp.15:16-17).

In *Initial Exploration, IoT Tea Time* provided a familiar context to the domestic IoT through an interactive representation of hot-drink making and a series of sketches of differing spaces of the home, types of detectable data and IoT outputs. This supported participant understanding of potential IoT proposals in relation to current workflows and tools, helping uncover attitudes relating to current and potential IoT interventions into the domestic space and providing new, alternative desirable qualities. While participants reiterated Techno-Centric benefits, new knowledge was revealed in their questioning of the necessity of these types of devices, problems relating to free choice, uncontrolled technology and overreliance on material objects and information. Finally, contextualising the IoT within

different spaces of the home indicated user comfort relating to data sharing and privacy depends on where in the home this happens.

Reflecting on these outcomes identified potential negative impacts of the IoT on Practice engagement, directing the research path towards ethnographic exploration of concrete examples of practices. PAR supports shared deliberation of key future issues, opening communicative spaces relating to social, cultural, material, economic or personal spheres to understand and transform the situation, while in PD *Discovery* stages designers and participants collaborate to determine User Generated Values (UGV) through a dialogical process. This supported understanding the range and constituent elements of practices, allowing for further contextualisation in future activities through Practice Themes and Domestic Practice User Generated Values (DPUGV). Semi-structured interviews revealed tacit knowledge relating to Practice and a workshop was structured using design tools focusing on specific practices, with participant selected objects acting as focal points of these, furthering understanding by contextualising actions in actual settings. Outcomes had minimal correlation with core Techno-Centric IoT concerns, sharing some within Human-Centric and Practice-Oriented directions, indicating clear tensions between proposed Techno-Centric IoT benefits and the role and significance of Practice.

Reflection indicated the need to *Discover* user attitudes to the IoT, with Practice providing a Socio-Technical perspective questioning systemic values and biases to provide context for exploring domestic technology. This aimed to communicate Practice concerns through an initial Practice-Oriented IoT model and card decks representing DPUGV, encouraging the development of concepts by communicating previous participant's knowledge, opinions and understanding through a design workshop, which within PD can focus projects, explain situations and drive outcomes. This intended to contextualise the IoT through DPUGV, uncovering participant attitudes to the IoT and establishing Internet of Things User Generated Values (IoTUGV) through feedback and thematic analysis, later communicated as IoTUGV in Professional Design Practices (PDP). This was also the start of a second, parallel PD process, with *Initial Exploration* of the effectiveness of applying DPUGV and a Practice-Oriented model to understand how this communicated people's concerns surrounding the IoT's impact on domestic experience

Integrating goals and values identified in *Discovery* stages in a *Prototyping* workshop positions this as a Values-Led PD process, where values are uncovered, explored and refined before being incorporated in appropriate methods that help stakeholders reimagine

and re-engage with these values; however, as participants differed from *Discovery* stages, this wouldn't follow a Values-Led model precisely, suggesting a design-for-future-use approach where Socio-Technical understanding supports development beyond initial design scopes while working with participants not present during initial stages. This stage therefore aimed to *Discover* how to best communicate UGV within PDP for later *Prototyping* stages as well as acting as an initial *Prototyping* stage, suggesting a number of changes to the toolkit and workshop structure.

The final research activity acted as a *Prototyping* stage for both PD processes, with outcomes indicating Practice-Oriented, supported by effectively communicated UGV derived through working closely with participants to uncover Practices and IoTUGV supports a change in mindset within PDP, showing the effectiveness of this PAR/PD process. Initially, a Techno-Centric IoT understanding was evident, but the workshop process and toolkit supported a shift in participants' understanding of Practice and its relation to the domestic IoT. While they may not have understood Practice in detail, this process provided greater awareness of differing competency levels between users and how these can alter the ability to utilise these systems; the negative impact of automation and how competencies that IoT agency assumed highlighted how much remained for users to complete; and the interrelations between things, which they felt the IoT was about.

User evaluation of open issues with PAR/PD as a synergetic pair acting as a force for change uncovered tacit, embedded and hard to gather knowledge, narrowing the gap between designers and participants through mutual learning (Béguin, 2003; Fowles, 2000; Mor and Winters, 2007) reducing 'communicative distance between researcher and researched,' (Foth and Axup, 2006, p.93). Through this the workflows and tools of participants, contextualised by the meshwork of the domestic space and Practice helped bring together human and material agency through understanding, refining and communicating a domestic, Practice-Oriented IoT. Engaging in dialogue with people's values during design supported alternative outcomes that were meaningful with respect to current practices, making outcomes more likely to fit within these and so more likely to be embraced (Leong and Iversen, 2015, p.314). Meaningfully reflecting on outcomes in a PAR framework directed the research pathway, establishing the effectiveness of PD to inform PAR and PAR to direct PD phases, so action phases maintained participatory attitudes, encouraging consideration of specific issues through problem identification, action, intervention and reflective learning. This builds upon previous IoT work by engaging participants through PD

using Practice-Oriented and using PAR in long-term, in-depth, exploratory research into this topic (Fig.85).

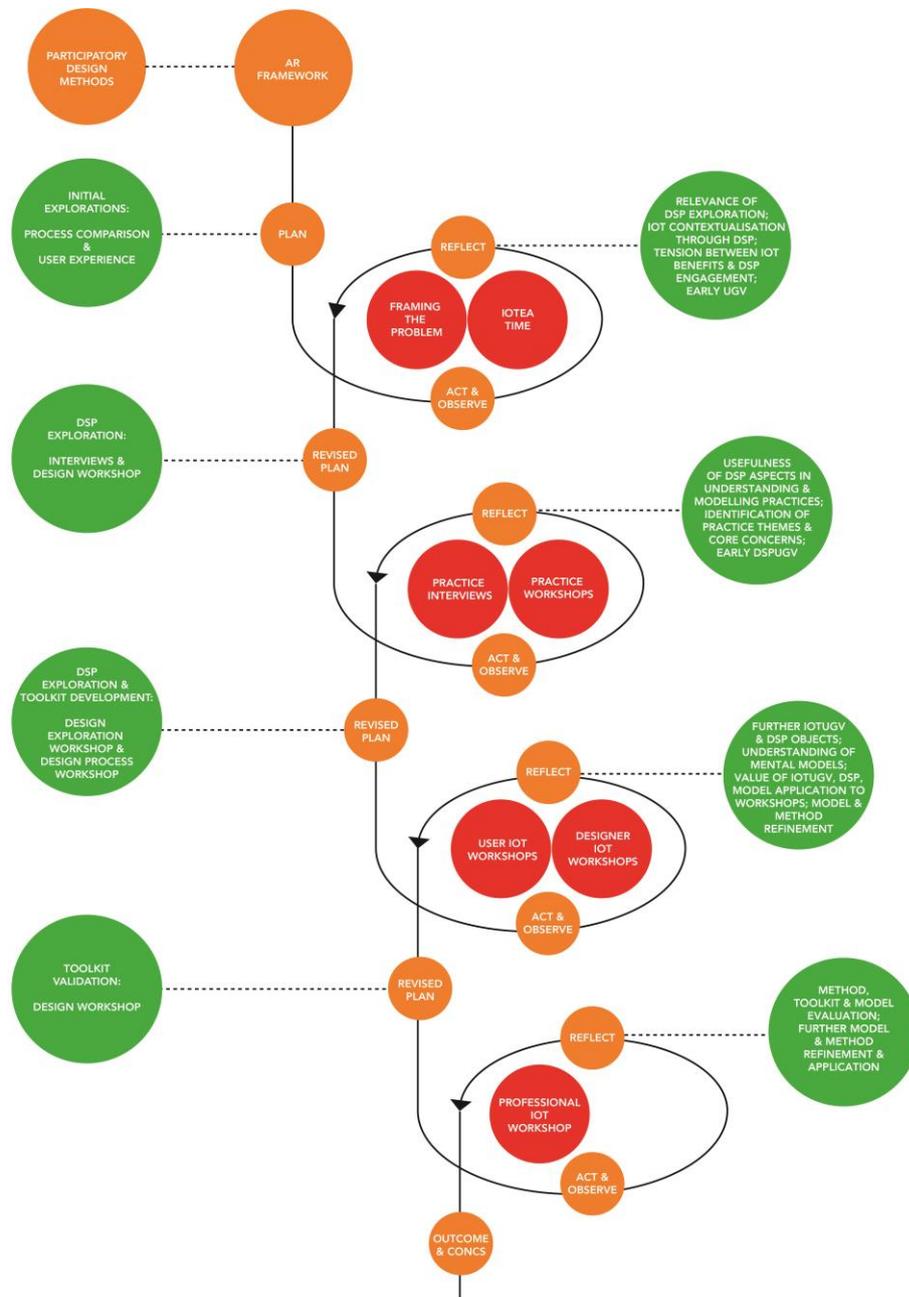


Fig.85: Interacting PD stages and PAR spiral including research activities

There were also innovative PD processes, both in the process and participants involved. Values-Led PD discusses three distinct stages, but reflection in a PAR pathway at *Discovering IoTUGV* indicated the need for new PD processes focusing on toolkit development for improved communication. Parallel PD processes (Fig.86) meant research in *Exploring Practice-Oriented Application* could be considered both *Initial Exploration* of UGV and toolkit application and *Prototyping* concepts based on earlier UGV. Furthermore, PD

tends to focus on one user group throughout, meaning they can determine developments that will directly affect them. However, there were different participants across most research stages, with only *Discovering Domestic Practices* maintaining broadly similar participants. This diversity built on the communicative space PD provides by incorporating wider understandings of current problems to explore future possibilities, leading to broadly applicable preferred futures. Finally, differing user groups extended the communicative possibilities of PD processes by conveying UGV to designers and IoT practitioners, reducing communicative space between potential users and designers.

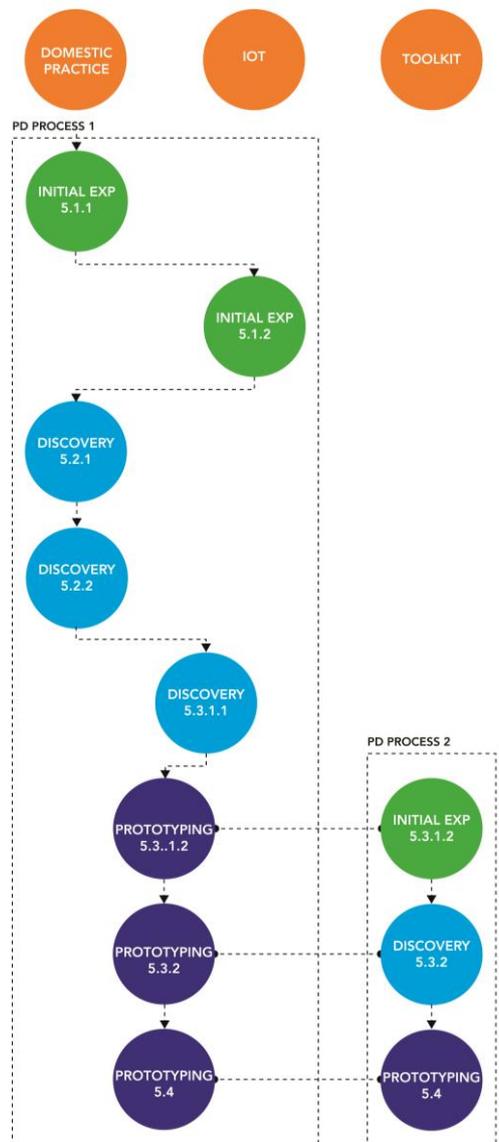


Fig.86: Parallel PD Processes Diagram

## 6.2 Agency, the IoT and Practice-Oriented

Disciplinary perspectives on agency in the IoT have proved important throughout: Techno-Centric perspectives described key IoT features as enabled by automation in data sensing, decision making and action (Kephart and Chess, 2003, p.41), continuing the logistical origins of this system. In the domestic context monitoring inhabitant's habits and preferences promises to make life easier by automating lighting, heating, music and entertainment (Deloitte, 2016, p.9; Innovate UK, 2016). This follows business dominated, innovation focused understandings, but removing or minimising agency can be problematic to moral agency, free will and individualism (Ustek-Spilda et al., 2019, pp.3–4). However, similar participant opinions recurred throughout: within *Problem Framing: Initial Exploration and Discovery* the IoT's benefits were understood as a predictive system that could help with daily actions, especially automating repetitive household tasks. In *Discovering IoTUGV* discussion and voting identified convenience, automation and saving time as core IoT benefits, while analysis of concepts identified themes of automation, intuitiveness and easiness. In *Exploring Practice-Oriented Application* minimised user control was understood as beneficial, with concepts aiming to make Practices easier through automation to support efficiency, accessibility and control; while in *Professional Prototyping of Practice-Oriented IoT* automation was a core element at the start of concepts.

This bias is problematic, as pre-responsivity inherently minimises intelligibility and the development of new knowledge (Ben-Ari, 2001, p.57; van Kranenburg, 2008, p.18). Furthermore, this enframing and ordering of resources means that it can be mistaken as the only 'true' way of conducting activities (Friedland, 2018, p.1385), negatively impacting on the development of new material and cultural practices (Wajcman, 2016, p.31). This approach fails to recognise the ways in which technologies are constituted by user's practices, where people shape emergent and situated use of technology so that 'technology-in-practice' changes the ways in which these are integrated into people's activities through the technological artefact, its materiality, the properties inscribed by designers and those added through user's experience, showing that designs are enacted by people in Practice (Kimbell, 2012, p.133). This is particularly relevant to the domestic space, a 'meshwork' (Ingold, 2008) of human/non-human agency defined in social and spatial aspects (Briganti and Mezei, 2012, p.3). If the practices of this space aren't linked by human agency, the practices constituting the domestic, and therefore the space itself, break down.

Techno-Centric IoT approaches are challenged by Human-Centric explorations focusing on people's engagement with this system and the potentially negative impact of automation in decision making and action, rejecting the 'smartification' of objects as commodities (Smart et al., 2019). *Human-Centric IoT and Domestic Experience* identified that working with users to identify starting points of designs (Vitali et al., 2017, p.S2593), can create 'people-aware IoT applications' (Fauquex et al., 2015, p.57) in a Socio-Technical approach. Criticisms of Techno-Centric IoT approaches argued this reduces people's participation and IoT understanding in the domestic space, so improving engagement in routines, recognised as mutually shaping the IoT and people's activities (Chin et al., 2019, p.52) could address fixed automation and domestic rationalisation by considering the experience of this space through daily domestic activities (Coskun et al., 2018). Concerns surrounding automation's impact on domestic activities was a core participant concern throughout: *Problem Framing: Initial Exploration and Discovery* identified the IoT could be annoying for interacting with people and simple things were being done for you, with automation lowering or countering free will and people being controlled by technology. Complications included physical and service related agential issues, including incorrect suggestions, unwanted marketing and ordering unwanted products and dependency on virtual objects when Things break down. IoT agency was identified as potentially complicating simple things to interfere with practices, manipulating and leading thinking.

This Human-Centric approach explores issues surrounding agency and participant concerns relating to the importance of engagement, decision making, lack of manipulation, social interaction and independence from these types of systems. These were understood as relating to supporting people's ability to act, instead of being constrained by predetermined, optimised outcomes. This also suggests that a purely utilitarian perspective minimises the personal symbolic meaning attained through affective, intuitive and holistic judgements, which are made and interpreted through engagement and action (Isomursu et al., 2011, p.184). This perspective provides balance to a fully automated, Techno-Centric IoT; however, despite some exploration of human/non-human agency (Kroner et al., 2012), it is inherently biased towards human agency and action, negating the role of the IoT in the co-constitution of people's activities within the domestic space and mostly identifying issues instead of suggesting new ways of envisioning this system. Instead a Practice-Oriented, shown in *Humans, Non-Humans, Practice and the IoT*, meaningfully explores a non-anthropocentric perspective where shared non-human/human agency constitutes practices through human interpretation of objects and the impact of non-humans on

practices (Spaargaren, 2011, p.817), so that agency is distributed between both, although in non-identical ways (Kimbell, 2012, p.144). Shove et al.'s (2012) Practice framework links materials, meaning and competency through agency, so practices are constituted by human agency, but things are also parts of Practice (Røpke, 2009, p.249), shaping agency and enabling action.

This provided key insights throughout: in *IoT Tea Time* participants were placed in the context of use through practice re-performance, shifting IoT understandings from an easy, data driven, smart way of living to one providing knowledge and support. In *Focusing on Domestic Practices* six Practice themes concentrated on engagement, function and context, indicating conducting practices is important and recognising the role and effect of objects on practitioners in organisational and emotional contexts. *Discovering IoTUGV* participants were wary about an automated IoT regulating domestic life, with assistiveness a more popular positive theme, while decreased human interactions and loss of social and physical interaction were concerns. Specific issues included negative influence on daily routines; IoT authority dis-empowering people who would believe the system over themselves; analysis of human interactions to replace them and dependence on this system. Assistiveness was preferred, balancing human/non-human agency and allowing the IoT to intervene in practices without overpowering human agency. Participant distinction between automation and assistiveness continued in *Exploring Practice-Oriented Application*, suggesting valuing the convenience of the IoT through automation to save time and provide accessibility and control, yet with major concerns about dependence on systems causing a loss of physical and social interaction. *Prototyping Professional IoT/Practice Synthesis* outcomes focused on physical use, quality and experience of interaction and intuitiveness, while participants recognised automation minimised user understanding and agency, leading to feeling manipulated. There was again concern around negative changing of practices, with minimised serendipity due to lowered agency in decision making identified. Concepts in *Professional Prototyping of Practice-Oriented Application within IoT PDP* considered human/non-human agency in engagement and supporting people's practices, recognising the importance and pleasure of conducting current practices to support future Practice engagement and development through experience and growing expertise, linking with the virtues and internal goods of Practice.

### 6.3 Values, Virtues, the IoT and Practice-Orientation

The previous section indicated perceptions and performance of agency shifted when viewed from Techno-Centric, Human-Centric and Practice-Oriented perspectives; the same is true when exploring IoT values. Techno-Centric perspectives espouse logistical, business and technological innovation dominated values of efficiency, productivity, speed and minimised cost (Hoss, 2014, p.5; Bosche et al., 2016, p.1; Bothun and Lieberman, 2017). Similar participant opinions recurred throughout: within *Problem Framing: Initial Exploration and Discovery* IoT values were understood as efficiency, saving time and making life easier through prediction. *Discovering IoTUGV* identified convenience, automation, accessibility and control and saving time as core IoT values, while concept analysis identified automation and intuitiveness; in *Exploring Practice-Oriented Application* similar values were incorporated into concepts throughout; in *Evaluating the Impact of Practice-Orientation in PDP* participant's initial concepts represented these, with PC continuing this throughout, culminating in serving a business model through subscription meal packs. This follows the IoT's logistical origins, applied to the home in a similar manner to historical approaches from domestic engineers that applied production line techniques to rationalise this space, failing to recognise the differing values of the domestic space and that rationalisation can negatively impact on understanding, social imagination and responsibility.

This application of industrial, logistical concerns to everyday life and the domestic space is problematic. The previously discussed values are seen as paramount, focusing on having and consumption in a manner where measurement becomes the basis for 'truth' and represents knowledge as comprised of 'commensurable bits' (Lambek, 2008, p.135). This economic definition of value is baked into modern technologies such as the IoT, with the orderability of algorithms, code, networks and AI dependent on capitalism, linking information and resources to value as price (Friedland, 2018, p.1384). This subsumes Practice in pursuit of the external goods of effectiveness, failing to provide an environment where goods of excellence can be attained (Beadle and Moore, 2006, pp.9–11). This can also be understood as an unbalanced relationship between humans and technology where people 'are never just the users, but always equally the used' (Fry, 2009, p.28).

Human-Centric perspectives critique Techno-Centric approaches as minimising Socio-Technical concerns, instead focusing on supporting improved engagement and interaction. Recognition of user expertise in reflective, domestic activities means incorporating tacit user values can inform future IoT development (Verweij, 2019) with Human-Centred Design

(HCD) techniques used to identify emotional, individual and social issues, object associated memories, trust, security, transparency and privacy (Apthorpe et al., 2018; Barthel et al., 2013; Vaisutis et al., 2014). These approaches incorporate values, goals and emotions (Koreshoff et al., 2013; Loke, 2011; Soro et al., 2017a) to support sense making and interaction (Frens, 2017; Soro et al., 2017a) and identify values relating to the IoT and the domestic space (e.g. community, porous boundaries, functional and emotional elements (Desjardins et al., 2019, pp.4–7)) that begin to explore the social role of Practice. Participant opinions throughout had similarities: within *Problem Framing: Initial Exploration and Discovery* the values of shared knowledge, enhancing dimensions and bringing people together were identified as potential benefits, while problems included potential complication of social interactions, lower free will, lack of privacy, manipulation and being controlled by this technology, which could lead choices and thinking. *Discovering IoTUGV* identified potential negative impact on human interaction, privacy and individuality as major concerns, while highly ranked positive themes included sociality and emotion; negative themes included dependence and loss of social/physical interaction.

When following a goal directed focus by addressing technical problems through product or system optimisation within a preconceived plan, HCD approaches can be criticised as leading to outcomes with limited interactivity, exploration and learning, but when focusing on behaviour and interactions this can inform outcomes that are physical, perceptually, cognitively and emotionally intuitive (Giacomin, 2014, pp.608-610). While this can support the final goal of development by improving the user's perception of value in terms of system/product impact, human values often conflict with financial goals (Isomursu et al., 2011, pp.184–185), corresponding with the external goods of effectiveness that are the fundamental motivation behind this conception of the IoT. While focusing on improved Socio-Technical outcomes, symbolic meanings and human ability to act and exercise judgement, which in turn support the virtues needed to achieve internal goods of excellence and provide balance between user and used, a lack of criticality continues the IoT's Techno-Centricity.

Practice-Oriented can instead support new ways of understanding the IoT, linking materials, people and activity and housing social phenomena, with co-ordination of current and future actions developing a coherent self of self (Schatzki, 2009, 1996; Warde, 2005). Practice-Oriented in *IoT Tea Time* placed participants in a practice context through imagined re-performance, shifting IoT understandings from an easy, data driven, smart way of living to one providing knowledge and support. Participants criticised the IoT's role and

suggested being able to turn it off, using it to enhance dimensions and broaden perspectives. While not IoT focused, interview analysis in *Focusing on Domestic Practices*, indicated Practice structures domestic life, providing meaning through subjective and shared understandings. Six Practice themes were identified, which had little to do with the IoT's automated, efficiency based benefits, instead extolling internal goods of excellence in skill based, social, emotional and self-improvement contexts. *Exploring Practice* analysed thirteen practices situated by specific objects, which included child rearing, baking, practicing instruments, self-care or listening to music. Again, there was little concern for efficiency, instead focusing on the expansion of human capacities by developing competency, self-improvement and meeting personal goals in non-gender specific roles, suggesting domestic efficiency and interests of technically minded men commonly addressed by IoT devices fail to engage with broader Practice considerations.

*Discovering IoTUGV* participants were wary of decreased human interactions and loss of social and physical interaction, specifically a possible negative influence on daily routines, the IoT acting as an authority to dis-empower people, who would believe the system more than themselves, while analysis of human interactions would replace them. They raised the potential negative impact of the IoT on individuality and knowledge of the consequences of actions in the world, the next generation's understanding of the world and the IoT become so widespread that it was inescapable, with changing practices identified as a negative theme. In *Prototyping Professional IoT/Practice Synthesis* Practice-Oriented prompted a change in concepts, moving from automation to supporting goods of excellence in loving relationships, playing or listening to music or intellectual stimulation. Finally, *Professional Prototyping of Practice-Oriented IoT* manifested IoTUGV, but also led to greater criticality towards the IoT's role in familial relationships, long-term development of competencies, emotional interactions, experimentation and creativity, belonging, sociality and maintaining traditions. When discussing the IoT's values/virtues, Practice-Oriented can support situated knowledge building subjective relationships, object meaning, social interaction, longitudinal Practice development, the development of competence in Practice in the pursuit of these elements and the ways Practice can situate the meshwork of space. A Practice-Oriented can therefore refocus typical Smart Home understandings from acquiring objects of value, external goods of effectiveness and efficient causes towards excellence, correlating with the pursuit of virtues internal to acts (Lambek, 2008, pp.139–151). This allows people to conduct practices, supporting an individual's search and

movement towards their *telos* (Beadle and Moore, 2006, pp.8–9) by questioning how to live and focusing on character (Lambek, 2008, p.134).

## 6.4 Modelling the IoT and Domestic Practice

A key aim of this project was to understand the IoT in relation to the domestic space and reconcile these through Practice. Commonly identified issues with the predominant Techno-Centric domestic IoT paradigm include how this can alienate people from home by overlaying industrial values, minimising people's agency and engagement with Practice and how this can impact on the internal values of Practice and the domestic space. Human-Centric approaches attempted to address this by understanding user feelings, situations and activities and improving physical engagement to improve upon dysfunctional '*Humans-in-the-Loop*' (Stankovic, 2014) approaches. This merely continues a conventional design tendency to separate the outcome of IoT use from the way it works and hide underlying complexity from people (Robbins and Giaccardi, 2019, p.25), despite some exploration of ecological perspectives challenging existing concepts of the IoT (Ghajargar et al., 2018). More impactfully, *Beyond a Human-Centric IoT* re-evaluated hierarchical structures in the IoT, exploring the flat ontologies of Object Oriented Ontology, Actor Network Theory and New Materialisms (Cila et al., 2017; Cruickshank and Trivedi, 2017a; Nicenboim et al., 2018). More-Than Human Centred Design imagined people as equal 'things' within flat IoT 'hyper connected and data-mediated assemblages' (Coulton and Lindley, 2019). Considering the IoT as flat allows parallels to be drawn with Practice, which can also be understood as a flat ontology of distributed, co-constituted elements (Schatzki, 2016). This also helps situate the IoT in the domestic space, which can be understood as a meshwork of place bringing together human and material agency so practices are lived, modified and understood (Pink, 2012, p.55).

This was modelled repeatedly, with iterative improvements made throughout based on the effectiveness in workshop application and participant feedback. The iteration in *Professional Prototyping of Practice-Oriented PDP* represents Practice as the interplay of materials, competencies and meaning connected by human agency, translated into five Practice elements that are either detectable (words and acts, object(s), time, space) or non-detectable (intentionality). Detectable elements act as inputs to the sensing capabilities of a smart IoT Object, bridging physical and digital realms. Practice is incorporated in the IoT, with Data: Current State rapidly becoming Data: Past State when moving to data stores through network activity, with IoT-Time the comparison between these. This is

supplemented by IoT-Space, bringing relevant external data to inform the Analytical Engine in determining IoT outcomes, with this IoT-Intentionality shaped by research insights into Practice Themes, UGV and DV. This determines the IoT-Act conducted by the IoT-Object's Output/Intervention, so that non-human agency assists the original practice by engaging with materials, meaning or competency. In this perspective incorporating human agency drives the IoT through Practice elements, mirrored by an IoT with non-human agency that acts through Practice engagement and reciprocates upon the original practice to inform its development. This frames the domestic IoT as a dynamic, behavioural artefacts-with-agency network, reliant on situated knowledge to support subjective relationships, incorporating object use and meaning, social interaction, longitudinal Practice development, and integration of social and technical concerns to build Practice assemblages connected through use and interaction.

This proposed model is by no means definitive or entirely accurate, but illustrates interaction between Practice and technical constellations to act as a tool for exploration, communication and development within and of a Practice-Oriented IoT. This perspective considers engagement with Practice to incorporate people's skills, values/virtues and goals in a way that models the relationships between devices, people and context through user and system activity to support domestic experiences in temporal, material, mental, social and cultural dimensions, in concert with technology to dynamically define meaning through understanding IoT devices as social objects. In this understanding, the IoT incorporates human/non-human activity within a Practice-Oriented; instead of modelling the relationship between people and the IoT as an exchange of information to support optimisation, which can disrupt understanding of the home through a negative impact on social imagination, interaction with the IoT is an 'open event where conduct is never fully determined, impossible to predict and potentially the site of something new' (Nicolini, 2012, p.20). This reconciles technology's autonomous impact with the assumption that human agency makes the ultimate difference in the world (Spaargaren, 2011, p.817), providing a fundamentally different model for the IoT. Instead of optimising actions against fixed goals in a way that can obscure the circularity of Practice and pursuit of internal goals, this instead suggests circularity between acting and understanding (Sweeting, 2015, p.7), removing the problem of unknown end goals through the maintenance of the internal goal of being on course towards unknown destinations (Sweeting, 2017, p.4). This recognises the impact technology can have on Practice and how evolving social norms can inform new practices through dynamic structural and behavioural complexities, in this case the

achievement of the internal virtues of Practices, which over time are instrumental in an individual's search for how to live and what kind of person to *be* (Lambek, 2008, p.134).

## 6.5 Developing a Practice-Oriented Toolkit and PDP Impact

Following a PAR/PD process explored attitudes towards the domestic IoT, Practice and how to best communicate these to inform the wider design and IoT community within PDP. A design workshop using card-based toolkits was developed to achieve this, following similar processes used to explore or communicate specific IoT topics. Academic research implements card based toolkits and methods (Gianni and Divitini, 2017; Luger et al., 2015; Mora et al., 2017); similarly, commercial design communicates the IoT through toolkit provision (Aspiala and Deschamps-Sonsino, 2014; Brito and Houghton, 2017; De Roeck, 2016) and workshops (Geerts, 2016; Stembert, 2017). Tending to follow Co-Creation processes these use cards, playing pieces, settings and contexts, values and evaluation tools. This development began in *Exploring Practice-Oriented Application* with the use of both Practice-Oriented and Techno-Centric elements. Participants (although not professional designers) developed IoT concepts framed by selected objects, firstly using a Techno-Centric model and deck and then a Practice-Oriented model and deck. Concepts developed using the former focused on efficiency and convenience; when using the Practice-Oriented tools concepts shifted from purely automated to intuitively assistive, with system agency based on Practice inputs.

Including Practice helped reframe IoT perceptions in *IoTea Time* and *Exploring Practice-Oriented Application*; in *Prototyping Professional IoT/Practice Synthesis*, this was developed further, leading to a process that communicated this more effectively to a professional audience. An updated IoT-Practice model delineated technical and Practice elements, compelling participants to develop coherent practices before considering technical implementation, while a supplementary deck included DPUGV. IoTUGV were also included as 'Specification' posters, communicating potential user opinions of positive and negative IoT aspects, although these were described by one participant as feeling like the outcomes of a workshop; these IoTUGV were also used to evaluate how concepts met these attributes at the end of this process. While some Practice-Oriented cards were unhelpful or hard to justify in concept development, the structure and materials communicated how Practice elements formed practices and was overall effective in supporting concept development focusing on practices rather than technological possibilities. Outcomes integrated experiential understanding of the domestic IoT, considering domestic space, human/non-

human agency, object use, sociality and meaning, all of which were framed by Practice-Orientation.

In *Professional Prototyping of Practice-Oriented IoT*, significant changes were made to the toolkit to reflect participant feedback and include further depth and research insights. Major system model changes also informed this development; while this wasn't directly applied in the workshop, it informed the overall structure and was communicated tacitly through this process. This led to a group activity with less overt facilitation due to effective integration of toolkit elements that conveyed a Practice-Orientation to participants. This updated toolkit used a range of tools to illustrate the concerns of this project, including Domestic Tiles, the People within it, Practice Themes, DV, DPUGV and IoTUGV, with participant understanding of these aspects supported through a number of explanatory tokens. This followed identification and designing of tools to support configurable social, technical and spatial infrastructures in design-games (Ehn, 2008, p.96). Furthermore, user examples of Domestic Practices (DP) elements were replaced by a blank Practice-Oriented deck and a parallel set of IoT-Practice cards due to feedback concerning mismatches when forming practices or that concepts were developing to justify their inclusion. Evaluation tools were also more flexible, personalised by using participant selected UGV to assess concepts.

These materials proved successful in supporting concept development throughout with final outcomes reflecting core Practice-Oriented IoT understandings. The physicality of the toolkit allowed participants to refer to them, supporting improved conceptual development and integration of user concerns within PDP. Domestic Tiles fostered a group dynamic and explicitly located concept development within the domestic space; cards explaining DV, DPUGV and IoTUGV communicated these more effectively than previously, while blank Practice and IoT-Practice decks supported participants in constructing practices in an explorative yet focused manner. This also informed participant analysis of situations and generation of concepts through understanding Practice elements as detectable inputs and IoT-Practice elements as data analysis, decision making and output elements. Evaluation using the earlier selected UGV compelled participants to reflect on their concepts, reducing the communicative space between potential users and design teams to improve understanding and design development.

There were limits to this success, with some elements poorly incorporated within concepts, particularly the concept of DP as consisting of materials, meanings and competencies,

despite explanatory tokens which may have been too academically focused. Furthermore, there are limitations to engaging design professionals as the final testing community, as they are not necessarily interested in questioning the IoT, although alternative perspectives were interesting to most of them. This was also limited by one-off engagement with different groups in isolated occurrences of collaboration, with Robbins and Giaccardi (2019, pp.37–38) discussing the value of long-term, sustained engagement in the context of the IoT, impacting not only individual design practices, but on programmatic levels through developing mutually shaped design ideals and intentions through discourse. Finally, this failed to close the loop of Values-Led PD by working with potential users or previous research participants who helped form these Values to evaluate the proposed designs (Leong and Iversen, 2015, p.315)

## 6.6 What worked, what failed and what can be improved?

The major successes of this project is the development of a Practice-Oriented IoT through a PAR/PD process, repositioning the IoT from a system that concentrates on convenience and efficiency to one supporting dynamic practices, while incorporating user concerns and values. This integrates Practice and the IoT by recognising the domestic houses practices that situate space through experience, encouraging engagement with these rather than automating them away. Modelling Practice elements as ‘inputs’ to the IoT and situating Practice in the IoT through IoT-Practice elements informed how IoT ‘outputs’ supported developing dynamic practices through IoT intervention, rather than as fixed or optimised processes. This positions Practice as a core driver and beneficiary of this system, with PAR/PD key in exploring people’s understandings of the domestic space, Practice and attitudes to the IoT. This PAR/PD approach is particularly appropriate, as PD considers user concerns and understandings within technical systems and utilises these to inform future development; IoTUGV and DPUGV were instrumental in understanding and communicating people’s practices and the IoT’s desirable and undesirable attributes. These informed the intent and direction of this project and, through inclusion in a toolkit supporting PDP, shaped professional understanding of user concerns to inform development of concepts more respectful of subjective domestic qualities, people’s engagement with practices and how making ‘Smart’ versions of existing products within Techno-Centric paradigms could harm engagement with Practice, now and in future. This successfully incorporates concerns from Human-Centric and Beyond Human-Centric areas through Practice-Orientation, recognising the value of material use and meaning, the meaning of practices themselves and the sharing of competency between human and non-human actants.

The failures in this project include specific elements within workshops, some aspects of the model combining IoT and Practice and elements of the research process itself. Throughout workshops explanations of Practice and UGV were unclear, addressed in the development of the final workshop through explanation of Practice's constituent elements. However, including materials, meaning and competencies caused confusion and, despite support from workshop materials and explanation, this was not understood by all participants. Specifically, there was little incorporation of materials as objects in concepts, as these tended towards digital apps, rather than supporting physical engagement. Similar issues include explanatory tokens using overly academic terminology, which perhaps misjudged the toolkit's audience. The application of the DV and Practice Themes to the intentionality of the IoT is useful in demonstrating how the IoT can incorporate Practice and UGV contextualised by Practice, but may be inaccurate in terms of positioning. Furthermore, including DV should have been considered earlier in the research process to allow for direct research into this topic rather than relying on secondary sources.

This means improvements could be made to the model, toolkit and process. The model is useful in the context of design practices, but could benefit from deeper technical development to extend application and audience. There are also possible inaccuracies in relation to the positioning of DV and Practice Themes, which could be applied to the Intentionality of the Practice itself to provide participants guidance on Practice meaning as well as IoT-Intentionality. Within the workshop, some participants chose multiple UGV and DV; limiting this to two choices that challenge, rather than support, concepts could engender deeper consideration of their implications. Materials, meaning and competencies could be utilised more effectively to stimulate concept development, perhaps providing clearer definition by integrating Practice understandings and examples while avoiding becoming overly theoretical. Further exploration of how different IoT concepts connect in group workshops through shared Practice elements, such as shared meaning, materials or competency, could also be beneficial. This is hinted at in the food preparation, event curation and organisational concepts in *Professional Prototyping of Practice-Oriented IoT*, which could combine to support sociality and developing tradition into the future in a larger IoT ecosystem within the domestic space. This could be attributed to shared participant understanding of the meaning of these activities by working in a company developing products that fit within the Practice themes of *Food and Drink Preparation* and *Sharing the Practice*.

## 7 Conclusions

This project began with three questions:

**RQ1:** What new perspectives can Practice-Oriented provide on agency and values in the context of new Internet of Things (IoT) Practices?

**RQ2:** How can the Techno-Centric nature of the IoT be integrated into the qualitative domestic experiences of people to better support Domestic Practices (DP)?

**RQ3:** How can potential user's perspectives on the IoT and Practices be constructively communicated to IoT developers within the context of Professional Design Practices (PDP)?

I was able to respond to RQ1 by exploring Practice Theory, identifying valuable insights from this perspective with parallels to concerns surrounding the IoT to explore the role of human/non-human agency in Practice and the IoT, the values and internal goods of Practices, how these can clash with predominant IoT perspectives and how these topics can engage with new IoT Practices.

Responding to RQ2 indicated the impact a Practice-Oriented has on developing an alternative perspective on the domestic IoT, following a Participatory Action Research (PAR)/Participatory Design (PD) approach to understand important elements and values of Practice, how people understand the IoT, how this could change domestic experience and how to represent this through a system model incorporating circularity between IoT constellations and Practice assemblages, connected through human/non-human agency and modelled in a flat ontology. Responding to RQ3 built on this by testing, developing and validating a Practice-Oriented toolkit to communicate this understanding to professional designers, where user perspectives and models gathered through research activities were included. The effectiveness of this toolkit in communicating alternative understandings within PDP were explored, with evaluation of workshops supporting development of better communication through improved toolkit elements. There are five original contributions to knowledge: the importance of PAR/PD in developing Practice-Oriented IoT systems; new understandings of human/non-human agency within the IoT through Practice-Oriented; the values and virtues within current and Practice-Oriented IoT understandings; the synthesis of Practice and the IoT and the development of new tools communicating these understandings. During this project, IoT research and commercial interest has grown, providing perspectives which supported this work theoretically and by demonstrating a growing interest beyond Techno- and Human-Centric perspectives. Therefore, there are two key audiences: IoT researchers interested in

a Practice-Oriented to reframe the IoT and support people's DP and professional designers who want to explore new perspectives on developing domestic IoT products.

## 7.1 Impact of PAR and PD in understanding the Practice-Oriented IoT

I have made contributions to new knowledge in the use of PAR and PD in concert to explore the themes surrounding disciplinary perspectives towards the IoT and biases in relation to agency and values, supporting development of a Practice-Oriented IoT and how to best communicate this within PDP. PAR allowed for practical problem framing and solving using a democratic, collaborative and open-ended approach to improve the experiences of potential users within a domestic Socio-Technical system, maintaining theoretical relevance by questioning in a manner aligned with the central research premise. As PAR is situated within a non-positivist paradigm concerned with co-constructed knowledge and perspectives, this, allied with a focus on Practice, countered Techno-Centric IoT concerns and participant preconceptions. Additionally, interpersonal perspectives provided outcomes in research activities to co-construct knowledge, informing understanding of their implications, shaping the research path by identifying topics of concern, areas that needed further exploration and future developments. PD proved key to contextualising the IoT within the domestic space through Practice insights into users' perspectives on the IoT, Practices and how these relate to systemic values and biases. Using Practice to explore the difference between what currently exists and what participants wanted to exist oriented the PD/PAR path to identify improvements supporting the development of IoT concepts respecting user needs and preferred futures, while considering the wider assemblages of Practice to avoid anthropocentric biases.

This addresses RQ1, using a PAR framework and PD processes to build on prior Practice understandings of the IoT's impact on human/non-human agency and its values/virtues to enrich the field. New perspectives on agency and values/virtues within the IoT were provided by a Practice-Oriented, where PAR cycles supported reflection on the outcomes gathered through PD processes to inform future steps. *IoT Tea Time* contextualised an everyday Practice to provide insights on user attitudes towards the IoT's agency and the values it represented, leading to solely focusing on these in *Discovering Domestic Practices*. Insights into agency and the values/virtues of Practice acted as prompts within *User Understanding and IoT/Practice Synthesis* to support user reflection on IoT expectations, concept development and understanding of systemic biases, highlighted through Practice-

Orientation. Feedback and research insights were tested in *Prototyping Professional IoT/Practice Synthesis* and validated in *Professional Prototyping of Practice-Oriented IoT*, where it was clear that a Practice-Oriented contextualised the IoT in the domestic space. This occurred through consideration of the IoT's impact on DP, taking the agency and values of the IoT and people into account based on previous outcomes within a PD process through a PAR framework that indicated following Practice-Oriented could provide new insights into the IoT.

This supported answering RQ2, as these outcomes are relevant to domestic experience incorporating Practice, with new perspectives on agency and values directing the research path to enrich understandings of the IoT and Practice in concert. Parallel PD processes were also used, with certain research activities acting as multiple stages in this Values-Led process. This is relevant to Design Research (DR) by showing the value of following PAR's reflection on personal and interpersonal perspectives, with co-constructed knowledge developed through subjective social processes. Values-Led PD stages of *Initial Exploration*, *Discovery* and *Prototyping* structured insights into Practice, the IoT and participant's attitudes towards these. This identifies the value of Practice-Oriented in this particular context, supporting the development of a coherent relationship between this and the IoT that reflected and communicated desired end-states regarding both. Furthermore, reflection in a PAR pathway allowed for the development of PD processes in a parallel manner, meaning one research activity could act as two stages simultaneously.

This approach was important theoretically and in communicating with designers, addressing RQ3. Initial user testing, feedback and analysis on the impact of this understanding allowed for refinement through working with non-professionals and professional designers. Research activities tested concepts, developed understanding and validated this approach through assessing how this influenced concept development and changing attitudes towards the IoT. This supported further refinement and feedback, reducing the communicative distance between these groups by capturing user understanding of and attitudes towards the domestic IoT and Practice to inform the development of toolkits. Through representing participant values within the context of a domestic, Practice-Oriented IoT toolkit, these were effectively communicated to a professional design team, indicating the relevance of this approach to PDP. These creativity relevant skills, informed by new interpretations of what is meaningful to people, supported design understanding and engagement through dynamic, iterative design processes that led to creative outcomes.

## 7.2 Agential Attitudes and a Practice-Oriented IoT

I have made contributions to new knowledge in understanding agency within the IoT, reconciling human/non-human agency through Practice-Orientation. This has supported the research path throughout and will potentially inform future developments in this field. Practice-Orientation articulated the impact of the Techno-Centric premise of a fully automated IoT, suggested alternative understandings of human/non-human agency and provided insights into users' perspectives on agency in their current practices. PAR's focus on subjective social processes serving as guiding principles steered the research path, leading to exploration of user's desired agential responsibilities and preferred system deferment, tempered by Practice-Orientation; PD supported the development of this understanding by exploring user needs without over-prioritising people in the IoT to balance human/non-human agencies.

This has addressed RQ1 by providing new perspectives on agency within the IoT, relating to new practices. Dominant Techno-Centric perspectives tend towards efficiency due to industrial origins and disciplinary biases, so human agency is used to determine non-human agency and minimise future system engagement. Human-Centric perspectives recognise the importance of human agency and integrate this through improved experience and engagement to promote usability, legibility and combat feelings of manipulation, but within a similar IoT proposition. Beyond-Human Centric perspectives advocate for ontologically flat, shared human/non-human agency within IoT constellations, with a Practice-Orientation following this to propose a non-anthropocentric perspective balancing human/non-human agency to support reciprocal engagement and tackle deskilling. Practice Theory expresses the importance of human agency in engaging with and developing practices and recognises the role of non-human agency in objects, symbols, technologies and infrastructures as co-constitutive, with differing agency distributed between humans/non-humans to shape agency and enable action. This supported developing a balanced perspective incorporating both human and non-human agency to explore this within participant research activities, system modelling and concept development, supporting a change in IoT understanding from both Techno-Centric and Human-Centric positions by providing a new framing.

This supports answering RQ2, as Practice can highlight the importance of agency in the home, with engagement with DP helping make this place meaningful and supporting future engagement through agency linked material elements, where knowledge and skill of actions

are necessities. In Techno-Centric perspectives domestic automation is consistently viewed positively, with disengagement from practices not considered problematic. Human-Centric perspectives recognise the importance of involvement in DP, but human agency is generally prioritised or applied to support better engagement with technologies. However, a Practice-Oriented perspective specifically recognises the domestic space as a meshwork of human/non-human agency in social and spatial realms, supporting the evaluation and fitting of action to circumstance through engagement and judgement that appreciates the human condition while considering the agency of the materials of everyday life crucial to Practice. This rejects the 'smartification' of objects as commodities and supports critical understanding of power imbalances in the traditional domestic IoT, allowing human/non-human agential reciprocity to do more than regulate the domestic space, instead supporting the ability to be present in everyday life, apply judgement and skill, and engage with the home through mindful knowledge of new IoT assisted Practices.

This also addresses RQ3 by applying Practice-Oriented within research activities to explore existing Practices and contextualise the IoT, supporting the gathering of explicit participant statements and the uncovering of tacit participant opinions on issues surrounding agency. This indicated the importance and impact of non-human agency in existing practices and identified issues around application of this within current domestic IoT propositions, the majority of which related to the ways this could disrupt or supplant Practice in short and long terms. These insights were communicated within PDP through the inclusion of Internet of Things User Generated Values (IoTUGV) cards which listed preferred and unwanted characteristics (including agential considerations) of potential systems to guide concept development and through the inclusion of Practice examples as Domestic Practice User Generated Values (DPUGV), which included direct quotations from participants on their involvement and sharing of agency. Furthermore, the use of materials, meanings and competencies to explore Practice, the positioning of agency within Practice and mirroring this within the IoT, and an underlying workshop structure focusing on shared agency in Practice over technological application tacitly communicated the importance that literature and participants placed on balanced agency in the domestic IoT.

### 7.3 Values and Virtues in a Practice-Oriented IoT

I have made contributions to new knowledge relating towards understanding the values/virtues of the IoT and DP, informing both the research path throughout and potential future developments. Contextualising the IoT within the domestic space through

Practice prompted re-evaluation of Techno-Centric IoT perspectives and provided insights into users' perspectives on this, Practice and how these relate to each other. Following PD through democratic and collaborative methods supported the development of concepts that considered user needs without over-prioritising people in the IoT. This again followed PAR's reflection on personal and interpersonal perspectives, with co-constructed knowledge developed through subjective social processes to serve as guiding principles that reflect user's desired IoT, tempered by Practice-Oriented.

In regards RQ1, Practice-Oriented provided new perspectives on the values of the IoT and the potential shaping of new possibilities relating to values/virtues, relating to both preferred values derived from user perspectives and in understanding values/virtues in the context of new IoT Practice. These are again linked with disciplinary biases and human/non-human agency within the IoT: Techno-Centric IoT approaches prioritise efficiency and lower cost, espousing a value-as-price logic where optimisation against goals pursues external goods of effectiveness to the detriment of understanding, learning and experience and, therefore, the domestic meshwork. Human-Centric approaches recognise these issues, but merely modify existing IoT perceptions by defining the Socio-Technical values of the domestic space based on human perspectives. Instead, Practice-Oriented can reconceptualise the values/virtues of the IoT by recognising home as a meshwork where the social world is brought to being through everyday activities, meaning that humans/non-humans can support each other in developing knowledge to comprehensively design good conduct in unpredictable, dynamic Practice. This prioritises the internal values of goods of excellence, representing movement towards the virtues internal to these acts and towards how a person wants to live and be. This necessarily engages with agency, moving from objects to acts and, beyond this, to character: as Practice is ontologically flat these goods of excellence can be considered part of the IoT itself, providing a new set of IoT values/virtues and character within this conceptualisation. Regarding new IoT-Practices, this no longer embeds the values of efficiency, speed and convenience by supplanting Practice or places too much credence in human perspectives on the IoT and the values it espouses. Instead, Practice-Oriented proposes an alternative model where Practice is situated within the IoT itself, conceptualising this as a system of co-constituted practices that reflect these virtues and support shared movement towards human and IoT *telos*.

This addresses RQ2, indicating Practice-Oriented approaches support integrating the IoT into domestic experience by identifying user opinions on beneficial and detrimental IoT aspects through IoTUGV, gathering rich examples of objects and practices and identifying

Practice Themes, constituent elements and important terms. Practice-Oriented was explored throughout and contextualised attitudes towards the IoT through interactive installations, provided examples of goods of excellence in existing practices, supported gathering of user's opinions on IoT values and provided structure to implementing insights within concept development. Outcomes were informed and evaluated via values relating to Practice and the IoT, and concept development and participant reflection on these indicated this supports reconsideration of the values espoused in Techno-Centric and Human-Centric IoT by following Practice-Oriented. This is relevant to DR by providing concrete examples of practices and participant attitudes towards the IoT tempered by the values embedded within a Practice-Oriented, while indicating future methods for determining values relating to not only the IoT but other Socio-Technical systems within spaces where Practice-Oriented is paramount.

This addresses RQ3 by corroborating several areas of user concerns, identifying novel issues through Practice Themes, DPUGV and IoTUGV to inform designers developing concepts for the domestic IoT. Conveying these to the wider community through iteratively developed design workshops led to the effective application of these values to express user attitudes towards the domestic IoT. While initially communicated as guiding 'Specifications,' participant feedback allowed for more meaningful integration as guiding principles for designers to select and evaluate concepts through. This may have been less effective in communicating all attitudes to the IoT and Practice, but communicated selected attitudes more effectively within concept development, while designers explored all these before selection. While this mostly supported a change in attitude towards the IoT, it is worth noting this was not always the case; in particular, participants with a commercial or implementation focus often maintained Techno-Centric IoT values in their concepts. However, in the main this validated effective communication of participant attitudes to the IoT and Practice to the wider design community through design workshops incorporating Practice-Oriented tools, supporting the development of concepts that consider, implement, develop and are assessed using these understandings.

## 7.4 Synthesising Domestic Practice and the IoT

I have made contributions to new knowledge in understanding the IoT in relation to the domestic space, reconciling these through Practice-Oriented. Iteratively modelling a Practice-Oriented IoT to link technical and Practice elements and incorporating participant attitudes towards the IoT developed a perspective engaging with the IoT and Practice

conceptually and visually. Practice elements are potential inputs to and beneficiaries of the IoT, while incorporating Practice elements in the IoT as IoT-Practice elements places a Practice-Oriented within this understanding of the IoT. This allows a system where human agency informs non-human agency to act on and in the original practice, supporting long term dynamism. This considers both Practice and technical elements in the constellations constituting the IoT, clarifying their interactions and necessitating user engagement with practices to inform technical IoT elements, which in turn impacts on people's practices dynamically and reciprocally. This system supports engagement and development of Practice in the light of societal and technological changes altering social norms, allowing for the development of new material and cultural practices.

Practice-Oriented addressed RQ1 by providing new perspectives on agency and values in the context of new IoT Practices, informing the development of this proposed system model of the IoT. Following Practice Theory's flat ontology, Practice assemblages and IoT constellations were placed on the same plane, so that each impacts and influences each other non-hierarchically. Human/non-human agency is balanced through this, allowing for shared agency between people conducting practices and the IoT intervention. Furthermore, Practice is also situated within the IoT, repositioning the intent of the IoT towards Practice and the expansion of internal goods through pursuing internal values. Therefore, agency is shared between humans/non-humans in a manner supporting experiential DP, with the IoT bridging physical/digital realities through a meshwork of behavioural artefacts-with-agency within a Practice-Oriented. This allows new, dynamic DP to engage with and be informed through the IoT in a way that recognises the circularity of Practice in acting, understanding and moving towards unknown destinations by maintaining internal virtues and values.

This responds to RQ2 by integrating the IoT's objective nature and people's experience of the domestic space, utilising Practice-Oriented's flat ontology to ensure equal prominence is paid to both. Modelling this represents people's involvement and experiences of these activities and technical, objective aspects of the IoT system itself, and synthesis of key technical IoT and Practice elements supports consideration of participant and systemic engagement throughout, not only as initial context provision, therefore supporting the development of future practices. This is supported by the inclusion of Practice Themes, User Generated Values (UGV) and Domestic Values (DV) on IoT Intentionality, further guiding IoT outcomes to support the development of Practice assemblages incorporating subjective opinions, social interaction, object use and meaning and experience. This proposed model connects the objective nature of the IoT with the

subjective and experiential nature of DP through Practice-Oriented's recognition of values, structure to facilitate participation and feedback on how to function in this type of system. This is relevant to DR relating to the IoT by proposing a new model and approach to understanding the IoT that is respectful of both human/non-human elements, building on current understandings and models in this field.

In relation to RQ3, this approach was tested, developed and validated through use as either an overt element of a design workshop or acting as an underlying structure. Through this process, testing and development was undertaken, initially via theoretical evolution informed by Practice insights gathered by working with participants, supplemented by their IoT insights and other relevant models. This was further developed through testing and feedback from designers, informing iterations that led to the final synthesised model. This was not overtly discussed or evaluated in *Professional Prototyping of Practice-Oriented IoT*, but the workshop outcomes validate this approach, indicating this tacit communication is mostly effective. Additionally, this overtly communicates this proposed understanding effectively and coherently, building on previous work in this field and conveying this development to inform future research and design practices. This is relevant to PDP by supporting the development of a workshop structure that communicates an alternative perspective on the IoT to refocus concept development from technical possibilities towards people's experience of the home and Practice enabled by potential human/non-human partnerships.

## 7.5 New Methods and Tools

I have made contributions to new knowledge through the development of new methods and tools using a Practice-Oriented perspective incorporating research insights gathered through a PD/PAR pathway, conceptualised and structured through the model discussed in *Modelling the IoT and Domestic Practice* and *Synthesising Domestic Practice and the IoT*. This linked the IoT and Practice practically and communicated this through the toolkit and workshop structure developed through this project. Following a parallel PD process, feedback on the application and effectiveness of toolkits was provided by participants and professional IoT designers, with *Initial Exploration* in *Exploring Practice-Oriented Application, Discovery* in *Prototyping Professional IoT/Practice Synthesis* and *Prototyping* in *Professional Prototyping of Practice-Oriented IoT*. This utilised cards, tokens and physical media to support concept development and creative engagement with diverse topics, building on existing tools in design and the IoT to support new perspectives. While similar

toolkits are used for creative development in the IoT, none focus on a Practice-Oriented IoT, therefore these elements, developed through a Values-Led PD process, communicate this original position.

This addresses RQ1 by providing new perspectives on agency and values in new IoT Practices for designers and developers. Through this toolkit and workshop process the importance of user's involvement in these activities was highlighted, with evidence this impacted on concept development. Automated IoT paradigms were seen as supplanting engagement and minimising competencies involved, impacting on future Practice involvement and development. Furthermore, this raised the issue of differing user abilities in engaging with practices and the ways that agency can be shared between humans/non-humans in the IoT. Placing Practice within the IoT and including blank cards for participants to complete focused on the reciprocal nature of this approach, so that the actions of the IoT impacted on the practice itself, demonstrating this shared agency on a flat level. New values for the IoT were also explicitly communicated through the inclusion of user opinions as Practice Themes, desirable and undesirable IoT attributes from previous research activities and DV. This was also tacitly included in the workshop structure and through the underlying Practice-Oriented: focusing on the domestic space, people and values prior to considering technological elements supported focus on the values and use of the home, while Practice focuses on the internal goods of excellence over external goods of effectiveness, supporting activities that can be meaningful to participants and thereby supporting designers in developing concepts considerate of Practice. Finally, reviewing concepts in a discursive forum using the values chosen at the start of the session reinforced these values and the ways these can support the development of IoT concepts to fit within and support new IoT practices.

This addresses RQ2 by reconciling Techno-Centric IoT aspects and Practice-Oriented considerations of qualitative, experiential practices in this process, guided by the underlying model detailed in *Modelling the IoT and Domestic Practice*. This is a new method in this field developed through two parallel PD processes and integrating new tools to provide a guided process based on a model that synthesises Practice and the IoT. This supports the design and development of concepts and outcomes differently to previous approaches, leading to outcomes more considerate of the subjective, experiential nature of practices, their specific relevance to the domestic space and how these can be the inputs to and beneficiaries of an IoT that takes UGV and Practice Themes gathered through a Value-Led PD process into account. This is particularly relevant to DR, as this demonstrates a toolkit and method

highlighting the importance of working with different groups of participants to gather values, refine methods and implement these to scaffold exploration of core issues. This process could be applied to other interests relating to the IoT, however there is room for refinement to these specific outcomes and the process itself.

In relation to RQ3, the parallel PD process meant testing occurred in *Exploring Practice-Oriented Application* and *Prototyping Professional IoT/Practice Synthesis*; development of the toolkit was undertaken for *Prototyping Professional IoT/Practice Synthesis* and *Professional Prototyping of Practice-Oriented IoT* and toolkit validation occurred in *Professional Prototyping of Practice-Oriented IoT*. Effective communication to professional designers was achieved through this refined workshop structure and toolkit, finessed through user feedback in testing and development phases and validated in a final workshop process. This validation was illustrated through feedback on the process itself, evaluation of concepts, the themes concepts engaged with and how they developed due to the influence of the toolkit, leading to outcomes that engage with the domestic IoT in a manner that considers, prioritises and supports DP. This is particularly useful within PDP as these are guiding principles for development, rather than providing starting points for developing bespoke domestic IoT devices, which can lead to fixed outcomes and static practices.

## 7.6 Future Recommendations

Researchers and companies interested in the domestic IoT may use a Practice-Oriented to further explore the integration of the IoT with the domestic space, while the IoT-Practice toolkit could be further applied as an inspirational tool for concept development. This could be developed for alternative audiences with specific interests, perhaps expanded in scope through focusing on specific aspects of the domestic IoT, generating useful feedback on the application and range of the toolkit to improve its reach and efficacy. Furthermore, conducting this process from *IoT Tea Time* to *Exploring Practice-Oriented Application* with consistent participants may allow for more effective application through gathering values from a more informed and constituent user group. Applying a Practice-Oriented perspective in future, research activities that consider alternative methods is a possible area of interest; this could support development of working physical representations of the concepts developed through this, or similar, processes. This would be supported by my professional background, allowing for extension of this work through the development of artefacts that can become a part of the assemblages/constellations of a Practice-Oriented IoT.

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## Appendix A - 5.1.1: Comparing Tea Making Practices: Hierarchical Task Analyses

### Making a cup of tea in a goal focused process

Purpose of HTA To understand the steps involved to make a cup of tea  
To understand the role that furniture may play in this routine.  
To gather data on how people interact with objects.  
To understand people's attitudes to the task through how the task is carried out.  
To understand people's conditioned behaviours and responses

Task goal Make a cup of tea

### Determine next level sub goals by breaking down overall task goal

CHECK WATER LEVEL OF KETTLE  
FILL KETTLE WITH WATER  
BOIL KETTLE  
CHOOSE DRINK  
CHOOSE VESSEL  
MAKE DRINK  
BREW  
MILK  
SUGAR

Keep breaking down until operations are revealed and define plans to describe how to perform the operations in each sub-goal level of the hierarchy

### **CHECK WATER LEVEL OF KETTLE**

REMOVE LID/VISUAL INSPECTION

*Open kettle lid*

*Press button on kettle/grip handle and lift lid*

*Check water level gauge*

LIFT KETTLE/TACTILE EVALUATION

*Grasp handle*

*Lift kettle (optionally swish side to side to move water) (FEEDBACK)*

*Judge weight to determine if enough water*

DECIDE TO FILL

Continue below, otherwise go to **BOIL KETTLE**

### **FILL KETTLE WITH WATER**

PLACE KETTLE UNDER TAP

*Grasp kettle handle*

*Lift kettle*

*Open lid/remove lid*

*Move to under tap*

*Release kettle handle*

TURN ON TAP

*Grasp handle*

*Turn clockwise/anticlockwise or push/pull*

*Allow water to flow until kettle is full to desired amount*

TURN OFF TAP

*Turn anticlockwise/clockwise or pull/push*

**BOIL KETTLE**

PLACE KETTLE ON STAND, SWITCH ON (ELECTRICAL)

*Grasp kettle handle*

*Lift kettle*

*Place onto stand*

*Release kettle handle*

*Flick switch on*

*Visually inspect to see the light is on/switch in position (FEEDBACK)*

*Wait until kettle boiled and automatically switches off*

TURN ON HOB, PLACE FILLED KETTLE (NON ELECTRICAL)

*Turn desired hob ring on by reaching out and rotating handle*

*For gas hobs, ignite using built-in spark or matches*

*Grasp kettle handle*

*Lift kettle*

*Place onto stand*

*Release kettle handle*

*Wait until kettle whistles (further steps can be made while waiting)*

*Turn off hob*

**CHOOSE DRINK**

OPEN CUPBOARD TO VISUALLY INSPECT OPTIONS (LOOSE TEA, TEABAG, GREEN TEA, HERBAL TEAS ETC)

*Grip cupboard handle/side or underside of cupboard door*

*Pull open*

PICK UP CONTAINER OF TEA

*Visually inspect options and decide*

*Reach out and grip desired container*

*Lift container from shelf and remove from cupboard*

*Place onto tabletop/ countertop etc. OR remain holding until after cupboard closed*

*Release grip on container once on surface*

CLOSE CUPBOARD

*Grip handle, push away/Push door directly*

**CHOOSE VESSEL**

OPEN CUPBOARD

*Grip cupboard handle/side or underside of cupboard door*

*Pull open*

CHOOSE VESSEL

*Visually inspect to see options and decide*

*Reach out and grip desired vessel*

*Lift from shelf and remove from cupboard*

*Place onto table top/countertop etc. OR remain holding*

*Release grip from vessel once placed onto surface*

CLOSE CUPBOARD

*Grip handle, push away/Push door directly*

**MAKE TEA**

OPEN DRAW

*Grip handle, pull*

PICK UP TEASPOON

*Visually inspect to determine desired spoon (if familiar this can be done solely through tactility or habit)*

*Reach into draw, grip cutlery and lift*

CLOSE DRAW

*Push draw directly*

OPEN CONTAINER

*Grip lid*

*Unscrew, remove lid, flip open box etc.*

*If lid removed, lower to surface and release*

USE TEASPOON TO TRANSFER DRINK INTO VESSEL

*Grip cutlery*

*Lift and move towards open container*

*Insert into container*

*Tilt and lift spoon*

*Move towards vessel*

*Rotate spoon to tip ingredient into container*

*Lower spoon to surface and release*

CLOSE CONTAINER

*Retrieve lid if placed onto surface*

*Replace lid and do up*

LIFT KETTLE FROM BASE/HOB (TURN OFF HOB)

*Grip kettle handle*

*Lift from hob/stand*

*Move kettle to vessel 1 while maintaining vertical position*

POUR WATER OVER INGREDIENTS

*Tilt towards vessel to pour water*

*Stop pouring and return to level once vessel filled as desired*

REPLACE KETTLE

*Move kettle back to hob/stand*

*Lower to hob/stand and release handle*

**BREW**

STIR WITH SPOON

*Grip cutlery and lift from surface*

*Move it towards vessel*

*Angle to upright position and insert into liquid*

*Move spoon in circular action to agitate liquid*

*Once agitated to desired amount, remove spoon*

*Lower spoon and replace on surface*

ALLOW TO STAND FOR PREFERRED AMOUNT OF TIME

*Wait as long as desired – the longer the wait, the stronger the brew*

## MILK

OPEN FRIDGE TO VISUALLY INSPECT OPTIONS (SKIMMED, SEMI, FULL, CREAM, ALMOND, SOY, ETC)

*Grasp fridge handle, pull*

*Visually inspect options and decide*

*Reach out and grip desired option*

REMOVE MILK FROM FRIDGE

*Grasp milk container and lift*

POUR MILK DIRECTLY TO VESSEL

*Open bottle by gripping lid and turning*

*Lift and maintain verticality*

*Move towards vessel, keeping vertical*

*Tilt to pour milk to desired amount*

*Return to vertical position*

REPLACE MILK INTO FRIDGE

*Move bottle to fridge, still in vertical position*

*Lower and place in fridge door/shelf*

CLOSE FRIDGE

*Push fridge door*

STIR

*Grip cutlery and lift from surface*

*Move it towards vessel*

*Angle to vertical position and insert into liquid*

*Move spoon in circular action to agitate liquid*

*Once mixed, remove spoon*

*Lower spoon and replace on surface*

## SUGAR/SWEETENER

OPEN LARDER TO VISUALLY INSPECT OPTIONS (GRANULATED SUGAR, HONEY, BROWN SUGAR, SUGAR LUMPS, SWEETENER ETC)

*Grasp larder handle, pull*

*Visually inspect to see options and decide*

*Reach out and grip desired sweetener*

*Lift sweetener and remove from larder*

CLOSE LARDER

*Push larder door shut*

PLACE SWEETENER ON SURFACE

*Lower sweetener towards surface*

*Release grip*

USE TEASPOON TO TRANSFER SWEETENER INTO VESSEL

*Grip cutlery*

*Lift and move towards open container*

*Insert into container*

*Tilt towards horizontal*

*Lift spoon in horizontal motion*

*Move towards vessel*

*Rotate spoon to tip sweetener into vessel*

STIR

*Angle spoon vertically and insert into liquid*

*Move spoon in circular action to agitate liquid*

*Once agitated to desired amount, remove spoon*

*Lower spoon and replace on surface*

Making a cup of tea in an experience focused process

Purpose of HTA To understand the steps involved to make a cup of tea in this highly formalised ritual

To understand the role that furniture may play in this routine.

To gather data on how people interact with objects.

To understand people's attitudes to the task through how the task is carried out.

To understand people's conditioned behaviours and responses

Task goal Conduct the process of tea making for aesthetic and practical purposes and create and experience for the performer and guests

Determine next level sub goals by breaking down overall task goal

OPENING THE DOOR  
PRESENTING THE SWEETS  
BRING IN TEA UTENSILS  
GREETING AND CLOTHES  
CLEANING THE NATSUME  
CLEANING THE CHASHAKU  
REMOVE FUTA FROM THE KAMA  
CLEANING THE CHASEN  
WARMING THE CHAWAN  
SCOOP MACHA INTO THE CHAWAM  
REMOVE LID FROM MIZUSASHI  
SCOOP HOT WATER INTO CHAWAN  
WHISK MACHA AND OYU  
SERVING GREEN TEA TO GUESTS  
DIALOGUE WITH SHOKYAKU  
CLEANING THE CHAWAN  
CONTINUE MAKING TEA  
FINISH THE TEA CEREMONY

Keep breaking down until operations are revealed and define plans to describe how to perform the operations in each sub-goal level of the hierarchy

**OPENING THE DOOR**

Open left hand door using left hand until two thirds open

Open remaining third with right hand crossed in front of body

Keep unused hand on lap in seiza position

**PRESENTING THE SWEETS**

Lift bowl with hands on either side of the bowl

Stand up in one smooth movement

Walk into room, left foot first

Sit

Place bowl close to guests

Say "Okashi wo doozo" (please have these sweets) while bowing

#### **BRING IN TEA UTENSILS**

Bring in mizusashi, held with both hands  
Place next to the furo  
Bring in chawan (left hand) and natsume (right hand, palm on top & fingers in front)  
Place simultaneously in front of mizusashi  
Bring in kensui with left hand  
When walking through door turn and sit diagonally facing the sliding door  
Close door in reverse manner to how opened  
Sit in middle of temaeza in front of furo  
Place kensui besides the body  
Lift hishaku with left hand  
Take futa-oki from kensui with the right hand  
Lift hishaku in front of chest  
Turn so that you can see into the cup of the ladle  
Take futaoki from kensui and place to left of furo with the right hand  
Place hishaku on top of kensui with handle pointing between knees

#### **GREETING AND CLOTHES**

Greet the guests with a bow  
Wait for guests to reciprocate  
Arrange clothes to ensure comfort for remainder of ceremony  
Take a breath to prepare a meditative state of mind  
When ready, move the kensui slightly forward in line with the knees

#### **CLEANING THE NATSUME**

Pick up the chawan with the right hand  
Transfer to the left hand  
Put down in front of the knees with the right hand  
Pick up natsume with the right hand  
Place between knees and chawan  
Remove the fukasa with the left hand  
Fold the fukasa  
Hold the fukasa in the right hand  
Pick up the natsume with the left hand from the left side with four fingers at the back and the thumb at the front  
Wipe the top of the natsume in the form of ko  
Flow to the left side  
Place the natsume in front of the mizusashi

#### **CLEANING THE CHASHAKU**

With the fukasa still in the right hand open and fold again  
Hold fukasu in left hand  
Pick up chashaku in the right  
Place the chashaku on the fukasa, held in the left hand at heart level  
Hold chashaku at the end  
Slide fukasa forward with the left hand to clean top and bottom  
Slide back to beginning to clean on sides  
Slide back and repeat to clean top and bottom  
Place chashaku on the natsume

Take the chasen from the chawan and place next to natsume

Bring the chawan closer to the knees with the right hand

#### **REMOVE FUTA FROM THE KAMA**

Pick up the hishaku with the left hand and hold at chest height

Remove the futa from the kama with the right hand

Place on futa-oki

Take the fukin from the chawan and place on the futa

Take hishaku in the right hand

Scoop ladle of hot water into the chawan

Rest hisaku on the kama

#### **CLEANING THE CHASEN**

Take the chasen with the right hand and stir the water in the chawan gently from right to left side and back

put chasen down facing to the right

hold chawan steady with left hand

Lift chasen with the right hand and slowly bring up and turn to check all the tines of the whisk

Bring down again and stir again from left to right and back

Put chasen down on the right for a moment

Repeat process twice

Whisk the water to warm up the tines of the chasen

Finish by drawing a no shape in the water

place next to the natsume

#### **WARMING THE CHAWAN**

Pick up the chawan and place it on the palm of the left hand

hold with two hands, slowly tilt in anticlockwise motion three times

discard the water into the kensui with the left hand **only**

take chawan into the right hand and put down in front of knees again

#### **SCOOP MACHA INTO THE CHAWAM**

With the right hand take the chashaku from the natsume

Pick up the natsume with the left hand from the side

Bring the natsume in front of the chest

Hold the chashaku with the little and ring fingers only

With the two free fingers take the lid from the natsume

Place lid next to chawan and scoop one and a half spoons of powdered macha into the chawan

Bring natsume closer to the chest

Smooth out the powdered macha

Tap chashaku twice on the edge of the chawan to remove residual macha

Put lid back on the natsume

Place back by the mizusashi and the chashaku on top of it

#### **REMOVE LID FROM MIZUSASHI**

Lift the lid with the right hand

Bring closer to body

Flip so that the lid faces right

Grab with the left hand with thumb on the right

Grab the lid above the left hand with the right hand

Place standing against the mizusashi on the left side

#### **SCOOP HOT WATER INTO CHAWAN**

- Use the index and middle finger to lift the hishaku from the kama
- Slide fingers forward slightly and bring around to hold the ladle like a pen
- Pour a full cup of water into the chawan slowly
- Return any leftover water to the kama
- Place hishaku on the kama

#### **WHISK MACHA AND OYU**

- Take the chasen in the right hand
- Hold chawan with the left hand to secure during whisking
- Whisk the oyu and macha to froth with half the chawan covered with foam
- When well mixed finish by drawing a no in the chawan
- Place chasen in front of the mizusashi

#### **SERVING GREEN TEA TO GUESTS**

- Pick up the chawan with the right hand and place on palm of left hand
- Turn anticlockwise 90 degrees twice so the front faces the guest
- Place the chawan on the other side of the tatami border

#### **DIALOGUE WITH SHOKYAKU**

- The first guest will approach to ask questions

#### **CLEANING THE CHAWAN**

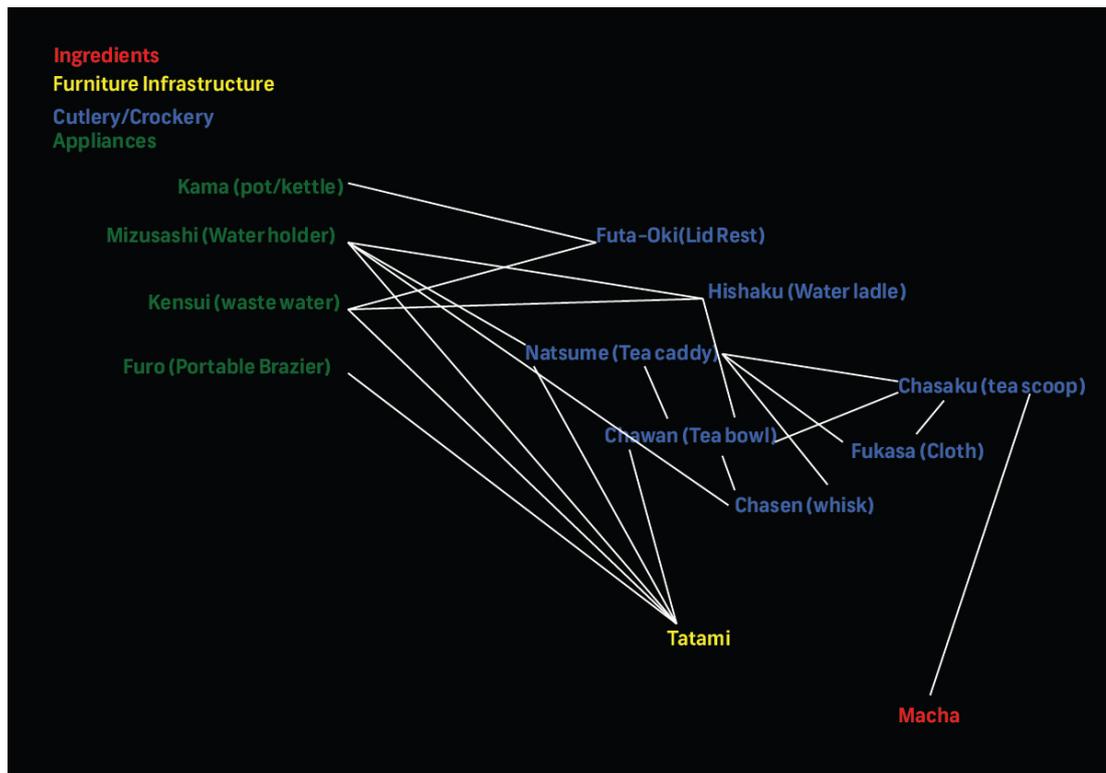
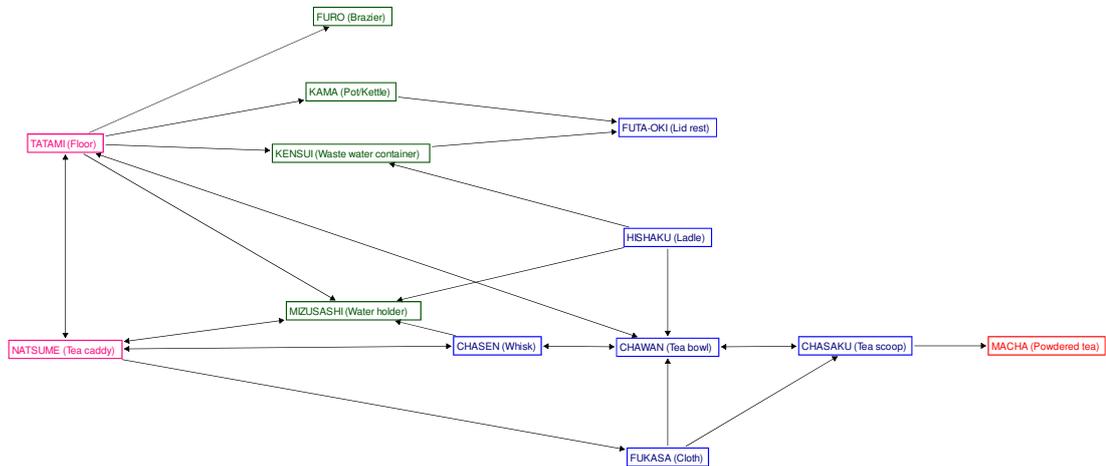
- The guest returns the chawan to exactly from where picked up, but turned 180 degrees
- Take the chawan and place in front of the knees
- Pick up the hisaku
- Pour half a scoop of water from the kama into the chawan
- Pick up the chawan with the right hand and placed on the palm of the left hand
- Tilt water around in an anticlockwise motion three times
- Discard the waste water into the kensui with the left hand
- Ask if the guests have had enough to drink

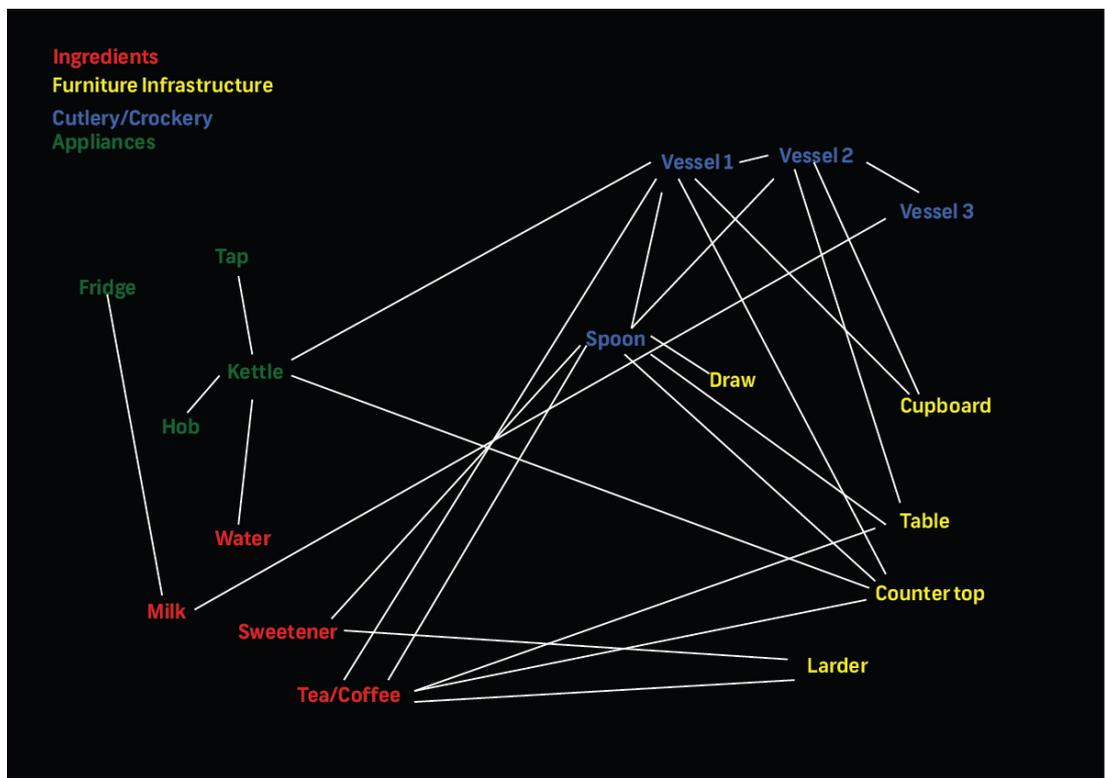
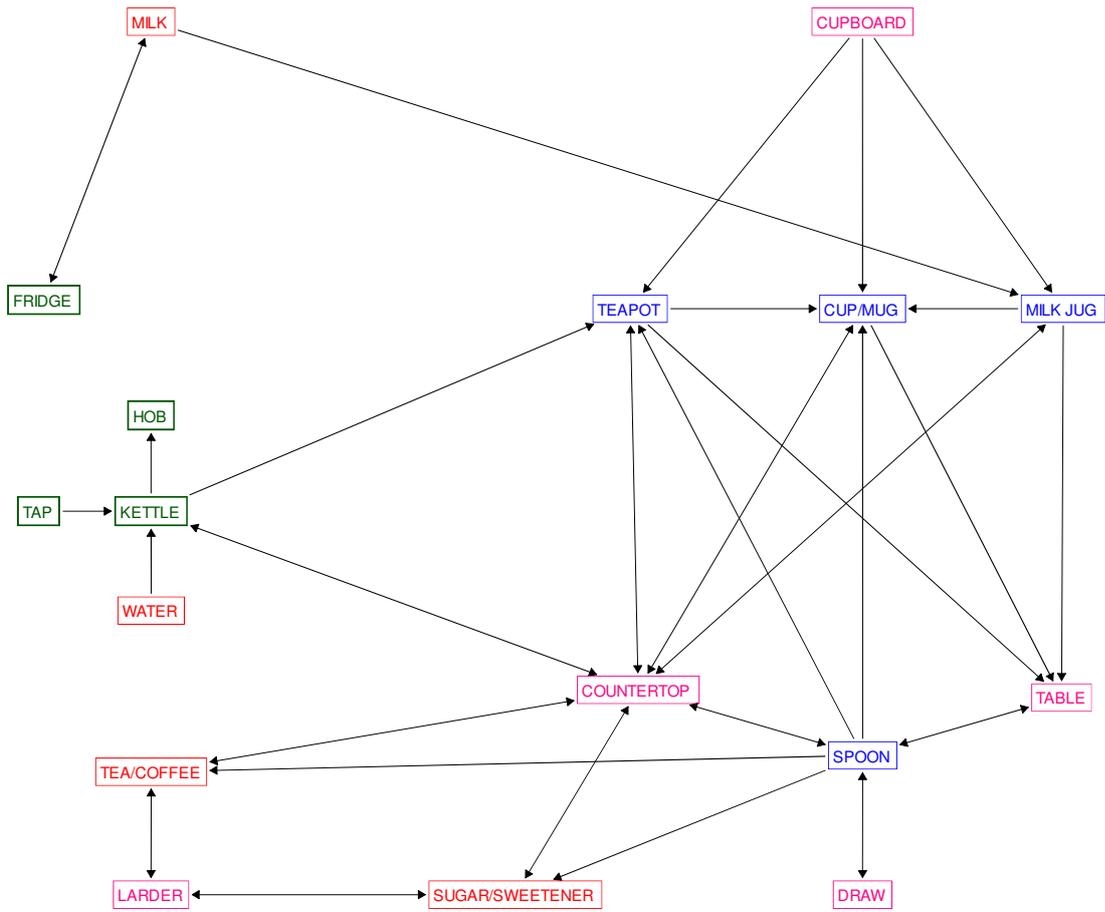
#### **Continue making tea**

- Pick up the fukin and place into the chawan
- Open fukin and fold over the rim of the chawan so that half is inside and half is outside
- Place thumb inside the chawan and four fingers outside chawan
- Wipe chawan one third at a time, holding with the left hand and turned with the right
- Slide fukin upwards and place into chawan
- Hold fukin with the thumb, index and middle finger
- Wipe clean the chawan with yu shape
- Place chawan on futa in front of knees

#### **FINISH THE TEA CEREMONY**

## Appendix B - 5.1.1: Comparing Tea Making Practices: Diagramming





## Appendix C - 5.1.2: IoTea Time

A range of options of drinking vessel, teas or coffees, milks and sweeteners were placed above Light Dependent Resistors linked to an Arduino Mega so choices could be logged. Participants made a drink, lifting their selections from the surface of the plinth at each step. A thermal printer provided a receipt and recommendations of other products based on their choices. These elements followed previous scenario-based IoT studies to navigate and understand negative individual and social consequences.

INTERNET THINGS DIGITAL MANAGEMENT CONTROL TECHNOLOGY EXPERIENCE  
DATA & PRIVACY HEALTH & ELDERLY CARE UNWANTED ADVERTISING

### 2) If so, can you describe [The Internet of Things]?

- A -
- B Connected objects.
- C -
- D -
- E -
- F Things connected virtually.
- G Technology in everyday. Amazon your kitchen.
- H -
- I -
- J Connection between devices from historically different times.
- K network of smart things/ ecosystem of stuff.
- L -
- M An internet in things that haven't had internet. Making everything smart.
- N Understanding objects networked by technology augment our existence.
- O Smart way of living that affects your life.
- P -
- Q Gathering data through objects through everyday life. Life easier.
- R Individual objects communicating.
- S -
- T Internet knows about you, can predict and make your life easy.
- U -
- V -
- W -
- X Connected objects
- Y -
- Z Virtual objects.
- a Digital and objects.
- b -
- c -
- d Managing plus changing daily experience through the internet.

### 3) Can you see any benefits or worries related to the Internet of Things?

- A - Both.
- B - Benefits except for privacy.
- C - Good for companies analysts and sharing protocols. Speeding daily life.
- D - Benefits
- E - Benefits - Targeted products Worry - Information sold to companies and control
- F - Worry - Privacy
- G - Worry - Invasion of your life
- H - Benefits
- I - Worry invasion of privacy, deductions you don't want. Benefit - helps solves problems.
- J - Life easier and predict.
- K - Lots
- L - Lack of privacy, assume standardisation, save time.
- M - Worry - security, when self and internet no longer self. Is it worth it to take the risk?
- N - More efficient. What depends on the meaning.
- O - NO worries.
- P - It's like predictive text, sometimes good, sometimes bad.

- Q – Worry - **Yes, cant filter information** inferences about lifestyle. **Contrary to free will.**
- R – You don't know, it's very new. If it's for evolution it must be good – **technology** the new god.
- S – Worry - **Privacy**. For the inhalers for the air quality. **Benefit in the aggregate, not in the individual.**
- T – Unexplained/Unexplored(?) – worse than people assuming.
- U – You try not to think about it – it's better not to.
- V – **Big brother element. IF everybody knows everything, no privacy**
- W – Both.
- X – Benefits.
- Y - **Worry – too much mapping and manipulate life.**
- Z – **Espionage**
- a – **Privacy**
- b – Benefits completely.
- c – Worry - **Information**
- d – Benefit - **Bringing people together.**

4) Could you tell us two things that the Internet of Things could provide to:

a) Improve your life

- A - Make **things** simpler and **easier**.
- B - **Easier life**, learning machine, if it breaks it can repair, or send problems and receive a diagnosis.
- C - **Speed up, diet and health.**
- D - **Quick**. Given stuff.
- E - **Optimise time**
- F - Reminders, but this exists on your phone, just improves them.
- G – **Suggesting things you forgot**
- H – G **knowledge and remove repetitive tasks.**
- I – Go shopping, **health recognition/medicines.**
- J – **Order milk**
- K – Enhance dimension/**connect things**/deal with complex issues.
- L – **Save time** and replacing (if something's broken?)
- M – **Health monitoring (if you don't have it, anxiety)**
- N –
- O – **Automate as much as you can – life simpler.**
- P – **Deliver supermarket when fridge is empty**, just daily actions.
- Q – **Automating household tools.**
- R – Life more **efficient**, more decisions for you.
- S – No. Google is big brother.
- T – **Knows what I need and order automatically. Unnecessary thing.**
- U – How I shop.
- V – **Sensors to help your daily actions remove management.**
- W – **Health, care for elderly, security devices.**
- X – Comments. Wake up more.
- Y – Suggestions
- Z – Easy access to things.
- a –
- b – **Society would benefit from more statistics. Good as long as you can disable it.**
- c – Research purposes.
- d – Considerations, **broaden perspectives** if you **don't give that to big companies.**

b) Complicate your life

- A - **Privacy.**
- B - **Privacy problems must be sold.** Simple things made hard for you. No buttons and mechanics that are easy (as inputs)
- C - **Privacy**
- D - **Leads choices and leads thinking**
- E – No complication unless it prompts you wrong suggestions
- F – Tell you things you already know
- G – Suggesting things you don't want.....???????
- H – Not at all.
- I - Marketing
- J – Things going wrong
- K – If it's not thought through, it must be developed by the right brains.
- L –
- M – **How is this information going to help?**

- N -
- O - Nothing.
- P - Government control. Too much technology not being controlled. Choices should be taken freely.
- Technology winning us over
- Q - Offering too many choices. Google too much wrong suggestion, it need refinement.
- R - If it doesn't work.
- S - Things breaking down and you cant control them anymore.
- T - Feed a lot of information to get what you want.
- U - No.
- V - No privacy.
- W - Paranoid. Too much information.
- X - Intrusive information storage.
- Y - Scary, too much information and suggestions. Manipulate. Advertising. Addicted to information.
- Z - Too attached to objects.
- a - Many things you don't need
- b - Too many reminders
- c -
- d - Irritating. Marketing. Consumption.

5) We are already providing a lot of personal information through the Internet. Do you think that in the future you will need more control over the information that you share?

- A - Yes. It makes me nervous about the future.
- B - You wont be able to choose something that is not connected, connected to the government. Everything will be shared/connected to data.
- C - Yes, children pictures.
- D - More corporate control, get to know where you information is going and who is seeing.
- E - Yes, although it will happen anyway.
- F - We should have the freedom to share or not to share. No control.
- G - Teenage kids, we need more control.
- H - We don't believe in giving out information -Facebookm twitter etc.
- I - We will need it but maybe it will all be shared.
- J - So much data and to know who you are is too difficult.
- K - It needs a framework, different access points and guidance to an open space.
- L - Yes
- M- Yes, what is the benefit of all this?
- N - Young people don't care, they don't analyse
- O - No, just educate people.
- P - Data protections
- Q - Yes
- R - Yes.
- S - yes.
- T - Not really. We've crossed the line - no way back.
- U - To control what you share you need to understand.
- V - Yes some things must be personal.
- W - It's happening - more control.
- X - Creepy.
- Y -????
- Z - Yes.
- a - Yes. It's like driving a car without a traffic light.
- b - Freedom to choose who????
- c -
- d - Obviously.

EXTRA COMMENTS

- C - If it's for research and health then sharing is ok.
- D- No everyone, only research or your doctor.
- F - Not for everyone, why do people need to know?
- H - Information for the benefit of making is ok. Too much information is not my personality.
- I - Kitchen is a more public space.
- J - In relation to washing machine - I would worry that the landlord could sense if I was overusing it.  
Mug - I would like other people to know that I'm drinking tea.  
Kitchen - Who would be interested.
- K - Only if it's not personal or intimate, e.g. sleeping pattern/sex. For your own at the moment, it's too blurry what happens with your data.
- L -Kitchen has irrelevant information and that I haven't realised how many things that I use can be connected.
- M - Too much information for the sake of information. Sharing in different places depends on personality. Wouldn't share without a purpose, already we are sharing so much in social networks.
- N - Kitchen is linked to consumption. Who and why are the important questions if you would share the information.
- O - Bedroom only statistics, but not personal/not my name.

- P – Not to dictate.
- Q - Bedroom – **For health conditions** I would give information depending on what comes back.
- R – You will know my habits.
- T – Random associations. Unexpected outcomes, none of them make your life easier or better.
- V – **Maybe if it's handed to researchers, but not to everyone**
- W – **Privacy** above all, **only health information** and elderly yes.
- X – I would share only if I could choose what information and if it would be stored.
- Z – Understand more the technical – visualise it.
- b – Statistics ok. You can't **control** what you don't require.
- d – **It depends with who**, it's all personal choices and a problem of too many suggested products.

Q2 theming identified six topics: Internet, Things, Digital, Management, Technology and Experience. Further theming suggested participants considered management, health and elderly care, sociality and society and data control core to improving life, while complications included issues around privacy, manipulation, unwanted advertising and focusing on materialism. Data theming showed concerns over privacy, manipulation and power (im)balances, too much information and technological imperatives. This confirms Techno-Centric concerns of management are considered a core benefit, however, social, societal and data considerations are also confirmed as important aspects, sharing concerns raised by Human-Centric and Practice-Oriented work. Potential complications again share some Human-Centric issues, such as privacy, data use and manipulation, tangentially relating to advertising and business applications. New concerns around the oversaturation of information and material goods were also identified.

## Appendix D - 5.2.1: Discovering Domestic Practices Interview Template

### Domestic Practice Interview Template

Ethics form complete - YES/NO

#### Participant details

Identifier:

Age:

Where do you live?

Can you describe your house?

Who do you live with?

Q1) Can you tell me about your routines in your house?

*Prompts & follow up questions*

#### **Personal**

First thing in the morning / throughout the day / when you get home / before going to bed.

Familial / Community - Interactions with family / partner / housemates / pets.

#### **Spaces**

Within the home – personal space, shared spaces?

Reaching out from the home – communication; leaving the home; welcoming others into the home.

Shrines – religious / object collections / family pictures?

#### **Time based**

Daily; Weekly; Monthly; Yearly?

#### **Rituals/Ceremonies?**

Making food/drinks?

Dinner parties

Washing / Cleaning house/self/clothes/crockery.

Religious / spiritual?

Q2) Why do you do these routines/rituals:

*Prompts & follow up questions*

Personal habits?

Forced to?

Historical imperative – started doing it at age...

Cultural contexts, narratives – family history?

Q3) How do the things you've described impact on your life?

*Prompts & follow up questions*

How do they make you feel?

How would you feel if you didn't do them?

Could/Would you replace these elements of your life if technology enabled you to?

Q4) Can you tell me about past routines/rituals/ceremonies that you don't do anymore?

*Prompts & follow up questions*

Grown out of them – being tucked in / story before bed when a kid?

Don't have time for them

Not useful

Emotional impact lessened?

Q5) What objects are important to you in completing these things?

*Prompts & follow up questions*

How do you feel about these objects?

Do they have a history?

Could they be replaced?

Can you see yourself passing them on?

Would you like to see how and when you use them and their interactions with other objects?



For further information  
Supervisor:  
*Prof. Ashley Hall,*  
*Innovation Design Engineering,*  
*ashley.hall@rca.ac.uk*

DATE:

*The Internet of Things in the Domestic Space*  
**Interview Consent Form**

I (*please print*).....have read the information on the research project *The Internet of Things in the Domestic Space*, which is to be conducted by Michael Kann from the Royal College of Art, and all queries have been answered to my satisfaction.

I agree to voluntarily participate in this research and give my consent freely. I understand that the project will be conducted in accordance with the Information Sheet, a copy of which I have retained.

I understand that I can withdraw from the project at any time, without penalty, and do not have to give any reason for withdrawing.

I consent to:

- Complete an anonymous interview which will take approximately 30 minutes.
- Give personal information if required.

I understand that all information gathered from the survey will be stored securely, my opinions will be accurately represented. Any images in which I can be clearly identified will be used in the public domain only with my consent.

Print Name:.....

Signature.....

Date: .....

This project will be conducted in compliance with the Research Ethics Code of the Royal College of Art.



Royal College of Art  
**RESEARCHRCA**

For further information  
Supervisor:  
*Prof. Ashley Hall,*  
*Innovation Design Engineering,*  
*ashley.hall@rca.ac.uk*

DATE:

*The Internet of Things in the Domestic Space*  
**Interview Consent Form**

Dear Potential Participant,

I am Michael Kann, a Research Student in Innovation Design Engineering. As part of my studies, I am conducting a research project entitled The Internet of Things in the Domestic Space. You are invited to take part in this research project which explores the future role of technological artifacts in the home and the impacts they could have to the way we use this space, our routines and rituals in the home and our relationships to our curated possessions. You are invited to participate in this research.

If you consent to participate, this will involve:

- Completion of an anonymous interview which will take approximately 30 minutes.

Participants are invited to take part from across a spectrum of ages, socio-economic backgrounds and family statuses from amongst a network of peers and associates.

Participation is entirely voluntary. You can withdraw at any time and there will be no disadvantage if you decide not to complete the survey. All information collected will be confidential. All information gathered from the survey will be stored securely and once the information has been analysed all questionnaires will be destroyed. At no time will any individual be identified in any reports resulting from this study.

If you have any concerns or would like to know the outcome of this project, please contact my supervisor, Ashley Hall, at the above address.

Thank you for your interest,

Michael Kann

**Complaints Clause:**

**This project follows the guidelines laid out by the Research Ethics Code of the Royal College of Art.**

**If you should have any concerns about your rights as a participant in this research, or you have a complaint about the manner in which this research is conducted, it may be given to the researcher or, if an independent person is preferred, addressed to the Research Ethics Committee of the Royal College of Art at the above address.**

Royal College of Art, Kensington Gore, London SW7 2EU. UK T: +44 (0)20 7590 4214 E: [research@rca.ac.uk](mailto:research@rca.ac.uk) [www.rca.ac.uk](http://www.rca.ac.uk)

## Appendix E - 5.2.1: Discovering Domestic Practices Interview Theming & Analysis

A rich data set of approximately ten thousand words allowed for effective use of key word analysis theming (despite being more difficult than closely directed interviews. Each transcript was re-read; common topics and Practice terms were coded into themes; however, textual representation was unclear, so visual representation was used. Responses were refined with the top 15 terms per theme identified (ignoring the 10 most common filler words) and converted from occurrences to percentages of occurrence within themes to assist accurate comparisons. Circles dimensionally proportionate to the percentage of occurrence of each term were colour coded to corresponding themes and labelled, arranged in descending order in adjacent columns to compare and identify key-words-in-context, relations between themes and how terms were thematically common or unique.

### Initial Themes from Interviews

Coffee/tea/food prep PA PB PD PE PF

Desire for meditation but lack of discipline PA PE

Not having usual objects – doesn't feel right. PA

Wood/material/tactility

Light PA & P C

Emotional attachment and rituals surrounding things that they made – PA PE

Outside witnesses – sharing in the practices, observing the practices

Use of objects to time cooking/food prep? PB, PD, PF

Interactions with other people

Preferential chair/directing from there PB ... set up desk in PA. PLACES OF CONTROL?

Witnessing important objects, not merely in boxes in cupboards.

Winding down in evening – reflection? PA, PB and PC PD PE

Easy to romanticise rituals, but they vary a lot.

Optimistic to buy a product that changes your routine.

Vinyl collection – ritual of music consumption

Routines – smaller on the phone, screen based – PB PF

Watering plants – routine based on the hope that the product in the future will be great.

Cleaning & tidying.

Spatial – key bowl

Negativity to tech while using it...PA PB PC

EMOTIONAL SATISFACTION / impact of missing out

Reflection – visibility is important

Automatic nature of routine? Automatic drawing? Practice as pause – non-automatised

Important objects related to self-identity? PB – piano, PC - cars, PE –pens.

Transference of energy? Devotion to objects and routines of creativity?

Use of media to connect to wider world – PE's father, PB,PA,PF.

## Condensed themes

### Theme 1 – How and when do I break bread ?

Preparation of food & drink

Use of objects and aspects of routines to regulate routines – piano song, coffee timing...

### Theme 2 – Sharing and showing methods

interactions with others / Sharing the practice

### Theme 3 - Shaping space to shape us

Adjusting the domestic environment. Attachment and practices surrounding objects

### Theme 4 – Information and profane worship

Use of media to connect with wider world.

### Theme 5 – Actions that affect us

Emotional content/satisfaction

### Theme 6 – Space for mindfulness

Reflection/Space/Pause – non automatised actions / Winding down in evening / Tactility & visibility to enable reflection?

## Participant A, 16<sup>th</sup> December 2014

### **Age:**

44

### **Where do you live?**

Dartmoor, Devon

### **Can you describe your house?**

Wartime built, cottage/house, 5bed but he lives in one bed annexe to it. Middle of nowhere. Very isolated.

### **Who do you live with?**

Ostensibly on my own, but I spend time with the couple next door who are art teachers and their 32 year old daughter who's a designer

### **Q1**

It very much depends if I'm working or not. So, if I'm working I wake up quite early, about 6.30. And then I put on the kettle...I put the dog out to go for a wee...I make a cup of tea... I go and brush my teeth and sometimes have a shower and shave...get dressed, have a cup of tea...I'm always late so I do it all super-fast. I check my emails first when I wake up in the morning (first thing?) Yeah, in bed (oh on your pad or phone) Yeah, my iPhone. Then I sort of run next door, drop the dog off next door run to the car, generally run back to the house because I've forgotten something, get in the car and go.

### **And when you get home?**

I come back, park the car, walk down the drive go and have a cup of tea with them next door, come back in open the fridge, close the fridge...I light the fire now and then I'll cook something.

Quite often before I go to bed I'll spend some time on the computer and then I'll go to bed with an Ipad, read something like a book or a paper or a kindle.

### **If you're not working, is it very different?**

Well, in the house yeah. I'll always listen to the radio, I guess. Might make some coffee. I might go out for a walk...yeah, there's not much difference. I'll quite often sit at the desk and do a bit of work.

### **Different spaces and routines? Private/public?**

Because I'm on my own there are no public areas. When friends come round to stay they very much

### Any shrines in the home?

You know, we might be better talking about my flat in London (as current home is quite temporary). I don't have shrines in my flat, but here my shrine is my desk, which I've purposefully.....which wasn't here four months ago and I've purposefully got and put in place and set up and made work. So for example, the Wi-Fi didn't reach it so I got an internet extender and I've positioned it in exactly the place I want it to be and everything is around....the heater is within the reach and the dog is within reach. And in fact the desk is also my kind of sacred place in my flat.

### Any rituals, ceremonies or practices? Food, drink etc? Chores, set pattern?

Well washing up I do constantly, and I mean constantly. I hate the idea of coming to a massive pile of washing up. I cook a lot, so I definitely have sacred pots and pans and a knife.

### Is there a particular way or order to doing these?

There is at home – there's much more at the flat. Half an hour in the evening reading/food. If not a book find a bit of the afternoon to be on the sofa and read a book. If I could, I'd meditate but I never do. I'm too flighty.

### Why do routines you have?

Cooking is a family tradition – it was always a big thing in the family so I like cooking and I like eating. The reading a book thing is a cultural thing – I find myself with spare time and think that would be a good thing to do. And the desk thing, I'm not sure; I haven't even thought what that's about. It's like a control centre.

### Maybe interesting to think about the routine use of the desk – interact with it in certain ways.

Well, the first thing I'll do if I'm not at work I will get a cup of tea and get a cup of tea and sit at it. And actually my mac is really the centre piece of it, isn't it? So that's where Skype or email or work from. So really, it's my mac, but that's because I'm in the middle of fucking nowhere, I think. So I have here tobacco and my latest bill and my ipad and iPod and books that I'm supposed to be reading and sellotape and pens and chargers....

### How do the routines we've discussed impact on your life? For example, if you didn't cook and use your crockery, cutlery and knife...

I know it's a bit off...here for example there isn't a decent pan to cook stuff in. So it does impact the way I feel about doing stuff, it always feels like a bit of a compromise but I suspect that's what it is to be here, I'm in this kind of limbo state. It's a bit like going camping or being on holiday. I don't feel in my normal state. I think a lot of it is to do with not having the objects that I'm used to here. And everything here is a kind of makeshift approach...that situation again.

### How does the space feel on an emotional level?

The next door house is called Brimstone Down and at the weekend I was shown round it and offered it, and she's retired model/art restorer and her cottage is old and wood panelled and bathed in light and full of patina and ever since seeing it I want to move there. One massive room with a massive wood burner and a four poster bed right in the middle of it. So that's basically where I want to be and I think then my rituals and objects will have more....they'll feel more at home.

### Any practices from the past that you're not doing anymore?

I can think of one immediately lighting. A few years ago in my flat in London I designed and got built some walnut shelves in the living room and I spent a long time choosing the right colour LED lights... well white, but the right warmth LED lights and I spent a long time looking at the right voltage dimmers. So I realised that when I get home to my flat, the first thing I do is flick on those three LED strips and adjust their intensity. And I always look at...cos you know how light bounces off book spines? I realised that is one of....it's not a ritual but what I do every time is adjust them to exactly, exactly the intensity of light that I want. And I noticed that's not available here, and I'm pretty sure that's why I want to move down the road, because it's got that same wood, that same light. I'm pretty sure that's what it is because here it's all flick on, flick off lights – it's stark. I think it's very much the visual environment, the quality of light – it's one of my big rituals at home.

### Can you name 2 objects important in completing one of these practices?

Cooking pan & lighting.

### How do you feel about them; What do they mean?

I love them. If I think about selling my flat the first thing that comes to mind is what can I do with

those, how can I take those shelves with me, or, or, how can I make sure that those lights, those shelves are as appreciated as there are to me.

**The history of your shelves was very involved. The same for the cooking pan?**

No, I looked hard and bought the right one.

**So you did your research – how long have you had them?**

2/3 years.

**Not an 'old friend' then?**

No, but I bought the same model previously, so they don't last that long.

**So you can replace it, but the physical quality is important to the way you cook?**

Yeah, width of it and thickness of the base and the lid and the functionality of it really.

**Could you see yourself passing them on?**

....Yeah. Well. I suppose so. The shelves I'm really attached to, I have to say. There's no way... would like them to come with me. It helps to it....it adds to it for the ritual to be witnessed. You know that [X] has moved in now? It really adds to my sense, to the whole situation, the whole experience of those rituals when she, an observer, witnesses them as well. It's like...it's nice to share them. They're not private rituals as such but it's nice to get others to witness them.

Participant B, 23<sup>rd</sup> December 2014

**Age:**

28

**Where do you live?**

Muswell Hill or Wood Green, North Lodnon

**Can you describe your house?**

Yeah, two storey loft conversion. Not detached. Downstairs is a living room and kitchen, two bedrooms, a study and a bathroom. Two bedrooms in the loft.

**Who do you live with?**

My mother and my friend who lodges. Recently my brother moved out from the loft.

**Can you tell me about routines in the house?**

My routine is a bit peculiar. As you know, I'm a depressive, so a large amount of my time I work part time, I work on an off...I teach in the week evenings when I do music stuff for people and then I do on and off temping work which is admin based. So as a result, when I'm not in regular employment my sleeping patterns become exceedingly erratic. So a lot of my routines are dislodged by that and it's about me trying to keep routines. So they're quite important, but the time changes.

**Is it more based around how you're spending time during day that the hour?**

Yes, that's a good way of putting it. The first kind of obvious routine for me getting up would be coffee. I get a coffee and a pint of water and if I've got emails and admin stuff to do I do that then, the most sober time of the day, when you're going through stuff and reviewing what you have to do. My partner has been living with me for the past three months, she's just moved out, but she's there on and off, so she's in bed as well. If she's left it doesn't matter, but if she's waking up she'll do work, she'll be in bed and I'll be by the computer. If I can what I like to do as quickly as I can is be on the piano. Actually, while I'm making coffee I'm on the piano. Very recently I've been trying to do breakfast, and that's miso soup and I actually use the piano to time the soup – I've got a piece that is a certain amount of time to play.

**Are you at home – any practices when leaving, coming home any other times of day?**

If I'm working from home I have to leave the house at least once or twice. I do jog three times a

week, so that's good. Otherwise, I'll go and have a drink, a tonic or a beer at the local pub down the road. Or go for a walk around the area, visit friends that type of stuff.

**Is it important to have interactions with other people?**

Yeah definitely, definitely. And also just to leave the place you're in. If you stay in the same space for too long, you feel cooped up.

**Is there anywhere in the home that represents or triggers a routine/practice?**

Chair in room by computer which is...I've noticed with a lot of people their living room and bedroom are the same place...they tend to have a preferential chair which is where they direct everything from. It's interesting as anywhere else in my room you can sit and there would be no reason for me to want to sit where you're sitting, but if someone sits in my chair it screws up the logic of the room. Everything is built around controlling it from there. Obviously the piano downstairs is important to me. I work upstairs run downstairs compose....that gives me some distance. Kitchen is kind of just there for food, but I cook a lot and enjoy it.

**So this triggers certain routines? Do you read the paper or listen to radio for example?**

More in my room. Not to as much of a degree anymore though, as we get the times and I don't want to read...I don't want to read the newspaper anyway. I use Reuters...usually in the morning go to my laptop and see what the headlines are. I do have a shrine in my room. It is profane if you're into religion, but to me it's sacred. The idea, it sounds really pretentious so I don't usually mention it or call it my shrine, but it's because I had a whole collection of important things that I didn't want to be damaged. I wanted to know that they were there. I didn't want to put them away, because if you put them in a drawer or if you put them in a box that keeps them nice and safe then your value of the things exists but there not actually...there not on display and the important thing is that you see these things that are important to you and they remind you of stuff. So I dedicated one shelf in my room to putting things ornamentally – I've got three first edition books my dad gave me, a preprint book and two other quite rare books, I've got a statue of Buddha someone gave me, so it looks like I'm a Buddhist but it's got nothing to do with that, and then a collection of things, some Kung Fu things I bought from an unusual experience I had and all of these memory things. I try and keep it as uncluttered as possible and not put anything up there that's just valuable. It came from Japan, the batsudan. I thought it was a nice idea and that if I didn't mention it to people then it doesn't sound pretensions. It's not a problem; you kind of do it for yourself.

**The practices we spoke about, why do you do some of them? Is it habit, age built into a body of behaviours?**

I avoid the front room because the TV is in there and I stopped watching it years and years ago, so if I haven't seen my mum in a while I'll eat in there when she's in there and I'll put on the television – we eat at different times a lot. Rituals – coffee, upstairs. Sort of being in your comfort space, which is nice.

**How do these impact on your life?**

If don't have a coffee, feel very strange for rest of day.

**Do you think that's physiological or experiential?**

Not sure...It's also about having a time where you can prepare, which is quite nice. At the same time spending time in the evening, before I go to bed I'll spend an hour sort of sitting, being on my computer or something. And I did notice that even if I come in really late from something, I'll still do that. So winding down is quite important and I don't tend to do that in bed.

**What do you do on your computer in evening?**

If feel good or distracting myself watch programmes film etc. I mainly read about stuff on line. I read books on public transport so I don't read them at home so much. As a result I read the online stuff and I also ...I listen to audio books when I'm doing stuff around, so that follows me around the house.

**Making coffee as example – compared to Japanese tea ceremony. Is it about coffee in morning or the steps taken to get there?**

It arises from me needing a coffee. If someone brings me a coffee it's a good thing. But the process...you talk to me about actually making coffee I could romanticise it very easily based on how much of that ritual is important to me. I used to before my brother moved out and took a stovetop with him; I need to get another one. But me and [PARTNER] we make, we call it special coffee but it's just normal, we do it most days. It's a stovetop with enough espresso for one cup, but we halve that, fill it up with a single cafetiere and then we use another cafetiere to pump milk, put

that in and a teaspoon of sugar beforehand. Sometimes I mix the sugar....I really like romanticising rituals that kind of give importance to the thing but at the same time I vary them a lot. This is something that I've wondered for a while just because I don't have a lot of these practice and a lot of the time as a depressive...people always say that you don't have those in that position, when you have that mental health issue and as a result I wonder if other people have more than I do. But I will say that if I don't touch a piano or guitar in two days I feel insane and it used to be that if I didn't touch a piano in one day I'd feel very nervous.

**Would you replace these with technology? Would this be a quicker, more effective, more beautiful, way of doing things?**

I had an Aeropress in my house for a while and I stopped making the other type of coffee as its much quicker and easier and I'm not really...I also enjoyed it as it's a newer technology and I think when you get different technologies to change your routine you feel as though your improving your life, but you're improving your life without having to put any effort into it. It's really optimistic to buy a product that changes your routine.

**What about a shrine?**

Well, there's my bookcase. If I go into someone's room I look at their bookcase. If I have a second go over and stare at it and it might seem a bit intrusive but I really like the idea that, for me the value of my intellect can be seen more in my bookcase than it can in anything else in my room and anything else that's visual in my life. As a result, if you were to get me a kindle, I wouldn't get rid of my book case. It's more about the value of what they represent in my space than necessarily their use. That's the value – It's like [HOUSEMATE]'s vinyl. He keeps buying them and he's got most of them on his computer. In fact, ritualising this kind of thing is kind of a way of worshipping it. It's far easier to listen to and just click on it and the storage is easier and everything is easier and cheaper, but the thing that you are doing is very important to you. Music is very important to [HOUSEMATE] and so the quality and having it as physical form, I think he likes extending the importance of music to having a ritual.

**Does technology actually improve life if people feel they need to reconnect ritualistically with something that they love doing?**

If something is sentimental you want it to have a ritual, and you want it to have more of a ritual. If I told you that you didn't need to warm the pot as it's been roasted...I think you're still going to. And if I told you that you don't need to stir the coffee...what's interesting is that you're getting irked at the fact I'm mentioning it. It changes the routine of something that is based emotionally and I guess it's really nice to ritualise the things that mean something to you, but the things that are just functional, unless that function means something great to you, you really want it to be done as quickly as possible. I'm realising I have a lot of limited things I do regularly. Recently, I water mushrooms to grow Oyster mushrooms, and going and watering them, which is something that you do three or four times a day is something...when I wake up I go and do that. And I like the idea of that, I used to do it within chillies, and the idea of the fact that they're going to get bigger and the fact that what you're doing is based on the hope of something in the future that's going to be awesome, that was always very reaffirming thing for me to do when I woke up. I could buy them, why the hell am I even doing it? It's based on the enjoyment of the process of the thing that I will eventually eat. Personal accomplishment – I guess nowadays most of the routines that I do instead are something that I do on my phone, they're a lot smaller and a lot more minute. I used to have a to do list, and it was part of my routine to write it every day, but now I have a thing on my phone that reminds me to do it and I press some buttons....

Participant C, 29<sup>th</sup> December 2014

**Age:** 33

**Where do you live?**

Finchley

**Can you describe your house?**

Semi-detached 5 bed.

**Who do you live with?**

My wife and son.

**Q1**

I don't really have any routines around the house as such, except for cleaning and tidying in the

evening, and that's about it. Nothing unusual, or out of the ordinary. Taking bins out on Wednesday, pretty straightforward.

**Anything that is a series of steps in a practice, or situational – keys in this place, based around physical spaces or an act?**

There is a key bowl. As there are so many cars in this house it can be very easy to lose keys, and there is also a lot of clutter, so it's imperative that anyone who uses or goes into a car returns the keys to the bowl.

**What do the routine?**

The only ritualistic routine I've got is to make sure the bookcase looks nice.

**But you do have them with the kids...**

But it's not a ritualistic routine though, it's a necessity. Because I'm quite a mutable person, I do what is necessary in my day. I don't mind if my routine is disturbed or I have to change whatever I'm doing or I have to wake up earlier or later.

**Of kids going to bed routine:**

It would be a winding down process, doing more relaxing things – lowering the lighting, making the place feel a little less active.

**Any sort of family rituals?**

Putting [SON] to bed is the thing that I do the most out of all the necessary interactions with your child, and it's only on rare occasions that [WIFE] does it on her own and he usually likes me to be down next to him and read him a story in his bed and fall asleep with him while he twiddles my hair. That's very important for him and he really feels quite agitated or irritable if I'm not there to do that with him.

**And if not able to do them?**

People not putting the keys back in the bowl would irritate me. And not putting [SON] to bed, I would find that a little disconnecting, I'd feel sad if he didn't need me for that. I have been sent away a few times (laughs). I can't see technology ever replacing those two things, or many of the things that you consider rituals. I suppose it would either be too unsophisticated in a household way, or be invasive, so I can't imagine technology replacing the two things I mentioned at all.

**Not replace, maybe augment, amplify or have positive impact?**

Well, things like putting keys away. If you didn't need keys that would be totally unnecessary. For example, if you had a chip in your body that allowed you to open your car by biometrics then you wouldn't need to worry where your keys were put if you had too many cars. On a much more human level, I think the less interaction that we have with technology, the better because we are too involved with egocentric technology and any more effect we have for them would be detrimental.

**What objects useful for completing your rituals in the home?**

The space around me is the most important thing and how it looks and feels. If the space I'm in is unsatisfactory, it makes me unhappy, it makes me not want to do them so that's very important, my surroundings. I do have one routine that I've developed recently which is listening to records in the evening. So the record player is my most important physical object in the house.

**How do you feel about the records then?**

Love them. They give me solace. And the record player is the enabler, it's like my pusher. Without it I can't get the emotional satisfaction that I want, that I get from music.

*Participant C's wife (CW) comes into room.*

**Anything else you can think of?**

CW: We aren't big on rituals in this house...we've got quite a lot of sentimental objects around us in the house...you know, this was a wedding present from my aunt and cousins, and there's my grandfather's rocking chair that he would sit in every night and there's the crockery that I'll bring out whenever my grandmother comes round because it used to be hers.

C: We have a lot of routines...You have more routines with them on a family level, especially now that I've gone back to work.

### What's important?

CW: Well, the high chair! It's funny, he used to have favourite bowls but he doesn't anymore now that he has adult cutlery and crockery, not really...he likes to sit here, he has a particular place at the table that he does have as his favourite spot, but I don't think there are items around the house. He has a nightlight that's beside the bed and that has to be on when he sleeps. And actually when he's trying to buy himself time and keep himself awake he'll tilt it towards the bed do there'll be a bit more light!

C: In terms of routine...I have very few routines as my family are the least routine people in the world, they have absolutely no concept of doing things on time or in a normal fashion. So when I was a child nothing was on routine, dinner was never at the same time, maybe there wouldn't be dinner! It's difficult to rely on routine when your parents are like that and whereas I think children really do like routines, it helps them to settle.

Participant D, 29<sup>th</sup> December 2014

### Age

33

### Where do you live?

Oxford

### Can you describe your house?

A couple hundred years old.

### Who do you live with?

4 housemates

### Q1

A house of 5 individuals means you've got five sets of routines that intersect with each other. So, the 3 of us on 1<sup>st</sup> floor who share a bathroom, our morning routines have to be perfectly balanced with each other. So I get up at a particular time so that I can go to the bathroom and be out of there so that [HouseMate1] can come in and use the bathroom and get out of there so that [HouseMate2] can get in, but we all have to do that before the two downstairs get up and start showering so that we have hot water. Similarly in the evening, there are routines that have developed without anybody having to say anything, like when people eat dinner, when music gets turned down in the evening.

### Sort of time based, or unspoken physical signal.

Yeah, unspoken physical signal is a good way to describe it. [HM1] goes to bed first and her room is directly above the TV, the living room, and [HM2] goes to bed around nine and we know that around that time we'll turn the TV down. But interestingly, the days when she isn't there the TV stays on loud extra late, almost like we're overcompensating for it. We have a dining room as well as a living room certain housemates eat in the other room, and it's always the same people. I eat in front of the TV, but [HM1] & [HM2] eat on the dining room table.

### Just an example, anything else?

D: Yeah, the cafetiere. Of the three people in my house who drink coffee in the morning I'm the first in the kitchen and I will make coffee. The action of making the coffee is part of my morning routine and on a psychosomatic level I start waking up even before I've drunk it because my body knows it's about to get caffeine and it's part of my routine, definitely.

### And is there a routine, set process of making it?

Definitely, yeah. There's a particular tablespoon – three dollops of that gets a good amount of coffee and I know exactly how much water goes into the kettle and when it goes into the cafetiere it gets swilled around halfway through and then stirred thoroughly when it's full. The top goes on to keep it warm while it's steeping and there are people's mugs, there is a mug that is definitely my mug.

### What about objects – shrine? A collection of objects as part of routine?

I do have that but because it's a static thing, it's a display of things that are important to me, it doesn't enter into any routines, it's just there, because it's not changing, it's fairly static. My mum will call every Friday evening to wish me Shabbat Shalom even though I almost never answer the

phone cos I'm out drinking with friends or doing whatever. I go to work on a Friday night, she'll call home me a vaizemal wishing me Shabbat Shalom then I'll call her back over the weekend. This is a thing that's been going on for years and years and years, ever since I moved out.

**How do these acts/actions impact on life or make you feel?**

They're good; they're connections to my housemates, to my friends, to my family. They're anchors. So much about our lives isn't routine these days compared to previous generations; a lot of stuff happens on impulse or changes much more quickly and much more arbitrarily than it ever did in the past. These things, these routines and community and family things we do, they're constants that anchor you down, in a good way.

**Can you see any way of tech augmenting these experiences?**

Well, my mum is calling my mobile phone and if didn't have a mobile phone, she'd be calling the landline of the house I was living in and me not being there would be quite a natural thing, cos I could easily be anywhere else, but a mobile phone, she knows it's on me, she knows I've seen her call me and that's an important part of the process. Even though I didn't answer the phone, she knows I saw her call. That's wholly dependent on this technology; it only exists within this tech.

**Any routines you don't do anymore?**

Skype -- because half of my family is in Buenos Aires. Skype has become part of our rituals on birthdays. In previous decades it would have been a letter, a telegram perhaps a garbled phone call, an expensive phone call, more to the point and hence a short phone one. Skype allows us to have free high quality communications with Dad's family, so Christmas Day, birthdays, high holidays -- it's become part of our routine, it's become a ritual for Dad to Skype with all the members of his family, so when I turned up on Christmas Eve this year he was just signing off with his first cousin and he'd spent the last hour with various other members of the family but he'd held off on calling his sister, my aunt, until I got there. And that's brilliant as it means we're all so much more connected and whilst I understand the idea that technology can be intrusive and can be depersonising and dehumanising, in the sense of the telecommunications area of technology, its shrunk the world to such a degree that I can maintain a relationship with my Argentinian family in a way that my dad couldn't when he was my age. And it's allowed me to have actual familial bonds with them that in a way that I never would have had otherwise.

**What objects are useful for completing your practices in the home?**

Well, saying my cafetiere is too obvious! So when I come home from work, my shoes come off, my slippers go on and the kettle goes on and whichever housemates are there get offered a cup of tea, or vice versa if I've timed it right.

**In addition? (Prompt of Shabbat)**

Living outside of a family environment, with 4 individuals all with their own routines means you don't have that in the same way because you're all doing your own thing, your all living 5 fairly separate lives. There aren't the same ritualistic gatherings and departing. I might come in and do a thing on one day, and I might want to do it more often, but it will be affected by what else has happened. I do have a particular bowl that I like to use for dinner, but someone else might have got there first and might be using it. I think rituals in that sense are far more prevalent in a family environment where you're all working together for a common cause -- any rituals I have tend to have are quite small and tend to be at the beginning and end of the day, which are the private times. So, brushing my teeth with my electric toothbrush, washing my hair and my body, generally in that order. But the vast majority of my time at home is spent in a fairly random series of coming together and departing and clashes of housemates.

**Age**

32

**Where do you live?**

Golders Green

**Can you describe your house?**

Detached with 2 floors. Family has lived there most of my life.

**Who do you live with?**

Family – mum, dad and older brother, no pets.

**What routines and practices do you have in the home?**

We all have routines, when you wake up in the morning, you go to the bathroom, you brush your teeth and all these sort of things...do you need details?

**Particularly unique, unusual?**

Consciously aware of and find quite interesting as I think rituals are interesting myself...I've got no curtains for a year, because....it was those blackout blinds and they fell off because they were crap. So what happened, I ad hoc made curtains for myself – I just put some nails on the wall and got a cloth and kind of cover it when I need to have the curtains on and I take it off every morning. And so every morning I'll do my routines in the bathroom, get changed and then I would climb on my bed, remove this cloth away from the window and it's like – ooh! The light comes into my room and I'm beginning my day.

**Unconscious level after washing and dressing ready for day?**

I'm ready now to see the world! And because the curtain thing works for me I haven't got round to buying new curtains. I aim to do that soon!

**Is that different process/feeling that just opening curtain?**

Yeah, before it wasn't really a sliding thing, before it was like a blind, a roller blind. You have to pull this thread thing – you do that, this gesture that I can't record! But I didn't think about it before, because the blind opened and closed, but the act of standing...I step on my bed and have to remove the cloth.

**Is that to do with unusual interaction with bed?**

Yeah, cos I have to stand on it.

**Is it more affective as you constructed it?**

I think because I have to physically remove the cloth every day, every morning it becomes more apparent to me to have that thought like – ah! When you asked about practice that's what I think of and I think it's been there for a long time because I have other things that I want to do and it's functional so it's at the back of my mind to do it. I quite like it though, that making my own sort of....

**Like it because you made it?**

Yeah....

**What about roller blind, dislike?**

No thoughts...I don't dislike it, but it broke and I had to change it. It wasn't working.

**Anything else – interacting with family, world in general?**

I notice my dad, when he's dressed and all ready. He's retired so he just hangs out at home. The first thing he usually does is turn the TV on. He might not necessarily watch it, he'll still do his other thing but then it's that kind of...when you talk about being ready for the world, TV is almost a weird window to a fake world. Cos he watches the news channel a lot, even though we can debate how real that is...a version of the world in a way.

**Anything in the house classed as a shrine, collection of objects interact with?**

When I think of a shrine I think of statues of things, together for you to worship...

### Not necessarily sacred – prized collections?

I don't. Maybe the word...I don't really have a collection of things...I do have a collection of things, but a shrine I think is static, fixed. If I describe my room to you?

### Some prompts of objects of importance – photos, minerals, plants, posters, prints, souvenirs?

I do have some pictures of my family, my grandmother and they've been there for a while. That could be one. I've got another bit of.... On the side of my wardrobe I put my own or other people's drawings...sometimes I like the image or it's something that I've done recently and I just need it to be there for me to look at.

### Weekly, monthly, yearly practices?

I used to have an annual ritual which was related to my drawing. I did it three times, usually in July I'll find a day where...its more looking where I'm going with my artwork or just emptying my mind out and I'll make a piece of work with that in mind. For me sometimes my artwork is also what's going on with my life cos I think they're linked because how I feel, how I'm affected effects the work I make. I deliberately set out that point of the year to start thinking, not really analysing too much what I'm doing but somehow clearing my mind and make an automatic drawing. For me, maybe it marks...maybe it marks a year, I don't know but it started when I started to notice rituals or worked with a group of people who make...the call their works rituals, they do ritual theatre and that's when I learnt that from them and got quite interested in that idea.

### Why do them in the way you do them? Every day or one off?

For the everyday stuff...What's the difference between a habit and a ritual? Something that you do out of necessity, like I have to brush my teeth or...It just happens, people get these routines and habits and then that becomes...a ritual has a kind of meaning.

### What about Japanese tea ceremony, super ritualised and what's the meaning?

Isn't that more the time to pause? To feel to just experience and to just calm down, especially today when everything is so fast.

### Anything that helps you do that?

I used to meditate, but I stopped doing that, does that count?

### Doesn't necessarily need to be meditation? Making tea, sandwich, washing? Space to think?

I think that it's making a cup of coffee before I work, that's something I would say. It feels better to have a cup of coffee before I work. It's again to start working mode, it has that.

### Because done lots and ingrained as habitual routine or effect of caffeine?

Delaying the process of working possibly! And then feeling, OK I've delayed the time now...I'm just overthinking it. I think it's more like a habit...I would say then it is kind of like a ritual, almost. It doesn't feel quite ritualised.

### Any sort of personal habits that are rituals? Unusual way of doing things? Family rituals?

In Hong Kong we had one, not to do with my immediate family but to do with the relatives and everyone where in Hong Kong every Sunday we all meet and have lunch. And my granddad who I never met set that up and the idea is that everyone still knows each other, so that's the meaning behind it, but it's just that everyone gets together and has lunch together. But then because everyone moved countries, that doesn't really happen anymore.

### How impact on life?

Part of it I guess. I would say for the drawing thing that I don't do – I like the idea of that, I like the idea of reflecting, I think I might need to implement it a bit as something I consciously do. I like having the time to reflect. That helps. It helps me to calm down as well. Everything else I described is part of my life. Some of them are about awareness.

### How does making coffee before work make you feel?

That I have to work. Preparing myself mentally for work. I think I would be more thinking of why am I delaying this now, I should just do it. But thinking about it now, I think it's more like a preparing myself to work. We're talking about making coffee and drinks and every time you see someone, you to someone's office or house, they will offer you a cup of coffee or tea as well.

### Past routines not done anymore?

**Past routines not done anymore?**

I used to meditate and I don't do it anymore because I lost the discipline. It used to be 15 minutes in the morning of everyday, just to pause. And that calmed me down a lot and I think life, other things in life that I feel I need to do, like work or other stuff and it didn't become a priority anymore, so I stopped doing that.

**What objects important in completing?**

My pens are very important. I'm very possessive of the pens that I use when I draw. I actually don't want people to touch them because they're mine and I don't want other people's energies or something (!) I see drawing as a ritual almost. Making artwork is something I do a lot, it is like a ritual thing. The act of making something is the same, what you make might be different. If you think of it...I don't mean to go down a religious route, but I think it's an easier way to explain...if you pray all the time it's like if you make artwork all the time, it's almost like your act of devoting yourself to art so all the ritual objects are the tools I use.

**Can you describe your pens?**

Fineliner pens, Rotring pens.

**Just generic, off the shelf? No particular history to you?**

The Rotring one is refillable so the pen doesn't change, it's like my friend. The other pens I use are the Staedler Fineliner and they're disposables.

**How do you feel when you throw them away?**

A bit weird, I don't really like to throw them. I love to buy new ones. I don't want to sound like a crazy person, but I feel like making a drawing is transference of energy, because you're focusing and then you're creating and you go through these pens. Somehow I have this attachment to "Oh, this pen's been through this with me, it's been through something with me." So I make sure that they're properly dead, that nothing comes out of them before I throw them out. And when I do throw them it's kind of like "thank you pen". I do have a weird attachment as object. I do have a bag of dead pens.

**How often do you draw/make artwork?**

It's not...it's such an engrained thing. I don't draw every day, I don't dedicate time to be like...sometimes I do draw every day, but it's not like "I have to draw every day!" Recently it's become ad hoc because of life things...other things in my life which stop me from being able to sit down and draw. It changes but I can't not do it for a very long time.

**What does it mean when you do?**

Just being myself. I feel like I need to draw or make something, it's just what I need to do.

**As we're talking about the domestic, if you had a studio would you do this at home or is it an important part of domestic life?**

The reason that I've not been drawing a lot is that I've created a space at home to work. The past year I had a studio where I would go to work, but with financial issues and other things I find myself working at home. I kind of like it and don't like it. I like it because I can work whenever I want, I can just work through the night and don't have to worry about travelling to get home and I don't need to

Participant F, 29<sup>th</sup> December 2014

**Age**

31

**Where do you live?**

Mill Hill East

**Can you describe your house?**

2 bed 1<sup>st</sup> floor flat.

**Who do you live with?**

My family – wife and two kids.

**Q1**

First thing that comes to mind, I'll start going through it chronologically so what I do when I wake up I guess. **The first thing I do is go and get [SON], bring him into our bed and hang out in bed for a while. I guess the first thing I'll interact with is taking [SON] out and putting him in his high chair, getting something for him to eat and putting the kettle on and making a cup of coffee.** And that's quite routine, that's something that I do every day, without fail. **Feed [SON] which usually entails spoons, bowls, bibs, yoghurt.** Then feasibly go and get number two, [DAUGHTER] the little one, he's doing his thing. **The next thing I do is get [DAUGHTER] and let [WIFE] sleep a while, get out [DAUGHTER] bouncer and stick her in the bouncer with [SON], tidy up the kitchen, have a cup of coffee...**this has all become pretty regular now.

**What about throughout the day, are you at home at all?**

It depends, I'm just about to start being at home all the time, but my usual routine is to go to work 4 days out of seven. That will be driving to work; recently I've been driving to work. Getting to work, routinely putting on the espresso machine and switching on my computer.

**In the car, any routines?**

I'll stick my phone in the holder and probably put on a podcast.

**Back in the domestic, any familial, community interactions inside the home that could be interacting with family outside the home?**

**I regularly use Skype to get in touch with my sister or [WIFE] will use it to get in touch with her family in Spain mostly.** I mainly do that on a Saturday morning, **I'll do that with my sister, I'll get up with [SON] and I'll get a tablet or a phone and Skype my sister and she likes to have breakfast with [SON]. So he'll sit there eating his yoghurt and she'll sit there eating whatever she's eating and they shout at each other.**

**Anything like a shrine, collection of important objects, family pictures?**

**Couple of locations where there are actually religious artefacts. That tagine has got a whole load of kippot and siddur in it, and there's the jewbox there that's got my tallit in it and another siddur and usually the chanukiah but that's out.**

**But not enter into routines really?**

Enter into routines that are annual rather than daily. **Yearly traditions – on Chanukah the chanukiah comes out and we do that with [SON] and at Pesach we get bits and pieces...you know, different parts of the year we'll get different bits and pieces out. And occasionally we'll have the family round and I'll get the siddur and kippot out and do a little thing.**

**Leading into ceremonies, anything in daily life more personal, maybe not religious? Certain order, same tools in a particular way to make more ritualised/formalised?**

The things that come to mind are micro detail of how I do stuff. A lot of time the kids have gone to bed and we're like, we're free now. **And we're bored of that after half an hour and we sit there and flick through photos on some sort of device; that feels oddly meaningful, looking back over the last couple of years and two kids have suddenly arrived. I guess partly what I think of meaningful is not being routine, right?**

**Well, looking at Japanese tea ceremony– not routine but highly proscribed. Similar to how people make coffee in morning.**

**That's funny, that's the micro detail...how many scoops I put in to the coffee.** I guess it's like a primacy effect, so it's one of the first things I do in the morning and it's something I do regularly. So, **I'll always put in the same amount of coffee, even if I know it's going to get a bit cold and [WIFE] won't get it, it's the way I make coffee cos I know the strength is going to be right.**

**Use particular utensils...**

**Yeah, the coffee is in a particular things and it's always in there. I'll take it out of something else, open it and put it into this particular tin, this green tin and I'll always use the same scoop even though we've got a few others, so I guess that quite ritualised.**

**Anything similar you can think of through the day or evening?**

**I guess the way we eat dinner. Food. A lot of drink and food has particular practices to it. The time and when and how we'll sit down and eat dinner is usually pretty ritualised if we're at home. We'll start food so it comes on just after [SON] goes to bed, and [WIFE] and I will eat dinner together, sometimes in front of the TV, sometimes together here (indicates dining table).**

**And regulated by his going to bed which is?**

8 o'clock sharp.

**Of the things we've spoken about, pick 1 or 2 really interesting, important, meaningful ones to explain why you do them in that way or why you do them.**

I guess the yearly religious traditions are probably meaningful because they are the ones that make me think most, because I don't really subscribe to the religious text. And for a long time I'm not really interested in any kind of literal interpretation for sure and in fact and kind of religious interpretation at all to be honest. You struggle with why you continue to perform these particular rituals throughout the year, and yet you keep doing them! So that in themselves, the fact that they are abstract from daily life and the fact that you still do them even though your abstract from the meaning makes you think and that in themselves makes them worthwhile. Just for the fact that they make you stop and think about why you're doing them, and so much of what I do is automatic or near automatized, to have reason to stop and think "Why am I not eating for 25 hours, this really isn't fun, I really should stop doing it!" Just that day of thinking about it is worthwhile. And the same with lighting the candles as well, because now it has a particular meaning to me because now I'm passing on that same dilemma to my kid right! And he's going to grow up doing the same bloody thing going, "Well, why the fuck am I doing this," right? So that has a new angle, not only am I doing this, but I'm inflicting it on another generation! But its good, just that space to think about it is the reason that I continue doing it. I thought it was something to do with community originally, I went back to synagogue and all these people are quite...but my connection to that kind of community is pretty distant at best. I don't see them regularly and the rituals we do perform about that are within my local family that I probably would have done anyway.

**What about at the opposite end of spectrum, making coffee. You described in such minutiae. Why do you do it in that particular way?**

I don't know why I do that in that way actually. I don't think I'd be hugely fussed if it goes off kilter. Recently our cafetiere broke, so I stopped making it out of the cafetiere and I used the machine, which I use sometimes, but not in the mornings - I'm just into this routine of...I'll do it but it kind of throws the timing off a little bit, so I have to wait until I do it cos it's not as hot and I can't have more if I want it, I've got to make another one. So I guess that made me think a little bit about the ritual and what I use that particular utensil, but the process of doing it I guess it's probably important as well.

**Maybe it creates space to reflect in the morning, or is it an automatic thing?**

Probably not just that, there's something about being automatised, about automatised behaviours that allow you to have space to think about stuff. I guess that's why our behaviours become automatised a lot of the time, is that it gives you...you have more room to cognitively do other things and process them.

**Automatic driving ...earlier participant spoke about automatic drawing and space...**

A parallel to that I guess is data processing. A ton of data processing is repetitive, automatised, clunky number crunching. Some of it is statistical and interesting and you have to look at it, but I quite enjoy the boring, monotonous, moving numbers, doing basic calculations. I can spend literally days doing that to EEG data, filtering and all the rest of it. I quite enjoy that because you know what you're doing; it's an automatised behaviour and within that you have the space to think about other things and think about stuff that's more interesting and meaningful, because you have to do a task, like Hannah Arendt, the banality of evil, but the banality of mundanity. There is something more meaningful in the day to day, so she said that evil itself was just boring and mundane and monotonous and automatic.

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**How would you feel if you weren't able to do religious practices, as we spoke about coffee being changed...**

Depends, I'll forget or go partying or I'll do something else, so it won't happen, so I won't do. So I'm not wedded to the ritual to such a degree. I end up doing it pretty much every Friday night, but if something happens that I don't do it, I'll reflect on it. I will often be out doing something, what was the most recent example? **Dh, it was a work Christmas party and decided to go to the Christmas party instead of Friday night dinner with the family and the whole Jew ritual and I had fun, it was a work do, it wasn't that amazing. But there's always a point where I'll stop and think to myself "I would usually be in this position doing this thing, giving [SON] some wine...It's not just thinking about where I'd be there's something meaning...that feels meaningful, there's something more to it. So missing out on that ritual must have an emotional impact, for sure.**

**Could this be replaced/altered/augmented with technology?**

I was thinking about how interact with technology day to day and much of it is very separated from everything else you do. It's a screen, I mean mostly, there are other examples but you interact by and large with smart technology by looking at a screen. So it's the real world, and a screen, so those kind of rituals seem like they're very manual and embodied, being in a place, doing a set of actions, scooping the coffee, lighting the candles, whatever. So if you were going to augment that it couldn't be with a screen, you wouldn't be able to offset that.

**Are there any practices you did in the past, but don't anymore?**

**Cigarettes with coffee in the morning.** I used to always, until [SON] was a year and a bit, whatever the situation I would find a way in which I'd have my coffee, go outside and smoke a cigarette. It was immutable that. I miss that actually, I miss smoking cigarettes (laughs). I've just started to lock the door, W used to tell me to do it but I rarely did it and now I do it much more regularly since we were robbed.

**What objects, how do you feel about them, can you replace them, any heirlooms?**

**I replace the cafetiere every couple of months because I manage to break them all the time! But I quite like cafetieres; we just bought a nice one, limited edition Boden. I quite like nice cups; I have particular cups I use for coffee, small yellow ones. I have an attachment to the objects we use in Jewish stuff, so that is an heirloom, from my father...no that was on my bar mitzvah, but my siddur was from my grandfather's bar mitzvah. The chanukiah we got was bought for us on our wedding by my cousin who's quite close to me. So they have emotion, those things are...I thought of another reason why it's so difficult to talk about that kind of thing with technology, because it's connected...the physical objects themselves are connected.**

**If it was possible for physical objects to have some display, showing info, usage networks physically? Would it be interesting to see the history and how objects interact?**

Stuff that is functional, I can see that being the case, I'm always interested in fiddling with technology. So, what I mean is when I make a cup of coffee, it's ritualistic, but the point is to get a cup of coffee at the end of it. So I can see there might be something in that. **With the religious stuff, that's...there's...maybe there is a goal, something that you can tap into some kind of historic...maybe there is something that you can do that would make it...the functional stuff is easier to imagine** – how strong your coffee is going to be or if you have a cup this big or this small how much caffeine are you going to take, something like that. How hot it is even, just a thermometer on the thing. But it's harder for me to imagine that stuff with non-goal orientated...The history is something I can envisage. **I go to use my chanukiah and it goes to bring up a picture of the last time I used it from last year, or the last two years or whatever.**

## Condensed themes

### Theme 1 – How and when do I break bread ?

#### Preparation of food & drink

#### Use of objects and aspects of routines to regulate time/action – piano song, coffee timing...

**A:**

So, if I'm working I wake up quite early, about 6.30. And then I put on the kettle...I put the dog out to go for a wee...I make a cup of tea... I go and brush my teeth and sometimes have a shower and shave...get dressed, have a cup of tea.

...have a cup of tea with them next door, come back in open the fridge, close the fridge...I light the fire now and then I'll cook something.

I cook a lot, so I definitely have sacred pots and pans and a knife.

Cooking is a family tradition – it was always a big thing in the family so I like cooking and I like eating.

Well, the first thing I'll do if I'm not at work I will get a cup of tea and sit at [the desk].

I know it's a bit off...here for example there isn't a decent pan to cook stuff in.

**B:**

The first kind of obvious routine for me getting up would be coffee. I get a coffee and a pint of water...

Very recently I've been trying to do breakfast, and that's miso soup and I actually use the piano to time the soup – I've got a piece that is a certain amount of time to play.

If I'm working from home I have to leave the house at least once or twice. I do jog three times a week, so that's good. Otherwise, I'll go and have a drink, a tonic or a beer at the local pub down the road.

Kitchen is kind of just there for food, but I cook a lot and enjoy it.

Avoid the front room because the TV is in there and I stopped watching it years and years ago, so if I haven't seen my mum in a while I'll eat in there when she's in there and I'll put on the television – we eat at different times a lot.

It arises from me needing a coffee. If someone brings me a coffee it's a good thing. But the process... But me and Holly we make, we call it special coffee but it's just normal, we do it most days. It's a stovetop with enough espresso for one cup, but we halve that, fill it up with a single cafetiere and then we use another cafetiere to pump milk, put that in and a teaspoon of sugar beforehand. Sometimes I mix the sugar....i really like romanticising rituals that kind of give importance to the thing but at the same time I vary them a lot.

I had an Aeropress in my house for a while and I stopped making the other type of coffee as its much quicker and easier

**C:**

...and there's the crockery that I'll bring out whenever my grandmother comes round because it used to be hers.

Well, the high chair! It's funny, he used to have favourite bowls but he doesn't anymore now that he has adult cutlery and crockery, not really...he likes to sit here, he has a particular place at the table that he does have as his favourite spot...

So when I was a child nothing was on routine, dinner was never at the same time, maybe there wouldn't be dinner!

**D:**

Similarly in the evening, there are routines that have developed without anybody having to say anything, like when people eat dinner...

We have a dining room as well as a living room certain housemates eat in the other room, and it's always the same people. I eat in front of the TV, but 1 & 2 eat on the dining room table.

Yeah, the cafetiere. Of the three people in my house who drink coffee in the morning I'm the first in the kitchen and I will make coffee. The action of making the coffee is part of my morning routine and on a psychosomatic level I start waking up even before I've drunk it because my body knows it's about to get caffeine and it's part of my routine, definitely.

There's a particular tablespoon – three dollops of that gets a good amount of coffee and I know exactly how much water goes into the kettle and when it goes into the cafetiere it gets swilled around halfway through and then stirred thoroughly when it's full. The top goes on to keep it warm while it's steeping and there are people's mugs, there is a mug that is definitely my mug.

So when I come home from work, my shoes come off, my slippers go on and the kettle goes on and whichever housemates are there get offered a cup of tea, or vice versa if I've timed it right.

I do have a particular bowl that I like to use for dinner, but someone else might have got there first and might be using it.

E:

I think that it's making a cup of coffee before I work, that's something I would say. It feels better to have a cup of coffee before I work. It's again to start working mode, it has that.

In Hong Kong we had one, not to do with my immediate family but to do with the relatives and everyone where in Hong Kong every Sunday we all meet and have lunch. And my granddad who I never met set that up and the idea is that everyone still knows each other, so that's the meaning behind it, but it's just that everyone gets together and has lunch together.

We're talking about making coffee and drinks and every time you see someone, you to someone's office or house, they will offer you a cup of coffee or tea as well.

F:

I guess the first thing I'll interact with is taking [SON] out and putting him in his high chair, getting something for him to eat and putting the kettle on and making a cup of coffee. And that's quite routine, that's something that I do every day, without fail. Feed [SON] which usually entails spoons, bowls, bibs, yoghurt...tidy up the kitchen, have a cup of coffee.

I mainly do that on a Saturday morning, I'll do that with my sister, I'll get up with [SON] and I'll get a tablet or a phone and Skype my sister and she likes to have breakfast with [SON]. So he'll sit there eating his yoghurt and she'll sit there eating whatever she's eating and they shout at each other. I mainly do that on a Saturday morning...

That's funny, that's the micro detail...how many scoops I put in to the coffee. I guess it's like a primacy effect, so it's one of the first things I do in the morning and it's something I do regularly. So, I'll always put in the same amount of coffee, even if I know it's going to get a bit cold and [FW] won't get it, it's the way I make coffee cos I know the strength is going to be right.

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I don't know why I do that in that way actually. I don't think I'd be hugely fussed if it goes off kilter. Recently our cafetiere broke, so I stopped making it out of the cafetiere and I used the machine, which I use sometimes, but not in the mornings – I'm just into this routine of...I'll do it but it kind of throws the timing off a little bit, so I have to wait until I do it cos it's not as hot and I can't have more if I want it, I've got to make another one. So I guess that made me think a little bit about the ritual and what I use that particular utensil, but the process of doing it I guess it's probably important as well.

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## Theme 2 – Sharing and showing methods

### Interactions with others / Sharing the practice

**A:**

Then I sort of run next door, drop the dog off next door, run to the car, generally run back to the house because I've forgotten something...

Because I'm on my own there are no public areas. When friends come round to stay they very much come into my hovel.

And actually my mac is really the centre piece of it, isn't it? So that's where I Skype or email or work from.

It helps to it...it adds to it for the ritual to be witnessed. You know that [X] has moved in now? It really adds to my sense, to the whole situation, the whole experience of those rituals when she, an observer, witnesses them as well. It's like...it's nice to share them. They're not private rituals as such but it's nice to get others to witness them.

**B:**

My partner [P] has been living with me for the past three months, she's just moved out, but she's there on and off, so she's in bed as well. If she's left it doesn't matter, but if she's waking up she'll do work, she'll be in bed and I'll be by the computer.

Yeah definitely, definitely. And also just to leave the place you're in. If you stay in the same space for too long, you feel cooped up.

Avoid the front room because the TV is in there and I stopped watching it years and years ago, so if I haven't seen my mum in a while I'll eat in there when she's in there and I'll put on the television – we eat at different times a lot.

It arises from me needing a coffee. If someone brings me a coffee it's a good thing. But the process. But me and [PARTNER] we make, we call it special coffee but it's just normal, we do it most days. It's a stovetop with enough espresso for one cup, but we halve that, fill it up with a single cafetiere and then we use another cafetiere to pump milk, put that in and a teaspoon of sugar beforehand. Sometimes I mix the sugar....I really like romanticising rituals that kind of give importance to the thing but at the same time I vary them a lot.

That's the value – it's like [HOUSEMATE]'s vinyl. He keeps buying them and he's got most of them on his computer. In fact, ritualising this kind of thing is kind of a way of worshipping it. It's far easier to listen to and just click on it and the storage is easier and everything is easier and cheaper. But the thing that you are doing is very important to you. Music is very important to [HOUSEMATE] and so the quality and having it as physical form, I think he likes extending the importance of music to having a ritual.

**C:**

Putting [SON] to bed is the thing that I do the most out of all the necessary interactions with your child, and it's only on rare occasions that [CW] does it on her own and he usually likes me to lie down next to him and read him a story in his bed and fall asleep with him while he twiddles my hair. That's very important for him and he *really* feels quite agitated or irritable if I'm not there to do that with him. And not putting [SON] to bed, I would find that a little disconnecting, I'd feel sad if he didn't need me for that. I have been sent away a few times (laughs).

**D:**

A house of 5 individuals means you've got five sets of routines that intersect with each other. So, the 3 of us on 1<sup>st</sup> floor who share a bathroom, our morning routines have to be perfectly balanced with each other.

We have a dining room as well as a living room certain housemates eat in the other room, and it's always the same people. I eat in front of the TV, but 1 & 2 eat on the dining room table.

My mum will call every Friday evening to wish me Shabbat Shalom, even though I almost

never answer the phone cos I'm out drinking with friends or doing whatever. 7, 8 o'clock on a Friday night, she'll call, leave me a voicemail wishing me Shabbat shalom then I'll call her back over the weekend. This is a thing that's been going on for years and years and years, ever since I moved out.

They're good they're connections to my housemates, to my friends, to my family. They're anchors. So much about our lives isn't routine these days compared to previous generations; a lot of stuff happens on impulse or changes much more quickly and much more arbitrarily than it ever did in the past. These things, these routines and community and family things we do, they're constants that anchor you down, in a good way.

Living outside of a family environment, with 4 individuals all with their own routines means you don't have that in the same way because you're all doing your own thing, your all living 5 fairly separate lives. There aren't the same ritualistic gatherings and departing. I might come in and do a thing on one day, and I might want to do it more often, but it will be affected by what else has happened.

E:

In Hong Kong we had one, not to do with my immediate family but to do with the relatives and everyone where in Hong Kong every Sunday we all meet and have lunch. And my granddad who I never met set that up and the idea is that everyone still knows each other, so that's the meaning behind it, but it's just that everyone gets together and has lunch together.

F:

I guess the first thing I'll interact with is taking [SON] out and putting him in his high chair, getting something for him to eat and putting the kettle on and making a cup of coffee. And that's quite routine, that's something that I do every day, without fail. Feed [SON] which usually entails spoons, bowls, bibs, yoghurt...tidy up the kitchen, have a cup of coffee.

I mainly do that on a Saturday morning, I'll do that with my sister, I'll get up with [SON] and I'll get a tablet or a phone and Skype my sister and she likes to have breakfast with [SON]. So he'll sit there eating his yoghurt and she'll sit there eating whatever she's eating and they shout at each other. I mainly do that on a Saturday morning...

Yearly traditions – on Chanukah the chanukiah comes out and we do that with [SON] and at Pesach we get bits and pieces...you know, different parts of the year we'll get different bits and pieces out. And occasionally we'll have the family round and I'll get the siddur and kippot out and do a little thing.

We'll start food so it comes on just after mo goes to bed, so [SON] goes to bed and [W] and I will eat dinner together, sometimes in front of the TV, sometimes together here (dining table).

And the same with lighting the candles as well, because now it has a particular meaning to me because now I'm passing on that same dilemma to my kid right! And he's going to grow up doing the same bloody thing going, "Well, why the fuck am I doing this," right? So that has a new angle, not only am I doing this, but I'm inflicting it on another generation! I thought it was something to do with community originally, I went back to synagogue and all these people are quite...but my connection to that kind of community is pretty distant at best. I don't see them regularly and the rituals we do perform about that are within my local family that I probably would have done anyway.

Oh, it was a work Christmas party and decided to go to the Christmas party instead of Friday night dinner with the family and the whole Jew ritual and I had fun, it was a work do, it wasn't that amazing. But there's always a point where I'll stop and think to myself "I would usually be in this position doing this thing, giving [SON] some wine...it's not just thinking about where I'd be there's something meaning...that feels meaningful, there's something more too it. So missing out on that ritual must have an emotional impact, for sure.

Theme 3 - Shaping space to shape us

Adjusting the domestic environment. Attachment and practices surrounding objects

A:

Well washing up I do constantly, and I mean constantly. I hate the idea of coming to massive pile of washing up.

I know it's a bit off...here for example there isn't a decent pan to cook stuff in. So it does impact the way I feel about doing stuff, it always feels like a bit of a compromise but I suspect that's what it is to be here, I'm in this kind of limbo state. It's a bit like going camping or being on holiday. I don't feel in my normal state. I think a lot of it is to do with not having the objects that I'm used to here. And everything here is a kind of makeshift approach...that situation again.

The next door house is called Brimstone Down and at the weekend I was shown round it an offered it, and she's retired model/art restorer and her cottage is old and wood panelled and bathed in light and full of patina and ever since seeing it I want to move there. One massive room with a massive wood burner and a four poster bed right in the middle of it. So that's basically where I want to be and I think then my rituals and objects will have more....they'll feel more at home.

A few years ago in my flat in London I designed and got built some walnut shelves in the living room and I spent a long time choosing the right colour LED lights... well white, but the right warmth LED lights and I spent a long time looking at the right voltage dimmers. So I realised that when I get home to my flat, the first thing I do is flick on those three LED strips and adjust their intensity. And I always look at...cos you know how light bounces off book spines? I realised that is one of....it's not a ritual but what I do every time is adjust them to exactly, exactly the intensity of light that I want.

I love them. If I think about selling my flat the first thing that comes to mind is what can I do with those, how can I take those shelves with me, or, or, how can I make sure that those lights, those shelves are as appreciated as there are to me.

B:

It's interesting as anywhere else in my room you can sit and there would be no reason for me to want to sit where you're sitting, but if someone sits in my chair it screws up the logic of the room. Everything is built around controlling it from there.

But I will say that if I don't touch a piano or guitar in two days I feel insane and it used to be that if I didn't touch a piano in one day I'd feel very nervous.

Well, there's my bookcase. If I go into someone's room I look at their bookcase. If I have a second I go over and stare at it and it might seem a bit intrusive but I really like the idea that, for me the value of my intellect can be seen more in my bookcase than it can in anything else in my room and anything else that's visual in my life. As a result, if you were to get me a kindle, I wouldn't get rid of my book case. It's more about the value of what they represent in my space than necessarily their use.

That's the value – it's like [HOUSEMATE] vinyl. He keeps buying them and he's got most of them on his computer. In fact, ritualising this kind of thing is kind of a way of worshipping it. It's far easier to listen to and just click on it and the storage is easier and everything is easier and cheaper. But the thing that you are doing is very important to you. Music is very important to [HOUSEMATE] and so the quality and having it as physical form, I think he likes extending the importance of music to having a ritual.

I guess nowadays most of the routines that I do instead are something that I do on my phone, they're a lot smaller and a lot more minute. I used to have a to do list, and it was part of my routine to write it every day, but now I have a thing on my phone that reminds me to do it and I press some buttons....

C:

The only ritualistic routine I've got is to make sure the bookcase looks nice.

...lowering the lighting, making the place feel a little less active.

The space around me is the most important thing and how it looks and feels. If the space I'm in is unsatisfactory, it makes me unhappy...

...we've got quite a lot of sentimental objects around us in the house...you know, this was a wedding present from my aunt and cousins, and there's my grandfather's rocking chair that he would sit in every night

D:

[HM2] goes to bed first and her room is directly above the TV, the living room, and [HM2] goes to bed around nine and we know that around that time we'll turn the TV down.

I do have that but because it's a static thing, it's a display of things that are important to me, it doesn't enter into any routines, it's just there, because it's not changing, it's fairly static

E:

I've got no curtains for a year, because....it was those blackout blinds and they fell off because they were crap. So what happened, I ad hoc made curtains for myself – I just put some nails on the wall and got a cloth and kind of cover it when I need to have the curtains on and I take it off every morning. But I didn't think about it before, because the blind opened and closed, but the act of standing...I step on my bed and have to remove the cloth. I think because I have to physically remove the cloth every day, every morning it becomes more apparent to me to have that thought like – ah! When you asked about ritual that's what I think of and I think it's been there for a long time because I have other things that I want to do and it's functional so it's at the back of my mind to do it. I quite like it though, that making my own sort of....

On the side my wardrobe I put my own or other peoples drawings...sometimes I like the image or it's something that I've done recently and I just need it to be there for me to look at.

F:

on Chanukah the chanukiah comes out and we do that with [SON] and at Pesach we get bits and pieces...you know, different parts of the year we'll get different bits and pieces out...

I was thinking about how interact with technology day to day and much of it is very separated from everything else you do. It's a screen, I mean mostly, there are other examples but you interact by and large with smart technology by looking at a screen. So it's the real world, and a screen, so those kind of rituals seem like they're very manual and embodied, being in a place, doing a set of actions, scooping the coffee, lighting the candles, whatever. So if you were going to augment that it couldn't be with a screen, you wouldn't be able to offset that.

I have an attachment to the rituals we use in Jewish stuff, so that is an heirloom, from my father...no that was on my bar mitzvah, but my siddur was from my grandfather's bar mitzvah. The chanukiah we got was bought for us on our wedding by my cousin who's quite close to me.

#### Theme 4 – Information and profane worship

##### **Use of media to connect with wider world.**

A:

I check my emails first when I wake up in the morning (**first thing?**) Yeah, in bed (**oh on your pad or phone**) Yeah, my iPhone.

Quite often before I go to bed I'll spend some time on the computer and then I'll go to bed with an Ipad, read something like a book or a paper or a kindle.

Half an hour in the evening reading Ipad. If not a work find a bit of the afternoon to lie on the sofa and read a book.

B:

I don't want to read the newspaper anyway. I use Reuters...usually in the morning I go to my laptop and see what the headlines are.

Avoid the front room because the TV is in there and I stopped watching it years and years ago, so if I haven't seen my mum in a while I'll eat in there when she's in there and I'll put on the television – we eat at different times a lot.

I mainly read about stuff on line. I read books on public transport so I don't read them at home so much. As a result I read the online stuff and I also ....i listen to audio books when I'm doing stuff around, so that follows me around the house.

I go into someone's room I look at their bookcase. If I have a second I go over and stare at it and it might seem a bit intrusive but I really like the idea that, for me the value of my intellect can be seen more in my bookcase than it can in anything else in my room and anything else that's visual in my life. As a result, if you were to get me a kindle, I wouldn't get rid of my book case. It's more about the value of what they represent in my space than necessarily their use.

That's the value – it's like [HOUSEMATE] vinyl. He keeps buying them and he's got most of them on his computer. In fact, ritualising this kind of thing is kind of a way of worshipping it. It's far easier to listen to and just click on it and the storage is easier and everything is easier and cheaper. But the thing that you are doing is very important to you. Music is very important to [HOUSEMATE] and so the quality and having it as physical form, I think he likes extending the importance of music to having a ritual.

C:

I do have one routine that I've developed recently which is listening to records in the evening. So the record player is my most important physical object in the house.

*(How feel about records?)*

I love them. They give me solace. And the record player is the enabler, it's like my pusher! Without it I can't get the emotional satisfaction that I want, that I get from music.

D:

[HM2] goes to bed first and her room is directly above the TV, the living room, and [HM2] goes to bed around nine and we know that around that time we'll turn the TV down. But interestingly, the days when she isn't there the TV stays on loud extra late, almost like we're overcompensating for it.

I eat in front of the TV, but 1 & 2 eat on the dining room table.

My mum will call every Friday evening to wish me Shabbat Shalom, even though I almost never answer the phone cos I'm out drinking with friends or doing whatever. 7, 8 o'clock on a Friday night, she'll call, leave me a voicemail wishing me Shabbat shalom then I'll call her back over the weekend. This is a thing that's been going on for years and years and years, ever since I moved out.

Skype – because half of my family is in Buenos Aires. Skype has become part of our rituals on birthdays. In previous decades it would have been a letter, a telegram perhaps a garbled phone call, an expensive phone call, more to the point and hence a short phone one. Skype allows us to have free high quality communications with Dad's family, so Christmas Day, birthdays, high holidays – it's become part of our routine, it's become a ritual for Dad to Skype with all the members of his family

E:

I notice my dad, when he's dressed and all ready. He's retired so he just hangs out at home. The first thing he usually does is turn the TV on. He might not necessarily watch it, he'll still do his other thing but then it's that kind of...when you talk about being ready for the world, TV is almost a weird window to a fake world. Cos he watches the news channel a lot, even though we can debate how real that is...a version of the world in a way.

On the side my wardrobe I put my own or other peoples drawings...sometimes I like the image or it's something that I've done recently and I just need it to be there for me to look at.

F:

A lot of time the kids have gone to bed and we're like, we're free now. And we're bored of that after half an hour and we sit there and flick through photos on some sort of device; that feels oddly meaningful, looking back over the last couple of years and two kids have suddenly arrived. I guess partly what I think of meaningful is not being routine, right?

## Theme 5 – Actions that affect us

### Emotional content/satisfaction

A:

Well washing up I do constantly, and I mean constantly. I hate the idea of coming to a massive pile of washing up.

Yeah. Well. I suppose so. The shelves I'm really attached to, I have to say. There's no way....I would like them to come with me.

B:

I had an Aeropress in my house for a while and I stopped making the other type of coffee as it's much quicker and easier and I'm not really...I also enjoyed it as it's a newer technology and I think when you get different technologies to change your routine you feel as though you're improving your life, but you're improving your life without having to put any effort into it. It's really optimistic to buy a product that changes your routine.

As a result, if you were to get me a Kindle, I wouldn't get rid of my bookcase. It's more about the value of what they represent in my space than necessarily their use.

If something is sentimental you want it to have a ritual, and you want it to have more of a ritual. If I told you that you didn't need to warm the pot as it's been roasted...I think you're still going to. And if I told you that you don't need to stir the coffee... It changes the routine of something that is based emotionally and I guess it's really nice to ritualise the things that mean something to you, but the things that are just functional, unless that function means something great to you, you really want it to be done as quickly as possible.

Recently, I water mushrooms to grow Oyster mushrooms, and going and watering them, which is something that you do three or four times a day is something...when I wake up I go and do that. And I like the idea of that, I used to do it within chillies, and the idea of the fact that they're going to get bigger and the fact that what you're doing is ritualistically based on the hope of something in the future that's going to be awesome, that was always very reaffirming thing for me to do when I woke up. I could buy them, why the hell am I even doing it? It's based on the enjoyment of the process of the thing that I will eventually eat.

C:

I can't see technology ever replacing those two things [putting son to bed, organising bookcase], or many of the things that you consider rituals. I suppose it would either be too unsophisticated in a household way or be invasive, so I can't imagine technology replacing the two things I mentioned at all.

I love them. They give me solace. And the record player is the enabler, it's like my pusher! Without it I can't get the emotional satisfaction that I want, that I get from music.

...this was a wedding present from my aunt and cousins, and there's my grandfather's rocking chair that he would sit in every night and there's the crockery that I'll bring out whenever my grandmother comes round because it used to be hers.

D:

They're good they're connections to my housemates, to my friends, to my family. They're anchors. So much about our lives isn't routine these days compared to previous generations; a lot of stuff happens on impulse or changes much more quickly and much more arbitrarily than it ever did in the past. These things, these routines and community and family things we do, they're constants that anchor you down, in a good way.

...if I didn't have a mobile phone, she'd be calling the landline of the house I was living in and me not being there would be quite a natural thing, cos I could easily be anywhere else, but a mobile phone, she knows it's on me, she knows I've seen her call me and that's an important part of the process. Even though I didn't answer the phone, she knows I saw her call.

E:

And so every morning I'll do my routines in the bathroom, get changed and then I would climb on my bed, remove this cloth away from the window and its like – ooh! The light comes into my room and I'm beginning my day.

For the everyday stuff...What's the difference between a habit and a ritual? Something that you do out of necessity, like I have to brush my teeth or...It just happens, people get these routines and habits and then that becomes...a ritual has a kind of meaning.

In Hong Kong we had one, not to do with my immediate family but to do with the relatives and everyone where in Hong Kong every Sunday we all meet and have lunch. And my granddad who I never met set that up and the idea is that everyone still knows each other, so that's the meaning behind it, but it's just that everyone gets together and has lunch together.

*How does making coffee before work make you feel?*

That I have to work. Preparing myself mentally for work. I think I would be more thinking of why am I delaying this now, I should just do it. But thinking about it now, I think it's more like a preparing myself to work.

Making artwork is something I do a lot, it is like a ritual thing. The act of making something is the same, what you make might be different. If you think of it...I don't mean to go down a religious route, but I think it's an easier way to explain...if you pray all the time it's like if you make artwork all the time, it's almost like your act of devoting yourself to art so all the ritual objects are the tools I use. ! I don't want to sound like a crazy person, but I feel like making a drawing is transference of energy, because you're focusing and then you're creating and you go through these pens. Somehow I have this attachment to "Oh, this pen's been through this with me, it's been through something with me." So I make sure that they're properly dead, that nothing comes out of them before I throw them out. And when I do throw them it's kind of like "thank you pen". I do have a weird attachment as object. I do have a bag of dead pens.

*What mean when you do them*

Just being myself. I feel like I need to draw or make something, it's just what I need to do.

F:

A lot of time the kids have gone to bed and we're like, we're free now. And we're bored of that after half an hour and we sit there and flick through photos on some sort of device; that feels oddly meaningful, looking back over the last couple of years and two kids have suddenly arrived. I guess partly what I think of meaningful is not being routine, right?

I guess the yearly religious traditions are probably meaningful because they are the ones that make me think most, because I don't really subscribe to the religious text. And for a long time I'm not really interested in any kind of literal interpretation for sure and in fact and kind of religious interpretation at all to be honest. You struggle with why you continue to perform these particular rituals throughout the year, and yet you keep doing them! So that in themselves, the fact that they are abstract from daily life and the fact that you still do them even though your abstract from the meaning makes you think and that in themselves makes them worthwhile.

there's always a point where I'll stop and think to myself "I would usually be in this position doing this thing, giving [SON] some wine...It's not just thinking about where I'd be there's something meaningful...that feels meaningful, there's something more too it. So missing out on that ritual must have an emotional impact, for sure.

So they have emotion, those things are....i thought of another reason why it's so difficult to talk about that kind of thing with technology, because its connected...the physical objects themselves are connected.

The history is something I can envisage...I go to use my chanukiah and it goes to bring up a picture of the last time I used it from last year, or the last two years or whatever...

#### Theme 6 – Space for reflection?

Reflection/Space/Pause – non automatised actions / Winding down in evening / Tactility & visibility to enable reflection:

A:

Quite often before I go to bed I'll spend some time on the computer and then I'll go to bed with an Ipad, read something like a book or a paper or a kindle.

Half an hour in the evening reading Ipad. If not a work find a bit of the afternoon to lie on the sofa and read a book. If I could, I'd meditate but I never do. (Why not?) I'm too flighty

**B:**

Not sure...It's also about having a time where you can prepare, which is quite nice. At the same time spending time in the evening, before I go to bed I'll spend an hour sort of sitting, being on my computer or something. And I did notice that even if I come in really late from something, I'll still do that. So winding down is quite important and I don't tend to do that in bed.

**C:**

It would be a winding down process, doing more relaxing things – lowering the lighting, making the place feel a little less active.

**D:**

**E:**

I used to have an annual ritual which was related to my drawing. I did it three times, usually in July I'll find a day where...its more looking where I'm going with my artwork or just emptying my mind out and I'll make a piece of work with that in mind. For me sometimes my artwork is also what's going on with my life cos I think they're linked because how I feel, how I'm affected effects the work I make.

Isn't that more the time to pause? To feel to just experience and to just calm down, especially today when everything is so fast.

I used to meditate, but I stopped doing that, does that count?

I think that it's making a cup of coffee before I work, that's something I would say. It feels better to have a cup of coffee before I work. It's again to start working mode, it has that.

Delaying the process of working possibly! And then feeling, OK I've delayed the time now...I'm just overthinking it. I think it's more like a habit...I would say then it is kind of like a ritual, almost. It doesn't feel quite ritualised.

Part of it I guess. I would say for the drawing thing that I don't do – I like the idea of that, I like the idea of reflecting, I think I might need to implement it a bit as something I consciously do. I like having the time to reflect. That helps. It helps me to calm down as well. Everything else I described is part of my life.

Used to meditate and I don't do it anymore because I lost the discipline. It used to be 15minutes in the morning of everyday, just to pause. And that calmed me down a lot and I think life, other things in life that I feel I need to do, like work or other stuff and it didn't become a priority anymore, so I stopped doing that.

**F:**

And we're bored of that after half an hour and we sit there and flick through photos on some sort of device; that feels oddly meaningful, looking back over the last couple of years and two kids have suddenly arrived. I guess partly what I think of meaningful is not being routine, right?

So that in themselves, the fact that they are abstract from daily life and the fact that you still do them even though your abstract from the meaning makes you think and that in themselves makes them worthwhile. Just for the fact that they make you stop and think about why you're doing them, and so much of what I do is automatic or near automatized, to have reason to stop and think "Why am I not eating for 25 hours, this really isn't fun, I really should stop doing it!" Just that day of thinking about it is worthwhile.

But its good, just that space to think about it is the reason that I continue doing it.

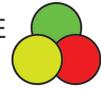
...there's something about being automatised, about automatised behaviours that allow you to have space to think about stuff. I guess that's why our behaviours become automatised a lot of the time, is that it gives you...you have more room to cognitively do other things and process them.

Depends, I'll forget or go partying or I'll do something else, so it won't happen, so I won't do. So I'm not wedded to the ritual to such a degree. I end up doing it pretty much every Friday night, but if something happens that I don't do it, ill reflect on it.

## Appendix F - 5.2.2: Domestic Practice Design Workshop Tools

*Object 1:* \_\_\_\_\_



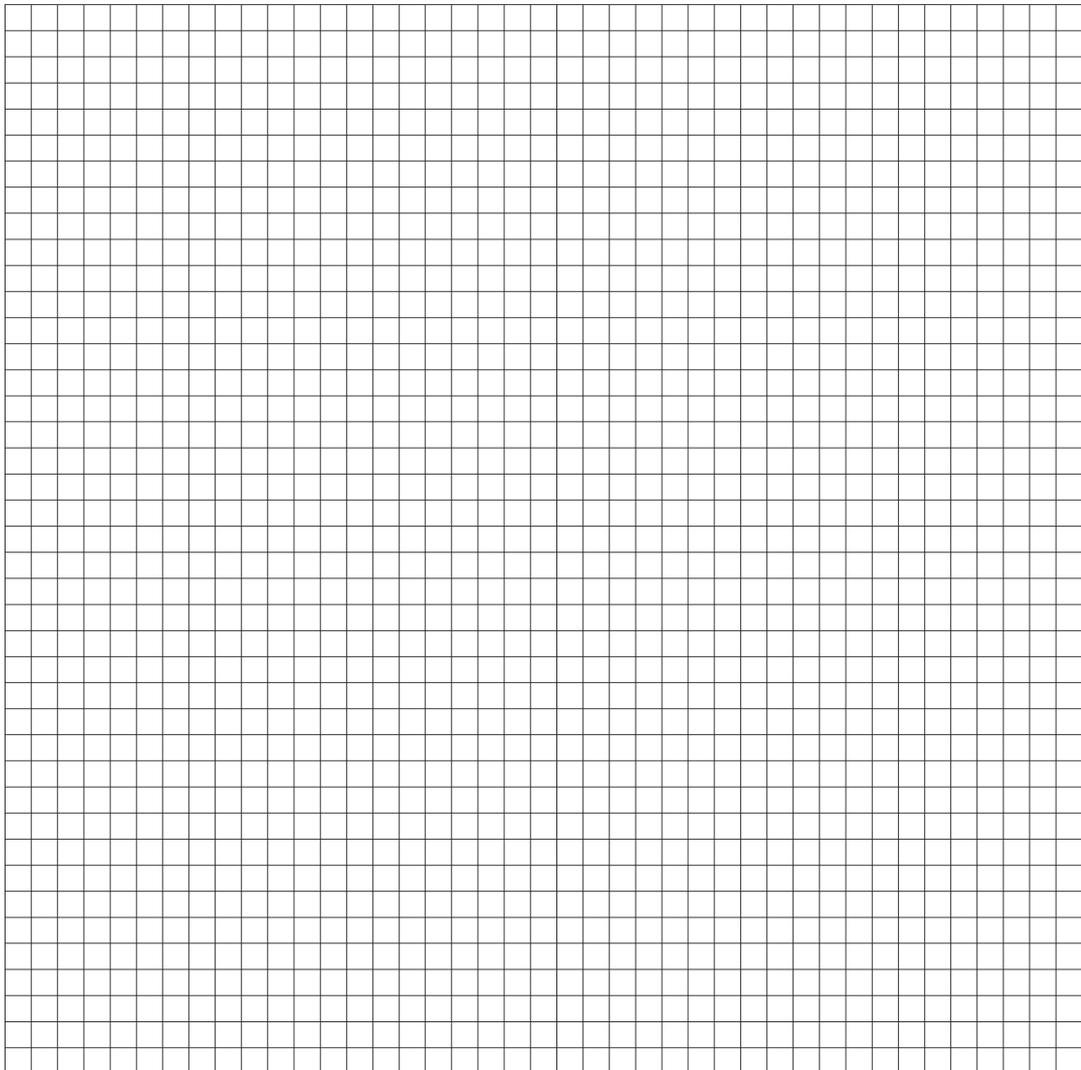


2 - SPACE

Use the grid lines below to draw a rough floor plan of a room in your house where the practices/routines/rituals that relate to your three objects take place and mark out where they happen. You can also create sheets related to objects that you didn't take pictures of, but please make a note of what they are in the space below.

Feel free to use as many sheets as you need and go into finer detail i.e. you can draw areas, objects and interactions within rooms.

Please remember to colour code based on the stickers on your postcard!



Identifier:

Sheet \_ of \_

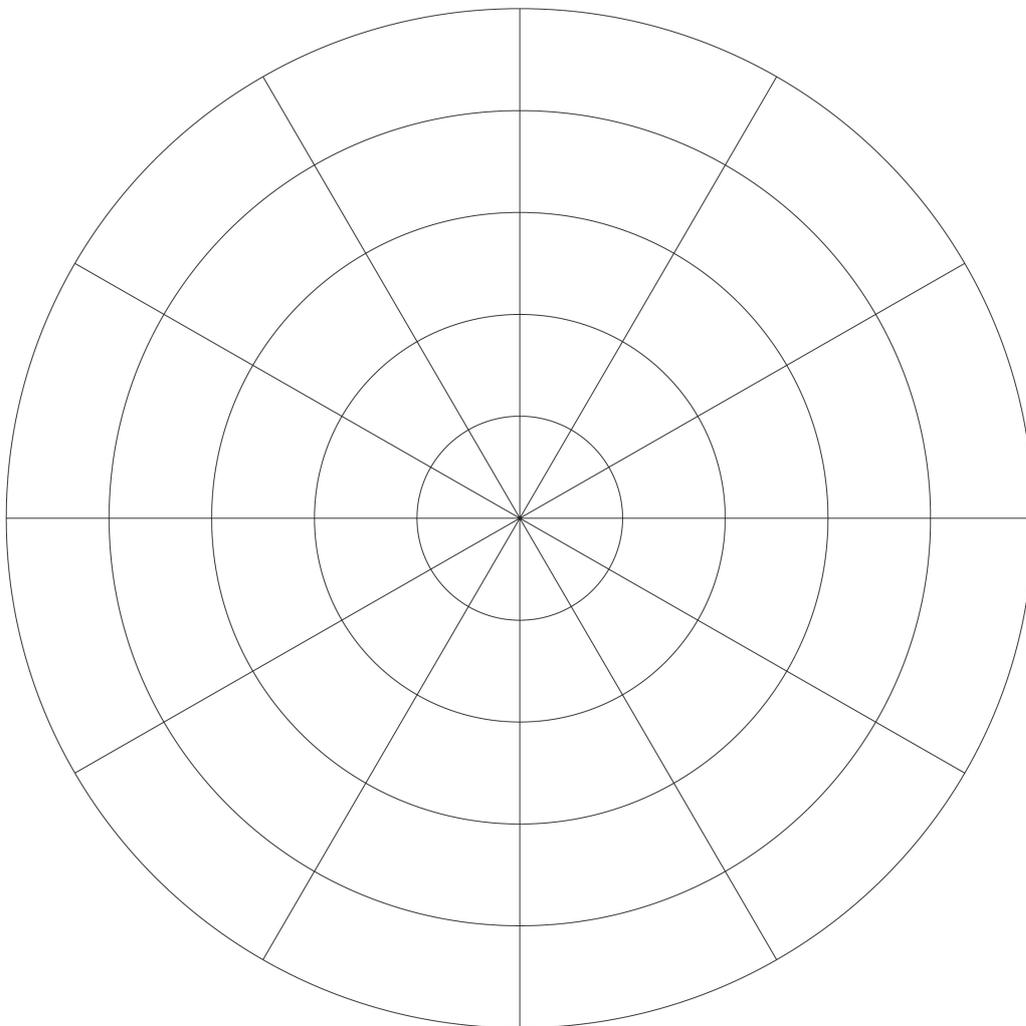


### 3 - TIME

Use the grid lines below to create a time based record of when the practices/routines/rituals that relate to your three objects take place. You can also create sheets for those related to objects that you didn't take pictures of, but please make a note of what they are in the space below.

Feel free to use as many sheets as you need and go into finer detail i.e. you can split the time taken from minutes to months and even more abstract and fluid notions of time.

Please remember to colour code based on the stickers on your postcard!



Identifier:

Sheet \_ of \_



#### 4 - ELEMENTS OF PRACTICE

Use the paper below and tokens provided to visualise what you feel the most important parts of the practices that you've described. If there are any categories that you'd like to add use the blank tokens to make them and add to your collage.

Feel free to use as many sheets as you need and to use anything else you might need to express your thoughts.

Please remember to colour code based on the stickers on your postcard!

Identifier:

Sheet \_ of \_



**Royal College of Art**  
**RESEARCHRCA**

For further information  
 Supervisor:  
*Prof. Ashley Hall,*  
*Innovation Design Engineering,*  
*ashley.hall@rca.ac.uk*

DATE:

*The Internet of Things in the Domestic Space*  
**Domestic Routines and Objects Workshop**

I (*please print*).....have read the information on the research project The Internet of Things in the Domestic Space, which is to be conducted by Michael Kann ([Michael.kann@network.rca.ac.uk](mailto:Michael.kann@network.rca.ac.uk)) from the Royal College of Art, and all queries have been answered to my satisfaction.

I agree to voluntarily participate in this research and give my consent freely. I understand that the project will be conducted in accordance with the Information Sheet, a copy of which I have retained.

I understand that I can withdraw from the project at any time, without penalty, and do not have to give any reason for withdrawing.

I consent to:

- Complete an anonymous interview which will take approximately 30 minutes.
- Give personal information if required.

I understand that all information gathered from the survey will be stored securely, my opinions will be accurately represented. Any images in which I can be clearly identified will be used in the public domain only with my consent.

Print Name:.....

Signature:.....

Date: .....

This project will be conducted in compliance with the Research Ethics Code of the Royal College of Art.



For further information  
Supervisor:  
*Prof. Ashley Hall,*  
*Innovation Design Engineering,*  
*ashley.hall@rca.ac.uk*

DATE:

*The Internet of Things in the Domestic Space* **Participatn Information Sheet**

Dear Potential Participant,

I am Michael Kann, a Research Student in Innovation Design Engineering. As part of my studies, I am conducting a research project entitled The Internet of Things in the Domestic Space. You are invited to take part in this research project which explores the future role of technological artifacts in the home and the impacts they could have to the way we use this space, our routines and rituals in the home and our relationships to our curated possessions. You are invited to participate in this research.

If you consent to participate, this will involve:

- Completion of a workshop investigating elements of routine in the domestic space, which should take around 2 hours.

Participants are invited to take part from across a spectrum of ages, socio-economic backgrounds and family statuses from amongst a network of peers and associates.

Participation is entirely voluntary. You can withdraw at any time and there will be no disadvantage if you decide not to complete the survey. All information collected will be confidential. All information gathered from the survey will be stored securely and once the information has been analysed all information will be destroyed. At no time will any individual be identified in any reports resulting from this study.

If you have any concerns or would like to know the outcome of this project, please contact my supervisor, Ashley Hall, at the above address.

Thank you for your interest,

A handwritten signature in black ink, appearing to be "Michael Kann".

Michael Kann

**Complaints Clause:**

**This project follows the guidelines laid out by the Research Ethics Code of the Royal College of Art.**

**If you should have any concerns about your rights as a participant in this research, or you have a complaint about the manner in which this research is conducted, it may be given to the researcher or, if an independent person is preferred, addressed to the Research Ethics Committee of the Royal College of Art at the above address.**

Royal College of Art, Kensington Gore, London SW7 2EU, UK T: +44 (0)20 7590 4214 E: [research@rca.ac.uk](mailto:research@rca.ac.uk) [www.rca.ac.uk](http://www.rca.ac.uk)

Appendix G - 5.2.2:  
 Domestic Practice Design Workshop Responses  
 Participant A



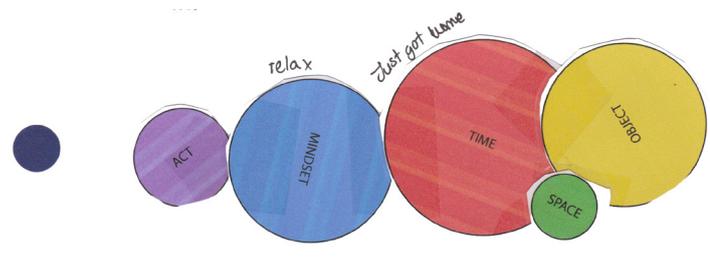
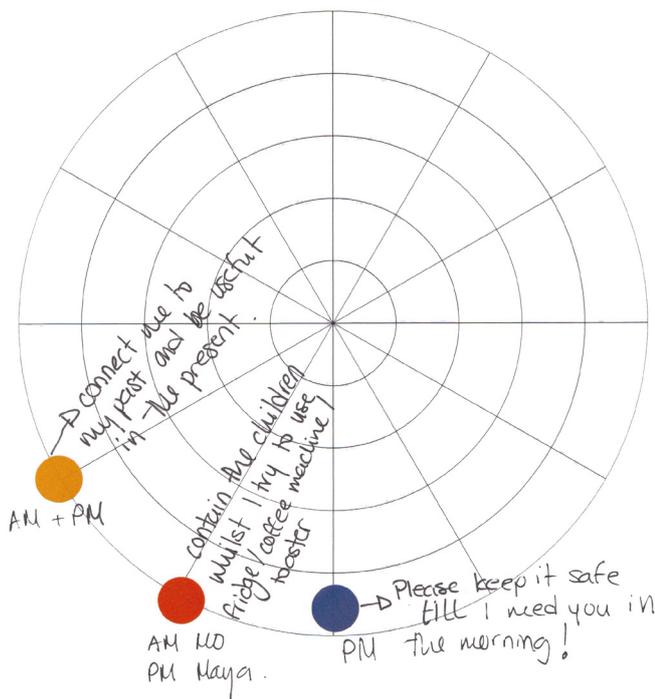
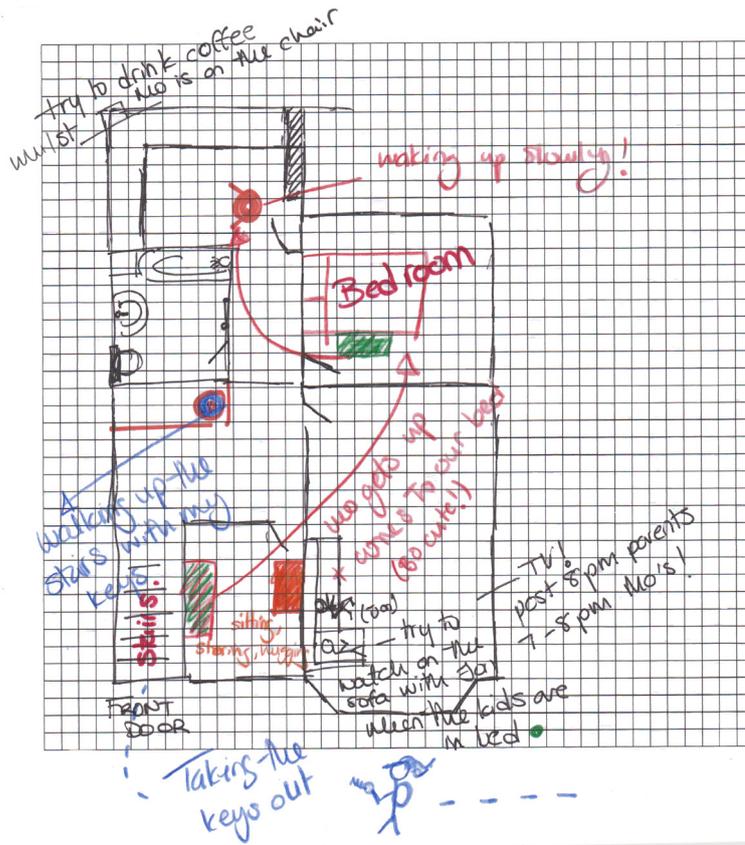
Hi, ●  
 Every morning my first kid sits in this chair to wake up slowly. The net under it is the dumping ground for all things "distracting children" whilst I try to cook, clean or drink coffee. The stool under it allows me to get to things + works as a mini table - it reminds me of my kids x.



TO WHOM IT MAY CONCERN, ●  
 This toy box is now mainly used as a prop when dressing the kids. Used to be where I sat to feed Mo, then Maya whilst reading to Mo. I have had it since I was a child myself. It is a connection to the past, my past.



To You, ●  
 This is a bowl that sits in my hall way. It was given to us for our wedding. Slowly it became part of our daily routine in that it is ~~that~~ where I leave my keys in the afternoon when I arrive from work. It means I know where important items are (wallet + phone end up there too). It is ~~my~~ a symbol of my life ~~as in~~ with Jo.



## Participant B



I BAKE ON WEEKENDS AND THIS BOOK HOLDER IS PART OF THIS ROUTINE. I SPEND MOST OF THE WEEK THINKING ABOUT WHAT I'M GOING TO BAKE THAT WEEKEND AND THEN THE BOOK SITS THERE ON IT, PATIENTLY WAITING FOR SATURDAY TO COME ALONG ~~AND~~ FOR. JUST LOOKING AT IT MAKES ME SMILE AND SALIVATE.

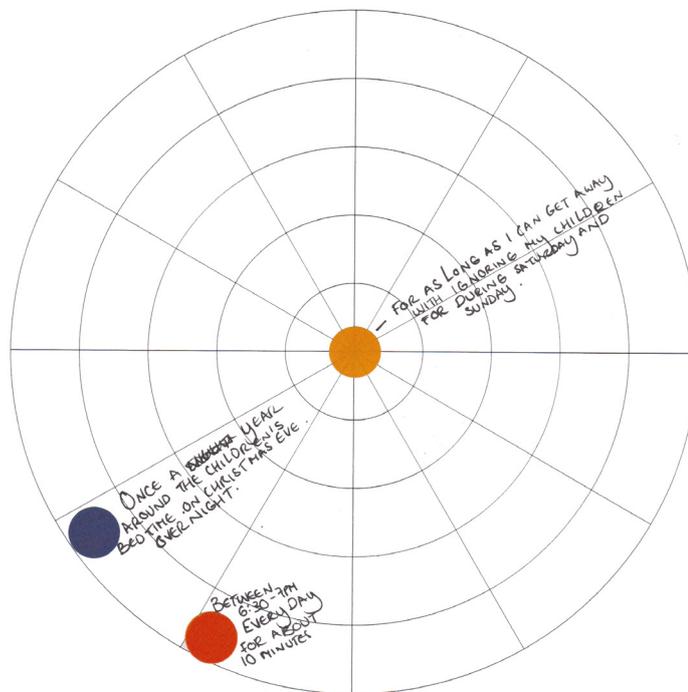
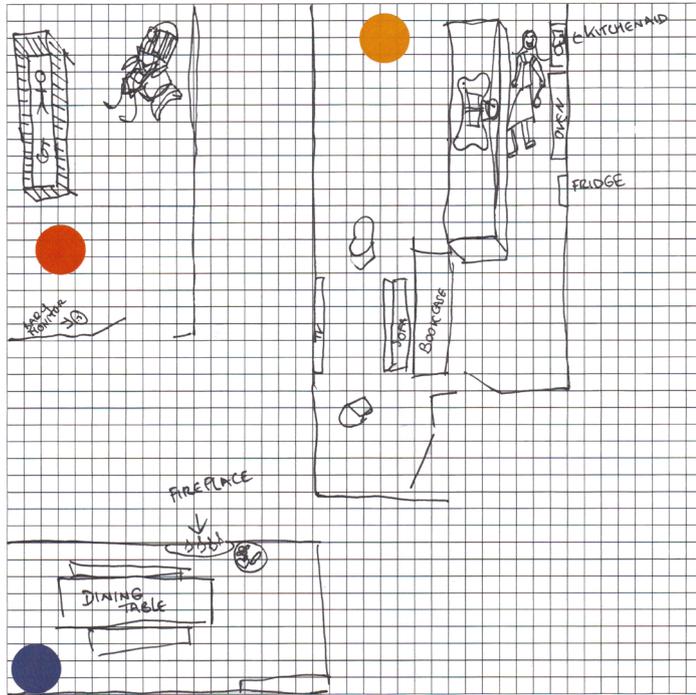


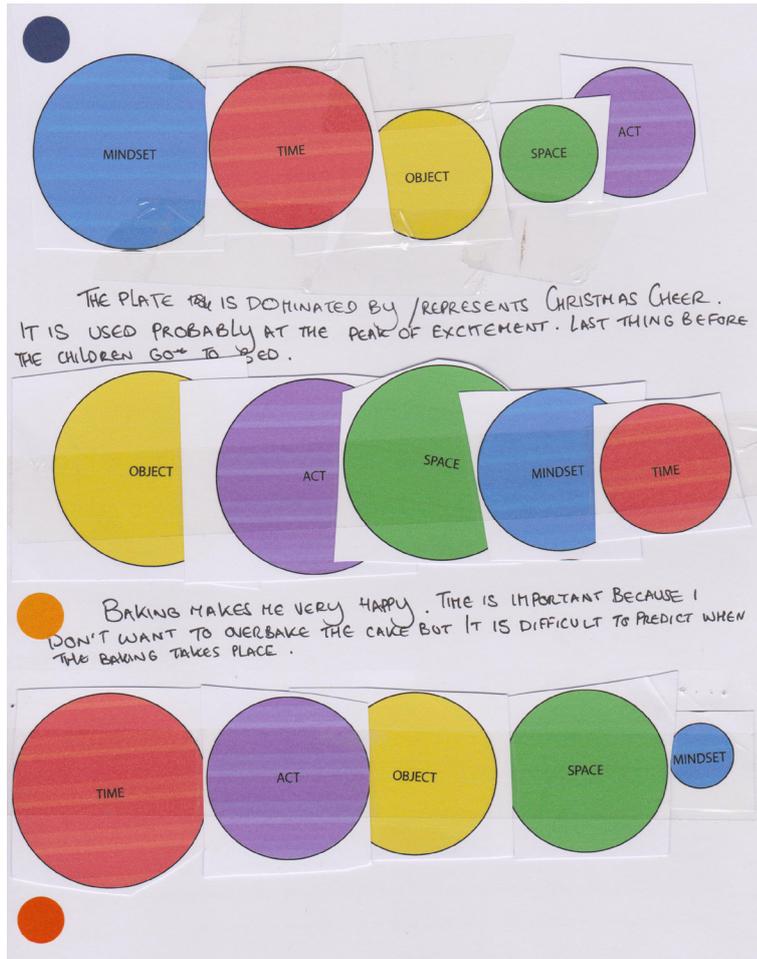
THIS ROCKING CHAIR BELONGED TO MY GRANDFATHER AND WAS PART OF HIS EVENING ROUTINE. NOW IT IS PART OF MINE. IT LIVES BY MY YOUNGEST'S COT AND I SIT IN IT EVERY NIGHT WHILE READING HIM HIS BEDTIME STORY.



THIS PLATE IS PART OF OUR CHRISTMAS ROUTINE. ON CHRISTMAS EVE WE PUT BISCUITS FOR FATHER CHRISTMAS AND A SNACK FOR THE REINDEER BY THE FIREPLACE WHEREVER WE ARE. IT'S QUITE A NEW ADDITION TO OUR CHRISTMAS ROUTINE BUT IT'S COMPLETELY OURS.







### Participant C



Dear Someone,

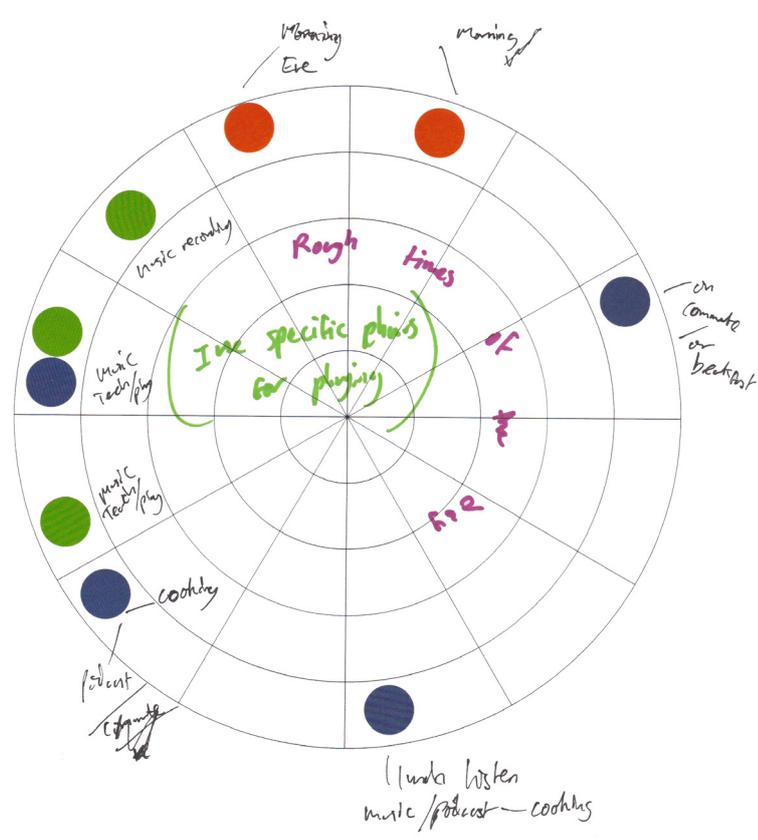
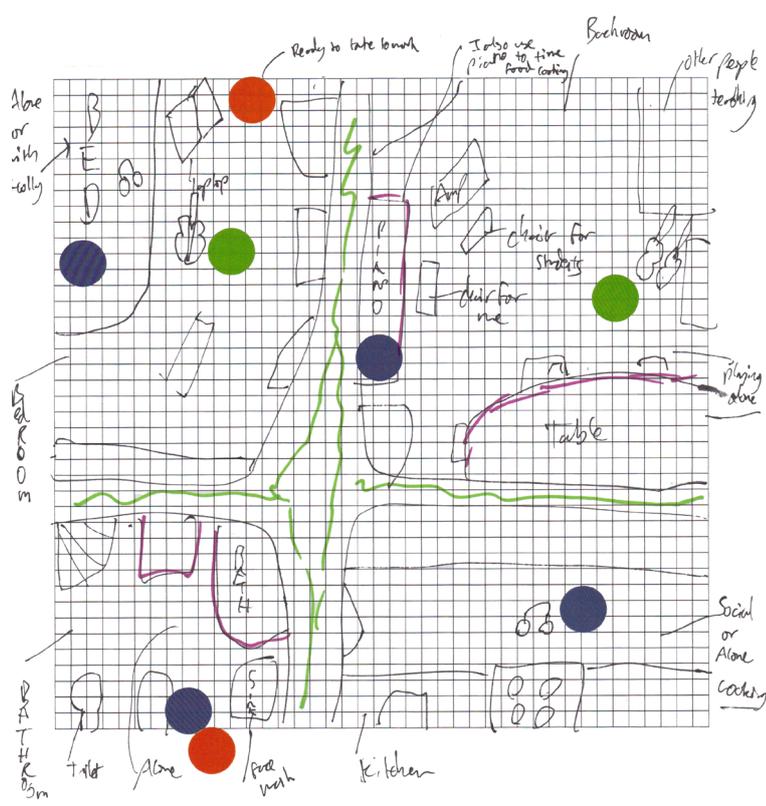
I use these objects twice a day. Morning and night. I am trying to fix a routine of exercise and cleanliness. I use these in order and they make me feel refreshed and on track.



Dear Someone,  
 These are my guitars, along with my piano I use them everyday to improvise (everyday), compose/songwriting (most days) and improve technique. If a day goes by without touching ~~an~~ an instrument I feel weird, anxious and restless.



Dear Someone,  
 I use this object every day in my day to day life when in motion. I use it to listen to 3 regular podcasts and ~~all~~ lots of music. It is wireless so I can take it running or use it when looking. I like the intimacy of sounds so close to me. I use these to inform, educate and entertain. Also to test my own compositions.





Participant D



Dear Chap,  
 On the reverse is an image of my box! It stores substances & appropriate paraphernalia which I consume regularly - at least daily. As well as the functional role of storage the box, given to me by a close friend, has an emotional attachment. I also like the feel & look of my important box. best,



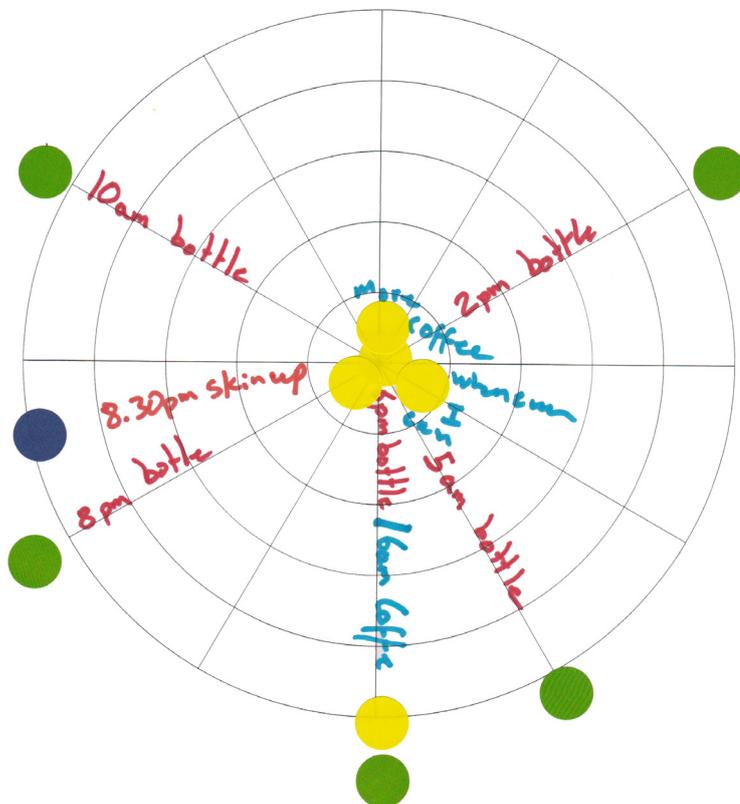
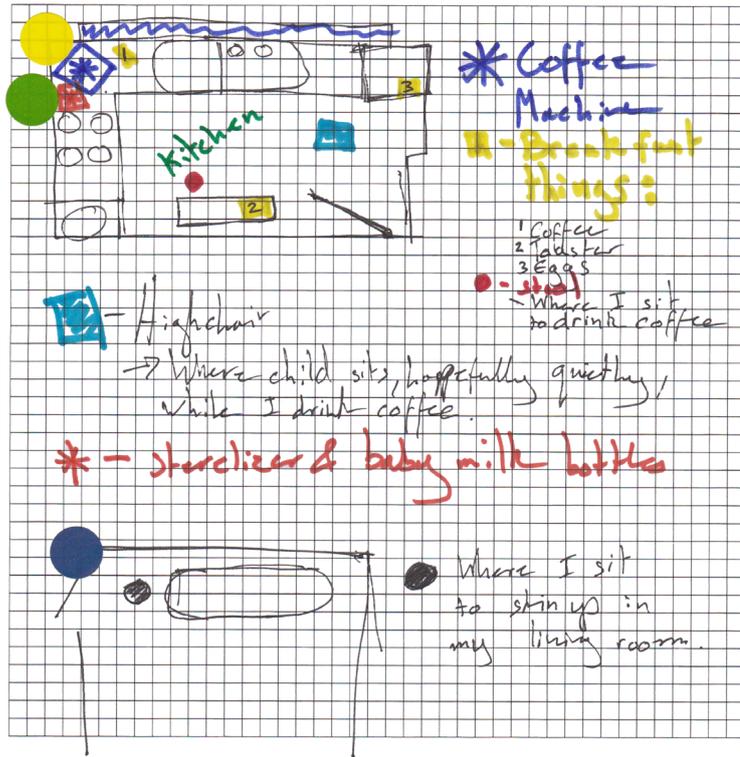
● Word.

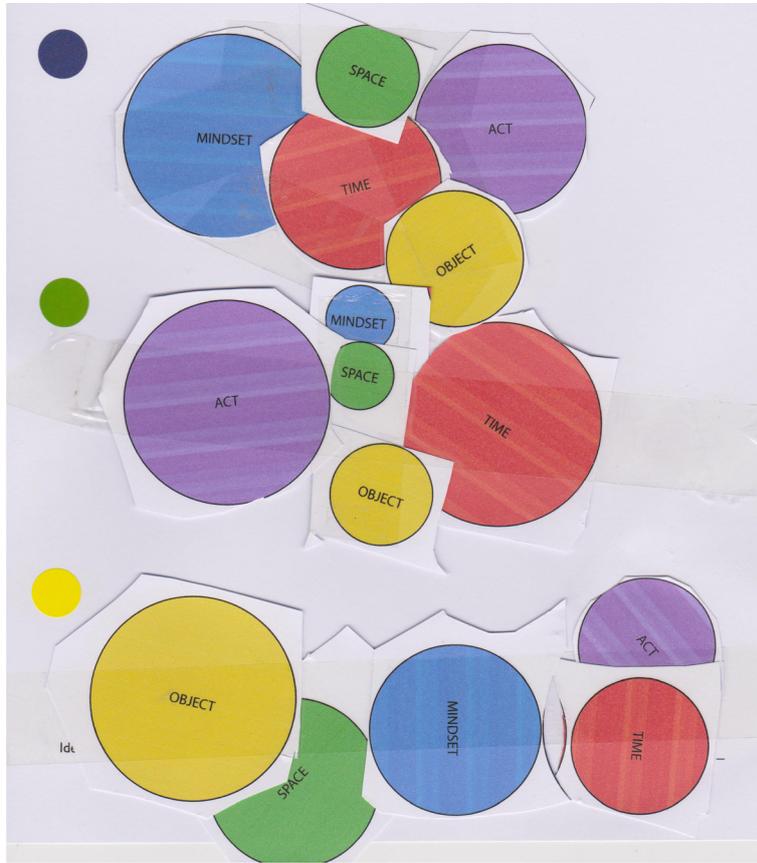
This is an image of the equipment & materials I use to make my daughter's milk. 5 times a day. As a full-time father for 6 months, this forms an important part of my day & has significant emotional connotations. best



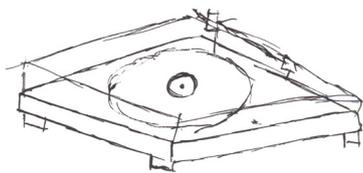
● Dear Friend,

On the reverse is an image of my coffee machine. I love it. It makes amazing coffee. I use it everyday & the simple act of using it seems to help me wake up.  
ipm,





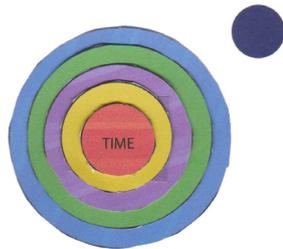
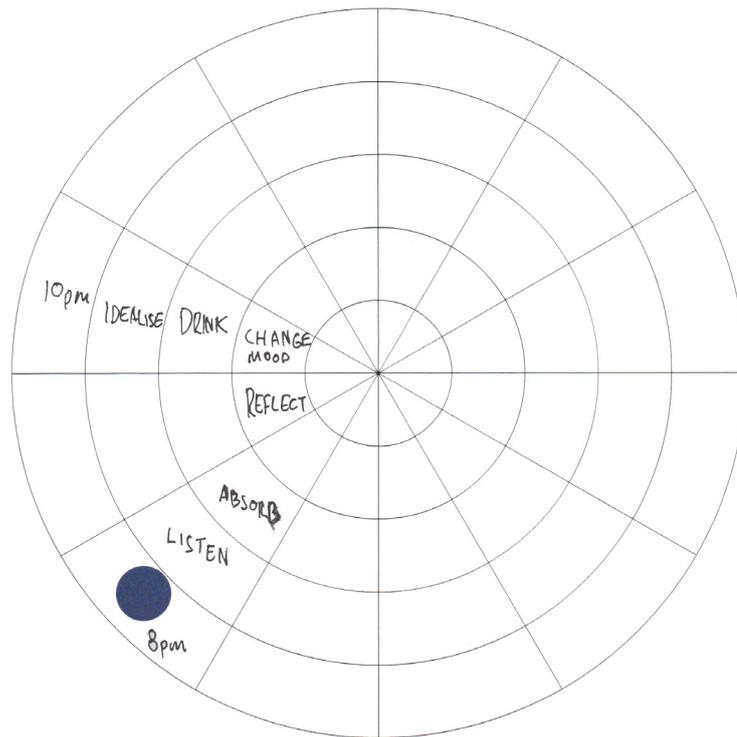
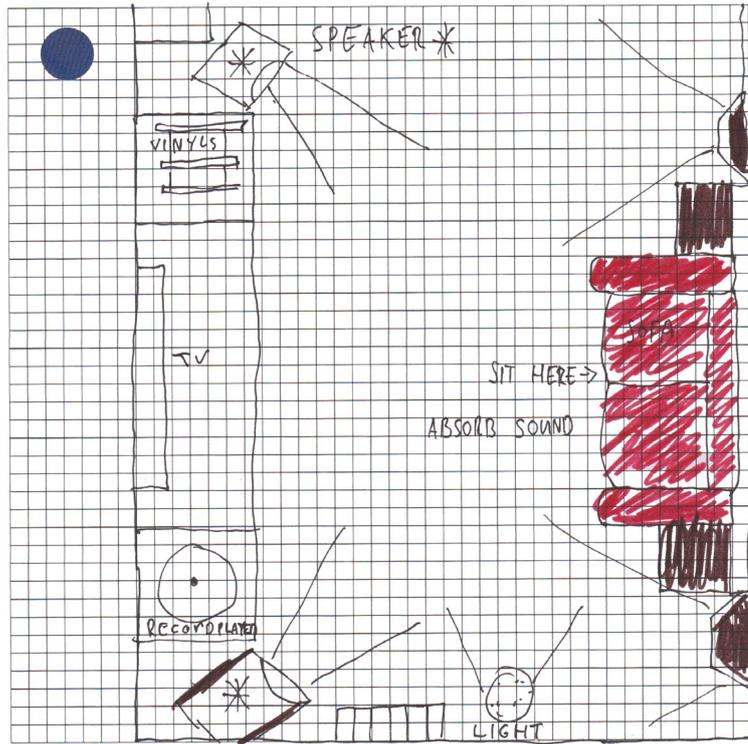
## Participant E



RECORD PLAYER

MR Record player.

Music defines my emotional state, and i find it helps me to understand the rythm of the physical world around me. Vinyls have a way of creating a ritualistic approach to taking in music in a way that defies the consumerist world we exist in. It brings me solace and the environment i listen to it in is my own creation.



The ritual of listening to music on my record player allows me to free myself psychologically from the other routines I participate in society.

It is a necessity to remove the debris that collects in the mind.

## Appendix H - 5.3.1: IoT/Practice Design Workshops Tools

<p> <b>smartphone</b></p>  <p>media</p> <p>A mobile phone with an advanced mobile operating system which combines features of a personal computer with other features useful for mobile or handheld use</p>	<p> <b>bed</b></p>  <p>furniture</p> <p>A piece of furniture used as a place to sleep or relax.</p>	<p> <b>chair</b></p>  <p>furniture</p> <p>A piece of furniture with a raised surface, commonly used to seat a single person.</p>
<p> <b>tableware</b></p>  <p>food preparation</p> <p>Tableware is the dishes or dishware used for setting a table, serving food and dining.</p>	<p> <b>cookware</b></p>  <p>food preparation</p> <p>Cookware and bakeware are types of food preparation containers, commonly found in a kitchen.</p>	<p> <b>shelves</b></p>  <p>furniture</p> <p>A flat horizontal surface used for display and storage of objects.</p>
<p> <b>newspaper</b></p>  <p>media</p> <p>A serial publication containing news, other informative articles and advertising.</p>	<p> <b>coffee/tea set</b></p>  <p>food preparation</p> <p>A coffee/tea set, in the Western tradition, is a set of dishes sold in a group for use at afternoon tea or a formal tea party. A tea set includes up to 25 objects.</p>	

<p> <b>doing housework</b></p>  <p>environment</p> <p>Keeping the domestic space clean and tidy through dusting, hoovering, mopping, washing etc.</p>	<p> <b>listening to music</b></p>  <p>environment</p> <p>Listening to music across a variety of conditions, including together or alone, through speakers or headphones, for background music or centre of attention etc.</p>	<p> <b>opening the curtains</b></p>  <p>environment</p> <p>Usually in the morning when waking up, but can be opened and closed at other times for a range of reasons.</p>
<p> <b>adjusting lighting</b></p>  <p>environment</p> <p>Altering the brightness of a space to suit a number of conditions such as environment, time, activity and people.</p>	<p> <b>leaving a note</b></p>  <p>media</p> <p>Leaving a short message for someone on a piece of paper that they will see later.</p>	<p> <b>sharing a drink</b></p>  <p>food/drink</p> <p>Having a number of drinks (non-alcoholic or alcoholic) with one person or a group of people over a prolonged period of time.</p>
<p> <b>putting keys away</b></p>  <p>environment</p> <p>Placing keys somewhere safe when arriving home/work.</p>	<p> <b>cooking for guests</b></p>  <p>food/drink</p> <p>Preparing, cooking and sharing food with friends over the course of a meal.</p>	

<p> <b>toilet</b></p>  <p>private</p> <p>A toilet is a room used for urination and defecation. Toilets often include a sink for handwashing and may also be part of a bathroom.</p>	<p> <b>hallway</b></p>  <p>public</p> <p>The entrance hall of a house is the space next to the front door or vestibule leading to the rooms directly and/or indirectly.</p>	<p> <b>bathroom</b></p>  <p>private</p> <p>A bathroom is a room for personal hygiene activities, generally containing at minimum a toilet and sink. A bathroom may also contain a mirror, a bathtub or a shower, and possibly also a bidet.</p>
<p> <b>kitchen</b></p>  <p>public</p> <p>A kitchen is a room or part of a room used for cooking and food preparation. In the West, a modern residential kitchen is typically equipped with a stove, a sink with hot and cold running water, a refrigerator, counters and kitchen cabinets</p>	<p> <b>back garden</b></p>  <p>public</p> <p>A back garden is a residential garden located at the rear of a property, on the other side of the house from the front garden.</p>	<p> <b>living room</b></p>  <p>public</p> <p>In Western architecture, a living room, also called a lounge room, lounge or sitting room, is a room in a residential house or apartment for relaxing and socializing.</p>
<p> <b>children's room</b></p>  <p>private</p> <p>A child's room is usually a bedroom within a house or other dwelling set aside for an infant or toddler and is generally the smallest bedroom in the house.</p>	<p> <b>bedroom</b></p>  <p>private</p> <p>A bedroom is a room of a house, where people sleep. A typical Western bedroom contains as bedroom furniture one or two beds, a clothes closet, a nightstand, and a dresser.</p>	



### birthday



A birthday is an occasion when a person or institution celebrates the anniversary of their birth.



### breakfast



Breakfast is the first meal of a day, most often eaten in the early morning before undertaking the day's work.



### weekend

SATURDAY	SUNDAY

The weekend is the part of the week devoted to rest. In most of the Western world the weekend is Saturday and Sunday.



### winter



Winter is the coldest season of the year in polar and temperate climates, between autumn and spring.



### spring



Spring is one of the four conventional temperate seasons, following winter and preceding summer.



### evening



Evening is the period of time near the end of the day, usually from 6:00 PM to night time.



### friday



Friday is the day after Thursday and the day before Saturday. In countries adopting Monday-first conventions it is the fifth day of the week.



### sunset



daily

Sunset or sundown is the daily disappearance of the Sun below the western horizon as a result of Earth's rotation.

**THE GOOD NIGHT LAMP**



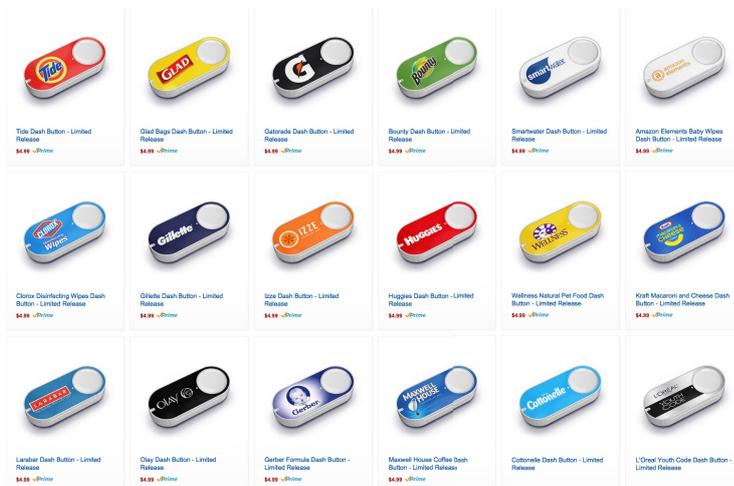
**The Good Night Lamp is an ambient communication tool for your global family & friends. Turn a Big Lamp on and Little Lamps which you've given away turn on too, anywhere in the world.**

**THE NEST LEARNING THERMOSTAT**



**The Nest Learning Thermostat doesn't need programming. It learns your schedule and uses Wi-Fi to connect to your phone. It's better than smart. It's thoughtful.**

**AMAZON DASH BUTTON**



**Amazon Dash Button is a Wi-Fi connected device that reorders your favorite product with the press of a button.**



Resdesigning the Practice of Everyday Life:  
A research project investigating the Internet of Things in the Domestic Space

I would like to invite you to participate in this project, which is concerned with your understanding and attitudes towards the Internet of Things, your rituals and routines in your homes and the objects that are important to these acts. I am also interested in how much interest you feel towards the various futures the IoT promises.

Why am I doing the project?

The project is an important part of the final development of my PhD at the Royal College of Art. It is hoped that the project could provide useful in guiding the development of an alternative method for engaging with the field of the Internet of Things and creating products and infrastructures that makes human interaction integral to this system.

What will you have to do if you agree to take part?

Take part in today's workshop session and, if you agree, further research project work.

1. We will conduct today's 6 hour long workshop, consisting of group and solo work through drawing, storyboarding, acting etc.
2. This workshop will focus on rituals, routines, acts and how you use your home. We will also engage with the concept of the Internet of Things, mental models and how human activities fit into this developing field.
3. When I have completed the analysis of this workshop, I will develop another project based on these results and a PhD Thesis after this. You are welcome to take part in the next part of the project and to receive a copy of the thesis.

How much of your time will participation involve?

One workshop session lasting no more than 6 hours including breaks and refreshments.

Will your participation in the project remain confidential?

If you agree to take part, your name may be recorded on the materials but the information will not be disclosed to other parties.

Your responses to the questions will be used for the purpose of this project only.

You can be assured that if you take part in the project you will remain anonymous.

What are the advantages of taking part?

You may find the project interesting and enjoy answering questions about the things you do in your home. You will learn about the Internet of Things and how this field could develop.

Are there any disadvantages of taking part?

You may not be comfortable talking about personal routines and objects.

Do you have to take part in the study?

No, your participation in this project is entirely voluntary. If you do not wish to take part you do not have to give a reason and you will not be contacted again. Similarly, if you do agree to participate you are free to withdraw at any time during the project if you change our mind.



Royal College of Art  
**RESEARCHRCA**

For further information contact:  
 Supervisor:  
*Prof. Ashley Hall,*  
*Innovation Design Engineering,*  
*ashley.hall@rca.ac.uk*

01/10/2016

*Redesigning the Practice of Everyday Life*

**Workshop Consent Form**

I (*please print*).....have read the information on the research project The Internet of Things in the Domestic Space, which is to be conducted by Michael Kann from the Royal College of Art, and all queries have been answered to my satisfaction.

I agree to voluntarily participate in this research and give my consent freely. I understand that the project will be conducted in accordance with the Information Sheet, a copy of which I have retained.

I understand that I can withdraw from the project at any time, without penalty, and do not have to give any reason for withdrawing.

I consent to:

- Take part in a 6 hour long workshop.
- Give personal information if required.
- Allow all materials developed by me to be used for the development of the research project.

I understand that all information gathered from the survey will be stored securely, my opinions will be accurately represented. Any images in which I can be clearly identified will be used in the public domain only with my consent.

Print Name:.....

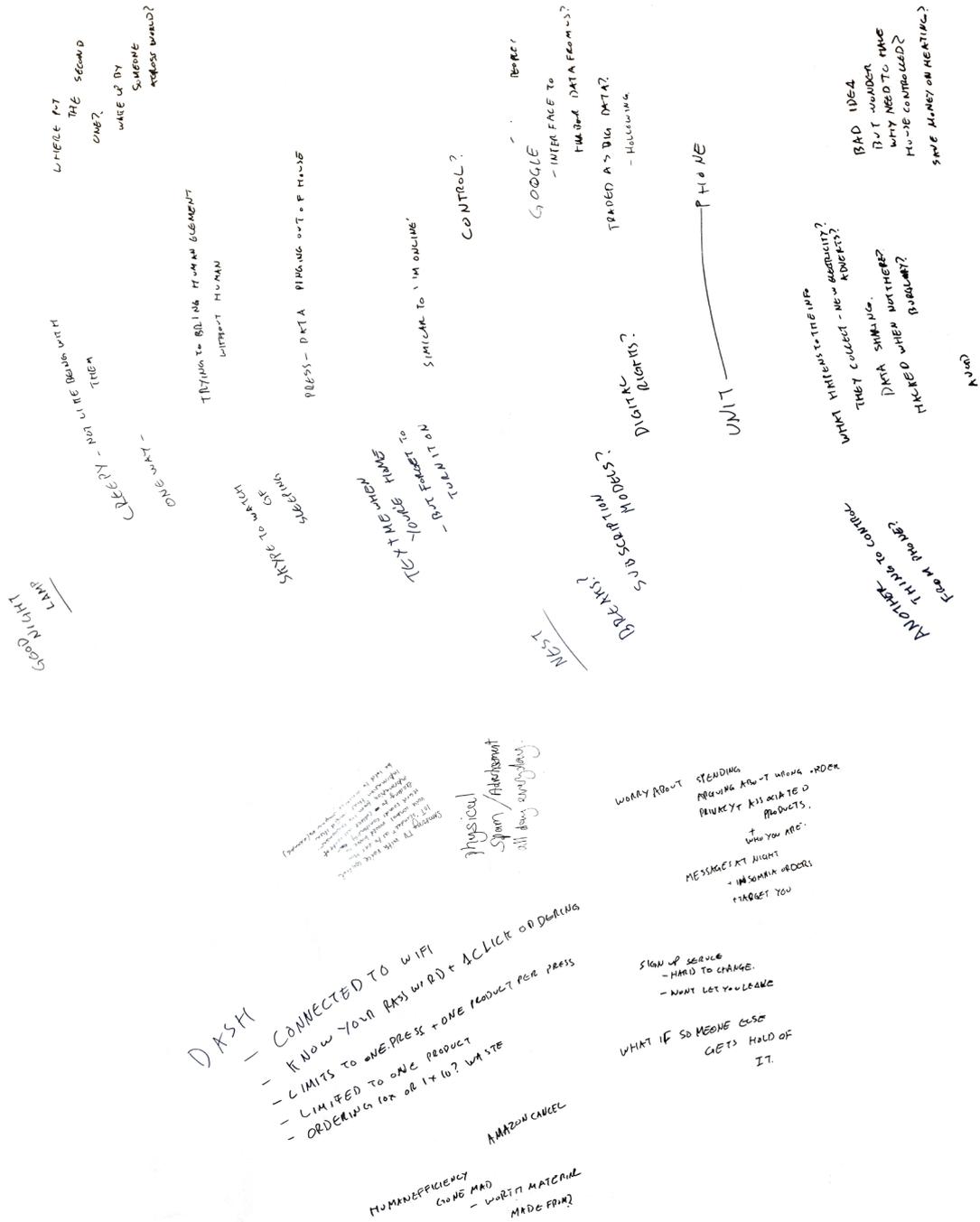
Signature.....

Date: .....

This project will be conducted in compliance with the Research Ethics Code of the Royal College of Art.

# Appendix I - 5.3.1.1: SPACE Design Workshop Responses

Participant IoT knowledge and attitudes were explored by discussing the Amazon Dash, the Nest Learning Thermostat and the Goodnight Lamp. Group discussions then explored opinions on desirable and undesirable aspects of the IoT, recorded on a flipchart for later individual voting for qualities considered most important. This determined IoTUGV to inform development of a product inspired by their practice and modelling this within an IoT system to explain it's behaviour in different scenarios, a technique applied to understand user trust of the IoT. Participants presented these for discussion, describing positive and negative aspects of their concepts and comparing these to the IoTUGV.



IoT (-VE)

- AS TIME CONSUMING AS SAVING ●
  - FAILURE - CANT FIX IT ●
  - OBSOLETE QUICKLY
  - GOING "OFF GRID" IS HARDER
  - SUBSCRIPTIONS + ENDLESS PAYMENTS... ●
  - DATA
  - SECURITY
  - Power electric usage
  - ACCESS TO TECHNOLOGY > REGULATED > FURTHER STRATIFICATION > INEQUALITY ●●●
  - decrease human interactions ●●●●●
  - PRIVACY ●●●●
  - how next generation learn about the world (just accept all been prepared & sorted)
  - become so ingrained in society that you can't escape from it (ie smart phone)
  - DISPOSAL AND "RECYCLING" OF ALL CURRENT AND FUTURE OUTDATED TECHNOLOGY
  - MINING FOR MINERALS & RAW MATERIALS FOR TECH (HUGE ISSUE) > WAR ●
  - INDIVIDUALITY without knowing the consequences in the world ●
- in context for example TOPIC RELEVANCE FIELDS IN CHINA

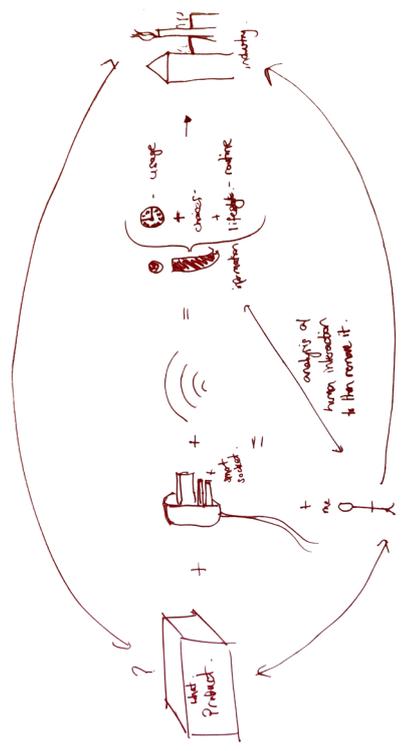
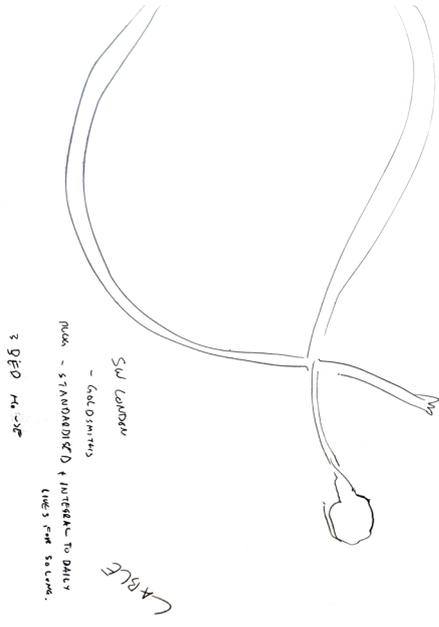
IoT (+VE)

- CONVENIENCE ●●●
- SPEED
- OBJECTS MORE INTERACTIVE - NICER
- MORE FREE TIME
- SAVING MONEY
- SAVING TIME ●●●
- COMMUNICATING PASSIVELY
- AUTOMATION ●●●
- WALLACE + GROMIT ●
- MAKES NEW OBJECTS - INSPIRE INNOVATION?
- ACCESSIBILITY + CONTROL ●●
- ADVANCE SCIENCE + KNOWLEDGE THROUGH DATA COLLECTION ●●●
- PATTERNS WE DONT REALISE.
- HOW PEOPLE INFLUENCE ENV. + HOW ENV. RESPONDES.
- IMPROVE EXPERIENCE OF LIFE IN HOME
- Improve safety of objects

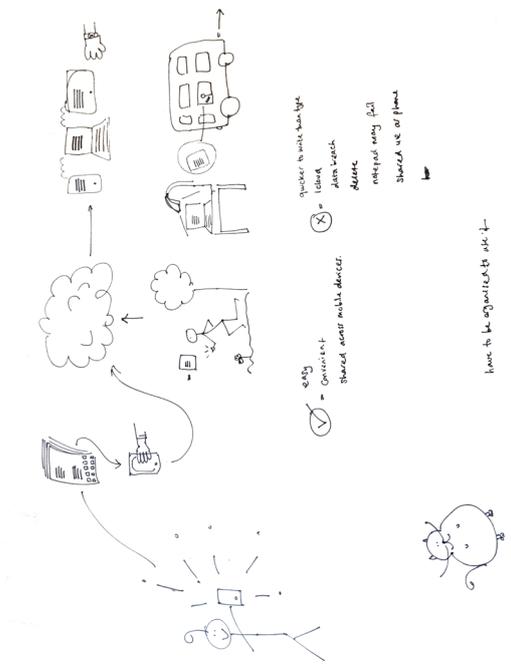




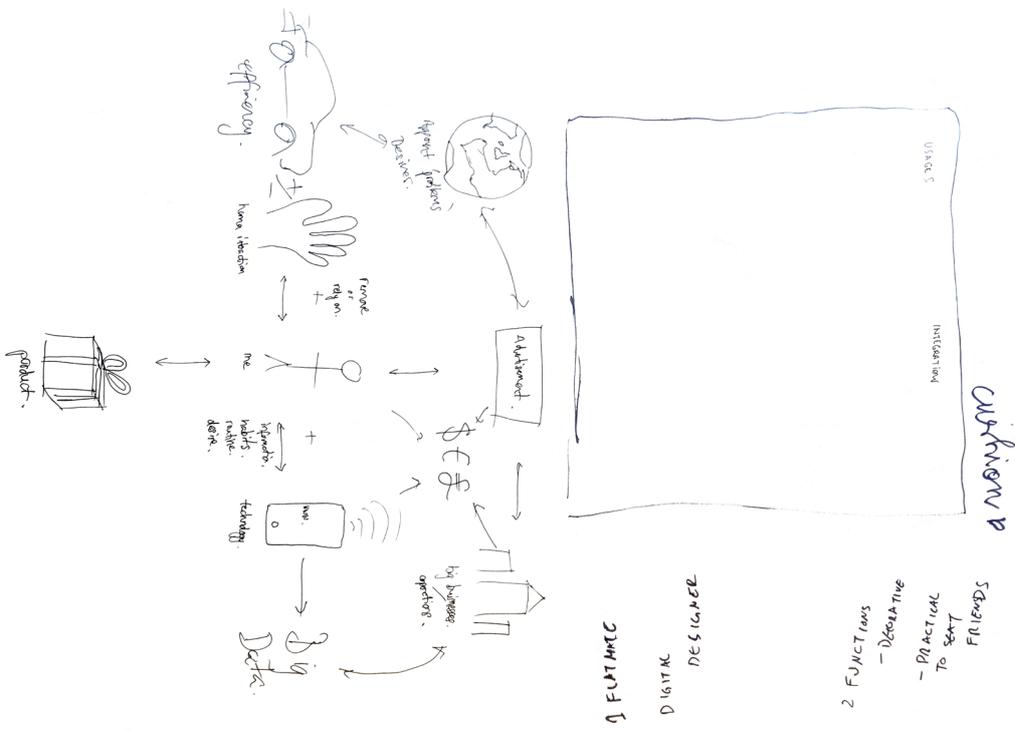
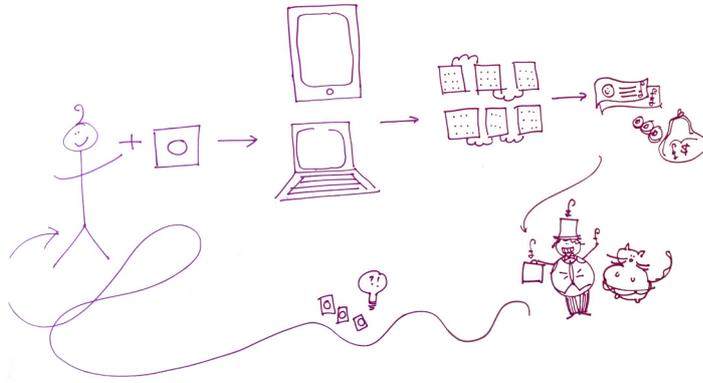
# Participant E



# Participant F



# Participant G



## Appendix J - 5.3.1.1: SPACE Design Workshop Analysis

PA - Toothbrush 1 – Similar, collects data in system to give you information. But the promise of tech to solve problems creates more problems. Those who need access to how to best meet oral hygiene around the world. The negative is that this is only accessible for a select group of people, so it drives stratification.

PB - Ring – Difficult to visualise IoT as there are so many ingredients. Concerned with information being shared and conspiracy? IoT is selling us unnecessary things. The IoT ring has a holistic function to the self – this is more important than function, control, light or touch less payments. The object will tell you how you are feeling, the weather etc., but no app – just look outside!

PC - Toothbrush 2 – Capacity to detect bacteria, gives feedback on brushing. Although this might mean that the object is taking over what you do. Takes skill away as so reliant on tech to tell you how to do something. Perhaps the best thing is to only give feedback when you make mistakes. This type of technology acts as an authority – it disempowers. (I imagine this is due to the infallibility of tech ideal we have.)

PD - Earphone – Collecting data based on how and when used (phone, mp3, laptop etc.) Where and when used (working out, walking, working) and how loud. Can change depending on the environment and through this it can be safer so you can hear around you if needed. Reminds you of proper sound levels and turns itself off automatically. Can be controlled by the user too, but automatic mostly. Live processing of sound & vision and can collect data on heart rate too to understand the emotions that are happening based on outside forces – what makes you calm, angry etc. and change music to alter emotional state. Positive – you can take it off if you don't like it or it doesn't learn properly. But you could become dependent on it? Could be in earphone or smartphone, but would be locked into ecosystem (like apple v Samsung v Google.)

PE - Smart Plug Socket – How to begin to analyse products and human interaction to take away human interaction. Supplying for user will be taking away our understanding of them. Positive – greater scientific knowledge and understanding, but this will be directed towards making new products we don't need. The understanding of the human element is the exception.

PF - Notebook – Apart from data, stuff needs to be managed and organised. Automatically deleting duplications? People think they've got a lot on because it's not done. Can't turn a page and cross through it. This is important. If it is automated to delete emails when they're "done" and makes those decisions it would be bad. I want control. Irritated when systems insist on doing things the new way that has been decided by others. We all work in different ways and should be given choices.

PG - Internet of cushions. Secure as uses encryption and is not reliant on a database that stores the info. Wants cushions to be used, talk to other cushions. 3 modes of interaction as per drawing. Can share hugs. Connected to IoT can bring people closer and send emotions.

### PA

#### OBJECT:

Toothbrush

#### PRODUCT:

Smart Toothbrush

#### Pro:

Detects Bacteria and gives feedback on tooth brushing  
Tracks your data  
Reminds you to book dentist appointments  
Recommends specific toothpastes

#### Con:

Has an influence on your daily routines  
Capable of modifying habits  
It has control over what kinds of data is produced

### MENTAL MODEL

Includes human/data/business and Internet. Internet is at the centre and everything is connected via it.

It's a mapping of the structure of the IoT on a larger scale (systemic) rather than re: the use of the object (specific.)

No (or uni) directionality between the nodes, but different paths that can be taken - i.e business can impact upon a person through the internet, the objects or through data.

### THEMES

Data ownership

Reliance on technology to instruct our practices (it only tells you if a mistake is made?)

Technology as an infallible authority.

### PB

#### OBJECT

Gold ring, given to her via mother's family. A napoleonic ring that used to have poison in it. No function, but if she doesn't wear it it feels weird.

#### PRODUCT

Smart Ring

Could function as light/torch; oyster/wireless payments; alcohol monitor; sports tracker; apple watch equivalent, music controller and can change colour.

Pro:

Hands free (but for what?)

Can collect information without the need to communicate it explicitly.

Con:

You might start to believe the apps more than yourself

Individualistic - doesn't encourage social interaction

Data can be sold for personalised advertising

A sense of loss if it's forgotten somewhere

### MENTAL MODEL

Includes person, IoT, object and capital/business

IoT is at the centre

Sceptical of "problems"

IoT provides persons with actual needs, adverts and "problems"

IoT sells data to capital and pushes solution into product

Capital drives "needs"

Interaction between the person and object causes adaptation, but also includes scepticism and time waste

### THEMES

Trust in system over self

IoT selling unnecessary things

IoT is hard to understand and visualise

Objects has holistic function to itself.

### PC

#### OBJECT

Toothbrush, as when they were travelling this was one of the only daily practices they had.

## PRODUCT

Smart Toothbrush

Should be cradle to cradle

Pro:

Collects data on caries in the user's mouth, bacteria, potential cavities, pH levels

Reminds user to floss

Warns if there are germs on it

Suggests changes to your routine to increase your health

Con:

Data collected in current system is for the company and would probably given falsified information (I think they means false feedback to promote sales?)

If it's a shareholder owned company, then it's likely to be made unsustainably to make cost of production lower and drive future sales

It's only accessible to a select group of consumers, so it drives stratification

## MENTAL MODEL

Abstract mapping! Includes the person, tech corp (google), private servers, satellites, animals (pets and in the wild) and plants.

Google and server have a bidirectional link, as do the server and IoT device, while the satellite links Google and the IoT device.

Users in one way link - only providing information to the IoT device (perhaps a lack of feedback/ownership)

Advertising - "You want this" appears through the PC screen

Refers to organic elements as "Hosts" suggesting IoT is a parasite?

## THEMES

Sustainability of materials, built in obsolescence and cradle to cradle

Data ownership

Lack of trust in companies

Promise of tech to solve problems causes more problems

Advertising

Social issues - are these being implemented in the areas that need it most?

## PD

## OBJECT

Earphones

## PRODUCT

IoT enabled bluetooth earphones. Can be controlled by the user, but it is mostly automatic.

Pro:

Changes volume depending on environment (working out, walking, working)

Automatically limits to the proper sound levels

Uses HR monitor to understand emotions and change music to suit it

Can be removed if user doesn't like it or the earphones don't learn properly

Con:

User could become dependent on it

User could be locked into the manufacturer's ecosystem (Apple/Google/Samsung etc)

### MENTAL MODEL

Object and person - in usage.

Object senses context - environment of use, when used and how, location of object.

Collected data from individual user's behaviour and learns through activity and user inputted data - it becomes more humanised.

Object, person, company, home all in supply chain

### THEMES

Context of environment and use

Emotion and humanisation

Senses usage from the individual

Dependence on the object and the company - becoming locked in

### PE

#### OBJECT

4-Gang power extension cord

#### PRODUCT

Smart electricity socket

Pro:

It can analyse the products that we use that have power supplied to them

Can provide a greater scientific understanding of the human element of this

Provides more choices and information into our lifestyles and routines

Con:

Analysis of human interaction could be to remove it!

Information provided may be directed towards making new products that we don't need

### MENTAL MODEL

Includes human, product and smart socket in bidirectional link, plus industry, plus information.

Product and smart socket and wifi equals information which feeds to industry.

Industry links to product, product links to human and industry and then back.

### THEMES

Greater understanding of human interaction

Loss of human interaction

### PF

#### OBJECT

Notebook - specific way and practice of use to organise time and thoughts.

#### PRODUCT

Smart Diary

Pro:  
Easy  
Convenient  
Shared across mobile devices  
Quicker to write than type  
Automatically deletes duplicated information

Con:  
Data breaches  
Notepad may fail  
Can't turn a page or cross through things - important  
If it's automated to delete emails when it thinks they're "done" (the event has passed or email read) it would be bad ("I want control")  
If the system does things in a way decided by others.  
You have to be organised to use it.

#### MENTAL MODEL

Person/object linked to PC to servers to money to businessman caricature, then a long meandering route back to the person/object with new ideas (Perhaps software/hardware changes to the product?)

#### THEMES

Control of details  
Dislike of imposed systems and practices  
Physical interaction is important  
Privacy/Trust  
Power

#### PG

#### OBJECT

Cushion

#### PRODUCT

Smart cushion - it wants to be used!  
2 functions - decorative and practical to seat friends  
3 modes of interaction  
Can share hugs

Pro:  
Connected to IoT - can bring people closer together and send emotions  
Can wake you up  
Secure as uses encryption and not reliant on a database that stores your information and could be breached.

Con:

#### MENTAL MODEL

Person at centre, includes technology, product, human interaction, efficiency, advertisements, money, big business and data.

Product and technology are separate  
 Adverts to target “apparent problems” via efficiency  
 Human interaction and efficiency are paired and then link to Human...  
 This link removes or relies on...  
 Technology and person, which are also linked. This detects information on habits, routines and desires.  
 Advertising is fed by tech, big data, person & big business.  
 The product is isolated.

THEMES

Security/Privacy  
 Human interaction (Loss or dependence on it)  
 Emotion to connect people  
 Advertising and apparent desires

WS01 Product Feedback  
Amazon Dash

EASY	LOSS OF SOCIAL/PHYSICAL	CONTEXT AND
ASSISTIVE	INTERACTION	ENVIRONMENT
AUTOMATION	SECURITY & DATA	EMOTION
EMOTION	OWNERSHIP	OBJECT DEPENDENCE
SOCIAL	CHANGING PRACTICES	ADVERTISING
	EXPLOITATION	DATA
	DEPENDENCE	INTERACTION
		SOCIAL
		TRUST

Comments & Feedback

Human efficiency gone mad - is it worth the material it is made from?  
**EASY, AUTOMATION, CHANGING PRACTICES, INTERACTION (LOST)**

Sign up service - hard to change, won't let you leave.  
**TRUST, EXPLOITATION, DEPENDENCE**

Worry about spending; arguing about a wrong order; privacy, associated products and who you are.  
**SECURITY AND DATA OWNERSHIP, DATA, ADVERTISING, INTERACTION**

Targeting insomniacs with messages at night to encourage spending.  
**EXPLOITATION, DATA, EMOTION,**

What if someone else gets hold of it?  
**SECURITY AND DATA OWNERSHIP, DEPENDENCE, INTERACTION, TRUST**

Physical spam/advertisement all day everyday.  
**TRUST, EXPLOITATION, INTERACTION, DATA, SECURITY AND DATA OWNERSHIP**

Samsung TV with voice control IoT “Scandal” as to hear the voice control would have to record sounds constantly leading to collect all sorts of information from the environment. Information that would be then sold to insurance companies (example.)  
**TRUST, EXPLOITATION, AUTOMATION, INTERACTION, SECURITY AND DATA OWNERSHIP,**

Goodnight Lamp

Comments and Feedback

Creepy - not like being with them.  
**SOCIAL, EMOTION, LOSS OF SOCIAL/PHYSICAL INTERACTION, INTERACTION**

One way.  
**LOSS OF SOCIAL/PHYSICAL INTERACTION, DEPENDENCE, OBJECT DEPENDENCE,**

Trying to bring a human element without human presence.  
**LOSS OF SOCIAL/PHYSICAL INTERACTION, SOCIAL, CHANGING PRACTICES, INTERACTION (NONE?)**

Where to put the second one?  
**EMOTION, SOCIAL, SECURITY/DATA OWNERSHIP, CHANGING PRACTICES, DEPENDENCE, CONTEXT AND ENVIRONMENT, TRUST**

Wake up someone across the world?  
**EMOTION, SOCIAL, CHANGING PRACTICES, INTERACTION, ASSISTIVE, LOSS OF SOCIAL/PHYSICAL INTERACTION,**

Similar to "I'm online."  
**SOCIAL, CHANGING PRACTICES, INTERACTION, CONTEXT AND ENVIRONMENT,**

Tell me when you're home - but forget to turn it on.  
**EMOTION, SOCIAL, CHANGING PRACTICES, INTERACTION, CONTEXT AND ENVIRONMENT, TRUST,**

Press - data pinging out of the house.  
**TRUST, SECURITY/DATA OWNERSHIP,**

Skype to watch girlfriend sleeping.  
**TRUST, EMOTION, SOCIAL, CHANGING PRACTICES, LOSS OF SOCIAL/PHYSICAL INTERACTION,**

Control?  
**TRUST, AUTOMATION, EXPLOITATION, SECURITY/DATA OWNERSHIP, DATA**

#### Nest Thermostat

##### Comments and Feedback

Unit ----- Phone  
**INTERACTION, LOSS OF SOCIAL/PHYSICAL INTERACTION, SECURITY/DATA OWNERSHIP, DATA**

What if it breaks?  
**EXPLOITATION, SECURITY/DATA OWNERSHIP, AUTOMATION**

What is the subscription model?  
**EXPLOITATION, SECURITY/DATA OWNERSHIP, TRUST**

What about digital rights?  
**EXPLOITATION, SECURITY/DATA OWNERSHIP,**

Google (not good people?) - an interface to harbour data from us.  
**INTERACTION, SOCIAL, CHANGING PRACTICES**

Traded as big data - hollowing.  
**EXPLOITATION, SECURITY/DATA OWNERSHIP, AUTOMATION, TRUST**

What happens to the information they collect? New electricity? Adverts?  
**ADVERTISING, EXPLOITATION, SECURITY/DATA OWNERSHIP, TRUST**

Data sharing - hacked when not here? Used to help burglary?  
**SECURITY/DATA OWNERSHIP, TRUST, EXPLOITATION, OBJECT DEPENDENCE, CHANGING PRACTICES**

Another thing to control from your phone.  
**LOSS OF SOCIAL/PHYSICAL INTERACTION, OBJECT DEPENDENCE, CHANGING PRACTICES**

Bad idea, but wonder why there's the need to have the house controlled like this? To save money on heating?  
**AUTOMATION, EASY, ASSISTIVE, CHANGING PRACTICES, LOSS OF SOCIAL/PHYSICAL INTERACTION, EMOTION**

Combined +ve & -ve

Arranged by votes, positive are standard, negatives are italicised

*Decrease human interactions (5)*

*Privacy (4)*

*Access to technology > Regulated > Further stratification > Inequality (3)*

*Convenience (3)*

*Automation (3)*

*Advance science and knowledge through data collection (patterns we dont realise, how people influence environment) (3)*

*Access to technology > Regulated > Further stratification > Inequality (3)*

*Individuality without knowing consequences in the world (2)*

*Saving time (2)*

*Accessibility and control (2)*

*Wallace and Grommet (1)*

*Mining for minerals and raw materials fro tech (huge issues) > war in Congo for example, toxic industrial fields in China (1)*

*As time consuming as saving (1)*

*Failure - can't fix it (1)*

*Subscriptions and endless payments (1)*

*Speed*

Workshop01  
Detailed analysis of mental models

This workshop was useful but had some issues in organisation and materials - the card sets etc. were locked in the programme director's office, so the card game and alternative model weren't available.

The participants were mostly design students from RCA, Goldsmiths, CSM.

They mostly lived in shared flats with 1 - 3 other people.

They seemed to have some understanding of the IoT, material culture, manufacturing etc.

**Product list**

**PA - Smart Toothbrush**  
**PB - Smart Ring**  
**PC - Smart Toothbrush**  
**PD - Smart Earphones**  
**PE - Smart Power Socket**  
**PF - Smart Diary/notebook**  
**PG - Smart Cushion**

**Mental model observations and critiques**

**PA**

A simple model of the IoT, containing the key elements of person, object, data, business and Internet. This model has no direction on the links, so it could be assumed that they are bidirectional connections.

In this model the person is connected to business through the object, internet and data - all of which flow in both directions. This implies that business takes the information from the person via the object, internet and data and then feeds back to the person via the same paths.

The object connects to the person, business & internet directly and to data via the internet. This implies that the object is used and change by both the user and business, while the object is only connected to the data it generates via the internet, which feels not quite right. There is also the issue of the object being directly and indirectly linked to business, which isn't quite right.

Data connected to business, the person and internet directly. This suggests that the data is generated by the person and feeds directly and indirectly via the internet to business. This isn't quite right and ignores the physical object in data generation terms.

The Internet is central to the model, connecting all the elements. This creates duplicate paths (i.e. person and object are directly connected and also via the internet, which actually works -while object and business connected by internet and directly doesn't) The centrality of the Internet to the IoT is interesting, but too simplified to actually work.

Overall, some strong elements (contains key aspects of IoT, interesting positioning of Internet etc) but too simplistic to explain IoT and lacks directionality in links)

**PB**

A model that contains IoT, people and capital and object - missing data (although implied in links). A far more critical model and the participants position is made clear by the language used and pictograms (i.e. skull and crossbones next to capital.) There is also directionality, so it's easier to read the flows of info and connections. The object is also modelled as part of the system connected to the person only.

In this model the IoT is still central and links the capital, human and object elements.

The IoT connects to the person directly via mixed actual needs, adverts and "problems," while the person links to the IoT via collecting (presumably data.)

The IoT feeds this to capital via selling link. Capital then connects to the person via a link labelled "needs."

The IoT also feeds directly to the ring objects with a link labelled solution. This has a bidirectional link to the person, which is labelled adaptation, skepticism and time waste.

There are also two links off of the object that lead to nowhere, one flowing out (positive) and one in (failure.)

Overall, a much more critical model that addresses a few elements that we later discussed (advertising, false needs and problems.) It also raises the issue of the object adapting the person using it and vice versa, while data is only read from the person, rather than the object too. Finally, the dangling links off of the object are confusing and don't help.

#### **PC**

This model is the most abstract, as it is a very loose model containing business (Google HQ), a satellite, privately owned servers (representing data?), a laptop (representing object?), person, animals ( a dog and a blue whale), plants and a device that is an interface that collects data from its "host" - i.e. the organic elements of the model. This use of host makes the data/interface parasites?

The links between the parts are confusing, but do have directionality.

Google/Business links to the privately owned server directly and via satellite, and links to no other element. It also takes in information from the "hosts" via the satellite and transmits this to the private server. There are no other links.

The server links to the laptop (object?) via a two way connection - so the object feeds the server and the server feeds/instructs the object. The object is telling the person "You want this" - so another advertising system.

The other organic elements are not part of the system directly or via objects, but only to transmit data out to the satellite and then back to business.

Overall, this model isn't accurate but expressive of the creators position towards the IoT - from the conception of the data generation from "hosts," to the forced advertising represented by a hand coming out of the laptop holding a trinket and telling the person that they want it and the inclusion of other parts of the ecosystem that are outside the standard applications and models of the IoT.

#### **PD**

2 mental models from this participant - one of which details the use of the object and the other the supply chain method.

Supply chain is a standard delivery flow and so can be ignored. However, the reasons for the participant drawing this model is unclear as it was clearly specified to make an IoT model of the object.

The model of product interaction is mainly text & non-pictorial. It contains a person and the information collected via the individual and the environmental context (although the object doesn't feature I assume this is what deals with this element.)

The sensing about context (where I am, when I use it, where it is, should I take a break) determines specific elements - reduction of volume, when to stop playing etc.

The information collected from individual human behaviour changes the interaction with the object through learning through activity and the direct input from the person (hand fixed) leading to the object becoming more humanised.

This model is missing many of the elements that would make it more accurate, has few links between elements and no circularities included, so is actually pretty poor. However, the participant actually modelled the object rather than the system on the whole and understood the role that contextual and directly inputted information could play on the behaviour of the object.

#### **PE**

A model that focuses on the way that the product would work. It contains an existing product powered by electricity, the IoT smart socket object, wifi/internet, data derived from usage, choices

Information feeds directly to the industry.

The product connects bidirectionally with the person and industry by two different links - the use of the product and the influence it has on the person are represented, while the product is developed by industry and provides feedback to the industry. That second link is a bit odd without data or sustainability(C2C) element, which isn't there. Perhaps the information allows the industry to adapt the object based on this input, but the product still can't feed directly to industry.

There is a final bidirectional link between information and the person labelled "analysis of human interaction to then remove it." This implies that the person directly changes the information that goes to industry, as well as indirectly via the combination of product, smart socket, wifi and person. This information then flows back to the person, implying that this will inform them of how they interact with their objects (use of electricity in this case.)

This is an interesting model as it has the elements needed to model the IoT as a system, but also looks at how data that is generated from a few sources and that depends on wifi can lead to information that impacts the IoT. There is also the role of the analysis of human interaction to consider and how the participant has modelled this as being outside of the product derived information. Again, this is a flawed model but shows the concerns of the participant in the removal of human interaction.

#### **PF**

IoT model

The model of the IoT contains a person and their device, a pc, servers, money, business (represented by a drawing of a tycoon and a literal fat cat.)

The person and device are paired, the info generated goes to a pc/tablet etc, then to data stores, then to money, then to business and then from business flows back to the person. Along this long and meandering link there is a light bulb and few other objects - I think this represents a new idea?

This model is all unidirectional - a single flow in one direction. There are also some elements that are out of order - I would have thought the data generated would go to servers before a pc/tablet.

This isn't the best model of the IoT in representing how the elements link or affect each other, but it is the first to show money generated from data/servers and as separate from business. (WSO102 showed capital as synonymous with business.)

Object model

Contains a person, object, cloud, context, computers.

The person and object are linked and the use of the object (input of data, space used etc) flows to the cloud. The device alerts users to appointments via a desktop/server set up (to represent data?) The user is able to add information wherever they are - the park, on the bus etc.

Not the most useful model and doesn't take into account the model of the IoT that the participant had made, but useful in showing their concerns and how they envision they might use their product.

#### **PG**

Feels as if this participant had some experience with the IoT - his model of the whole system was pretty comprehensive. Contains person, product, technology, big data, big business, advertisements, money, the world, efficiency/human interaction.

The person is at the centre of the model, connected bidirectionally to the product, human interaction/efficiency pairing, technology and advertisements (I don't think the two way connection to ad's is quite right?).

The person is connected unidirectionally to money.

Technology connects unidirectionally to big data, implying the tech feeds this. This then flows to big business, which also flows back to big data - meaning that data influence the business and business influences the data (again not sure that this is right.)

Big business flows to money and advertising bidirectionally. Again, not sure this is right as big

Big business flows to money and advertising bidirectionally. Again, not sure this is right as big business would take money but not feedback to it and create adverts but not necessarily be influenced by them (unless buying into own hype)...

Adverts also flow unidirectionally to money, which isn't quite right, as it should surely go via the person...

Adverts flow bidirectionally to the planet, where it creates apparent "problems" and desires. I suppose that this flow both ways is that adverts drive desires and the state of the world? Perhaps this works...

Finally, efficiency/human interaction is connected bidirectionally by the apparent problems and desires and then flows to the person bidirectionally too. This implies that the efficiency is developed with human interaction to solve these apparent problems, which then affects the person at the centre of the model. The person's interaction also drives the efficiency/human interaction element (which should probably lead to data generated?)

There are also interesting comments on the links: Person to tech - information/habits/routines/desire; Efficiency/Human Interaction to person - remove or rely on.

Other observations: The product is isolated and not a part of the system, the product isn't paired with the technology element, human interaction isn't situated quite correctly.

Overall a really interesting mapping that again raises the issue of human interaction being diminished for the sake of efficiency and also makes money an explicit part of the model, rather than implied in data flowing from people to business or adverts to people.

### Combined Products Pro & Con & Themes

#### PRODUCT

##### PRO

Automatically deletes duplicated information  
Automatically limits to the proper sound levels  
Can be removed if user doesn't like it or the earphones don't learn properly  
Can collect information without the need to communicate it explicitly.  
Can provide a greater scientific understanding of the human element of this  
Can wake you up  
Changes volume depending on environment (working out, walking, working)  
Collects data on caries in the user's mouth, bacteria, potential cavities, pH levels  
Connected to IoT - can bring people closer together and send emotions  
Convenient  
Detects Bacteria and gives feedback on use  
Easy  
Hands free (but for what?)  
It can analyse the products that we use that have power supplied to them  
Provides more choices and information into our lifestyles and routines  
Quicker to write than type  
Recommends specific toothpastes  
Reminds user to floss  
Reminds you to book appointments  
Secure as uses encryption and not reliant on a database that stores your information and could be breached.  
Shared across mobile devices  
Suggests changes to your routine to increase your health  
Tracks your data  
Uses HR monitor to understand emotions and change music to suit it  
Warns if there are germs on it

##### CON

A sense of loss if it's forgotten somewhere  
Analysis of human interaction could be to remove it!  
Can't turn a page or cross through things - important

Capable of modifying habits  
Data breaches  
Data can be sold for personalised advertising  
Data collected in current system is for the company and would probably given falsified information (I think she means false feedback to promote sales?)  
Has an influence on your daily routines  
If it's a shareholder owned company, then it's likely to be made unsustainably to make cost of production lower and drive future sales  
If it's automated to delete emails when it thinks they're "done"(the event has passed or email read) it would be bad ("I want control")  
If the system does things in a way decided by others.  
Individualistic - doesn't encourage social interaction  
Information provided may be directed towards making new products that we don't need  
It has control over what kinds of data is produced  
It's only accessible to a select group of consumers, so it drives stratification  
Notepad may fail  
User could be locked into the manufacturers ecosystem (Apple/Google/Samsung et  
User could become dependant on it  
You have to be organised to use it.  
You might start to believe the apps more than yourself

### **THEMES**

Advertising  
Advertising and apparent desires  
Context of environment and use  
Control of details  
Data ownership  
Dependence on the object and the company - becoming locked in  
Dislike of imposed systems and practices  
Emotion and humanisation  
Emotion to connect people  
Greater understanding of human interaction  
Human interaction (Loss or dependence on it)  
IoT is hard to understand and visualise  
IoT selling unnecessary things  
Lack of trust in companies  
Loss of human interaction  
Objects has holistic function to itself.  
Physical interaction is important  
Power  
Privacy/Trust  
Promise of tech to solve problems causes more problems  
Reliance on technology to instruct our practices (it only tells you if a mistake is made?)  
Security/Privacy  
Senses usage from the individual  
Social issues - are these being implemented in the areas that need it most?  
Sustainability of materials, built in obsolescence and cradle to cradle  
Technology as an infallible authority.  
Trust in system over self

## WSO1 - Combined Products Pros & Cons & Themes ANALYSIS

### PRO Themes:

EASY  
ASSISTIVE  
AUTOMATION  
EMOTION  
SOCIAL

# ASSISTIVE - 13

## AUTOMATION - 8

INTUITIVE - 4  
SOCIAL - 4  
EMOTION - 3  
EASY - 3

### PRO CONCERNS

Automatically deletes duplicated information +  
Automatically limits to the proper sound levels +  
Can be removed if user doesn't like it or the earphones don't learn properly +  
Can collect information without the need to communicate it explicitly. + + +  
Can provide a greater scientific understanding of the human element of this +  
Can wake you up +  
Changes volume depending on environment (working out, walking, working) + +  
Collects data on caries in the user's mouth, bacteria, potential cavities, pH levels +  
Connected to IoT - can bring people closer together and send emotions + + +  
Convenient + +  
Detects Bacteria and gives feedback on use +  
Easy + +  
Hands free (but for what?)  
It can analyse the products that we use that have power supplied to them +  
Provides more choices and information into our lifestyles and routines + +  
Quicker to write than type +  
Recommends specific toothpastes +  
Reminds user to floss +  
Reminds you to book appointments +  
Secure as uses encryption and not reliant on a database that stores your information and could be breached.  
Shared across mobile devices +  
Suggests changes to your routine to increase your health +  
Tracks your data + +  
Uses HR monitor to understand emotions and change music to suit it + + +  
Warns if there are germs on it + +

### PRO CONCERNS with most themes affecting it

Uses HR monitor to understand emotions and change music to suit it + + +  
Can collect information without the need to communicate it explicitly. + + +  
Connected to IoT - can bring people closer together and send emotions + + +  
Convenient + +  
Easy + +  
Changes volume depending on environment (working out, walking, working) + +  
Provides more choices and information into our lifestyles and routines + +  
Tracks your data + +  
Warns if there are germs on it + +  
Automatically deletes duplicated information +  
Automatically limits to the proper sound levels +  
Can be removed if user doesn't like it or the earphones don't learn properly +  
Quicker to write than type +  
Recommends specific toothpastes +  
Reminds user to floss +  
Reminds you to book appointments +  
Shared across mobile devices +  
Suggests changes to your routine to increase your health +  
It can analyse the products that we use that have power supplied to them +  
Detects Bacteria and gives feedback on use +  
Collects data on caries in the user's mouth, bacteria, potential cavities, pH levels +  
Can provide a greater scientific understanding of the human element of this +  
Can wake you up +

**CON Themes:**

DEPENDENCE  
LOSS OF SOCIAL/PHYSICAL INTERACTION  
SECURITY & DATA OWNERSHIP  
CHANGING PRACTICES  
EXPLOITATION

DEPENDENCE - 9  
SECURITY/DATA OWNERSHIP - 8  
CHANGING PRACTICES - 7  
LOSS OF SOC/PHYS INTERACTION- 6

**EXPLOITATION - 9**

CON CONCERNS

- A sense of loss if it's forgotten somewhere +
- Analysis of human interaction could be to remove it! + + + +
- Can't turn a page or cross through things - important ++
- Capable of modifying habits +
- Data breaches +
- Data can be sold for personalised advertising + +
- Data collected in current system is for the company and would probably given falsified information (I think she means false feedback to promote sales?) + +
- Has an influence on your daily routines + + +
- If it's a shareholder owned company, then it's likely to be made unsustainably to make cost of production lower and drive future sales + +
- If it's automated to delete emails when it thinks they're "done"(the event has passed or email read) it would be bad ("I want control") + +
- If the system does things in a way decided by others + + + +
- Individualistic - doesn't encourage social interaction +
- Information provided may be directed towards making new products that we don't need + +
- It has control over what kinds of data is produced + +
- It's only accessible to a select group of consumers, so it drives stratification + +
- Notepad may fail +
- User could be locked into the manufacturers ecosystem (Apple/Google/Samsung etc) + + +
- User could become dependant on it + +
- You have to be organised to use it. +
- You might start to believe the apps more than yourself + +

Concerns with most themes affecting it

- Analysis of human interaction could be to remove it! + + + +
- If the system does things in a way decided by others + + + +
- User could be locked into the manufacturers ecosystem (Apple/Google/Samsung etc) + + +
- Has an influence on your daily routines + + +
- If it's a shareholder owned company, then it's likely to be made unsustainably to make cost of production lower and drive future sales + +
- If it's automated to delete emails when it thinks they're "done"(the event has passed or email read) it would be bad ("I want control") + +
- User could become dependant on it + +
- Data can be sold for personalised advertising + +
- Data collected in current system is for the company and would probably given falsified information (I think she means false feedback to promote sales?) + +
- Information provided may be directed towards making new products that we don't need + +
- It has control over what kinds of data is produced + +
- It's only accessible to a select group of consumers, so it drives stratification + +
- Notepad may fail +
- You have to be organised to use it. +
- You might start to believe the apps more than yourself +
- A sense of loss if it's forgotten somewhere +
- Can't turn a page or cross through things - important +
- Capable of modifying habits +
- Data breaches +
- Individualistic - doesn't encourage social interaction +

## THEME THEMES

CONTEXT AND ENVIRONMENT

EMOTION

OBJECT DEPENDENCE

ADVERTISING

DATA

INTERACTION

SOCIAL

TRUST

TRUST - 13

INTERACTION - 9

OBJECT/SYS DEPENDENCE - 8

DATA - 8

SOCIAL - 8

CONTEXT AND ENVIRONMENT - 6

EMOTION - 6

ADVERTISING - 4

## THEME CONCERNS

Advertising +

Advertising and apparent desires ++

Context of environment and use ++

Control of details ++

Data ownership +++

Dependence on the object and the company - becoming locked in ++

Dislike of imposed systems and practices +++

Emotion and humanisation ++

Emotion to connect people +++

Greater understanding of human interaction +++

Human interaction (Loss or dependence on it) +++

IoT is hard to understand and visualise ++

IoT selling unnecessary things + ++

Lack of trust in companies +++ ++

Loss of human interaction +++

Objects has holistic function to itself ++

Physical interaction is important +++

Power

Privacy/Trust +++

Promise of tech to solve problems causes more problems +

Reliance on technology to instruct our practices (it only tells you if a mistake is made?) ++

Security/Privacy ++

Senses usage from the individual ++

Social issues - are these being implemented in the areas that need it most? ++

Sustainability of materials, built in obsolescence and cradle to cradle +

Technology as an infallible authority ++

Trust in system over self +++

### Theme Concerns with most themes affecting it

Lack of trust in companies +++ ++

Physical interaction is important +++

Privacy/Trust +++

Data ownership +++

Dislike of imposed systems and practices +++

Emotion and humanisation ++

Emotion to connect people +++

Greater understanding of human interaction +++

Human interaction (Loss or dependence on it) +++

IoT selling unnecessary things + ++

Loss of human interaction +++

Trust in system over self +++

Advertising and apparent desires ++

Reliance on technology to instruct our practices (it only tells you if a mistake is made?) ++

Security/Privacy ++

Senses usage from the individual ++

Social issues - are these being implemented in the areas that need it most? ++

Context of environment and use ++

Control of details ++

Dependence on the object and the company - becoming locked in ++

IoT is hard to understand and visualise ++

IoT is hard to understand and visualise ++  
Objects has holistic function to itself ++  
Promise of tech to solve problems causes more problems +  
Sustainability of materials, built in obsolescence and cradle to cradle +  
Technology as an infallible authority ++  
Advertising +

#### Final Reflections on WS01: Conclusions & Take-aways

##### Participants

There were 7 participants - 3 men and 4 women.

6 of the 7 were involved in design or were design students at RCA, CSM, Goldsmiths.

Most lived in flats or house shares with other people. Only one lived alone.

##### Personal object/Practice

Participants brought a range of items with them that were a part of their daily routines and practices in the home. 6 of these were intimate items - 2 toothbrushes, a ring, earphone, a cushion, a diary/notebook.

These are all to do with contact with the body directly, for different reasons. It can be argued that they are all also to do with are to do with maintenance of the self (physically/emotionally/identity/future.) Some of the items were very personal and had a history (ring) others were personal with less history (diary) some seemed generic (earphones, toothbrush.)

Some were used daily in routines (toothbrushes etc) for a short time, others were used repeatedly throughout the day (diary, earphones) the ring was not so much part of a ritual (apart from putting on in morning/taking off at night and generally fiddling) but more to do with absence if not there - at edge of perception until not there.

The exception was a 4-gang power supply cable - the participant wanted to use power as this was something that was a big part of the home, surrounded him and he wanted to understand how he used it - he thought it could be an interesting source of data.

##### Existing Product Feedback

The participants discussed three existing IoT that had different takes on the IoT - the Amazon Dash button, the Goodnight Lamp and the Google Nest. I did this to introduce the breadth of the IoT to the group and also gauge their attitudes to it. I also hoped that later this information could help shape the direction to take this work in based upon their understandings, wants and concerns about the products and topics

The group seemed pretty critical towards them, seeing some benefits to them but focusing more on the negative aspects.

**Dash** - The Amazon Dash was seen to be a case of human efficiency gone mad, providing Amazon with the opportunity to physically spam the owner with adverts, even targeting people based on past patterns of use to encourage more spending. There were also concerns about the subscription model and the ease of quitting, the security of the physical item and the possibility of being spied upon or the data generated cross referenced and sold to relevant companies.

Themes: EASY, AUTOMATION, CHANGING PRACTICES, TRUST, EXPLOITATION, ADVERTISING, LOST INTERACTION, SECURITY AND DATA OWNERSHIP,

**Goodnight Lamp** - The Goodnight lamp was included to show how a product could focus on quality of interaction, social connections and experience rather than efficiency. Feedback was critical, but instead of focusing on trust, exploitation, security & data and advertising they were more concerned about what they seemed to think was the hollow social experience that it developed. Participants thought that it was creepy and was not like being with them, that it was a unidirectional relationship and lacked a human presence.

Themes: SOCIAL, EMOTION, LOSS OF SOCIAL/PHYSICAL INTERACTION, CHANGING PRACTICES, CONTEXT AND ENVIRONMENTS, TRUST, SECURITY/DATA OWNERSHIP

**Google Nest** - Google Nest was again criticised, but for different reasons to the other two products. The participants felt that it was an unnecessary way (i.e. via phone) to control the heating in a home and had reservations about the subscription model, users digital rights, mining and control of data, hacking of the device for burglary and unit obsolescence. Overall, the benefits were outweighed by the drawbacks in their opinions.

Themes: INTERACTION, LOSS OF SOCIAL/PHYSICAL INTERACTION, SECURITY/DATA OWNERSHIP, DATA, EXPLOITATION, CHANGING PRACTICES, TRUST, AUTOMATION, EASY, ASSISTIVE, EMOTION

#### IoT Positives & Negatives - List and voting

The participants and I discussed the positive and negative aspects of the IoT as a whole, rather than specific products. This discussion led to two lists of around 10-15 points. These lists revealed that there were some good things in the IoT in their opinion, while the negative elements echoed much of the feedback from the product analysis. I then asked everyone to vote on the points that they felt were the most important elements to either their positive or negative understandings.

From this we found the top concerns in the IoT to this group:

**Positive** - Convenience (3), Automation (3), Advance humanity's knowledge through data (3), Saving time(2), Accessibility and control (2), Wallace and Grommet (1).

**Negative** - Decrease human interactions (5), Privacy (4), Access to tech → social inequity (3), Individuality without knowing consequences in the world(2), Raw Materials (1), As time consuming as saving (1), Failure states - can't fix(1), Subscriptions and endless payments (1).

This suggests that the values the convenience of the IoT through automation to save time and allow accessibility and control, while rejecting the decrease in human interaction and privacy, querying the impact of the IoT on social striation and individuality and the cost of raw materials in making something that could be more time consuming to set up that the time it promises to save, could also eventually fail in a way that means it can't be fixed and needs endless payments to keep it running.

The interesting element here is that the negative points of this baseline of the IoT echo the issues that they raised in specific products, but the positive elements that they point out are not send as positive elements in the same products. This could mean a few things: the products positive aspects that align with their positive elements of the IoT are poorly implemented in the products (that is, the convenience of automation to save time and improve accessibility isn't implemented well enough in the products we discussed); that the positive aspects of the IoT are implemented well in the products but the negative elements eclipsed them to such an extent that the positive aspects were hidden in the shadows or (and this is my inclination) that they were expressing the commonly held position that the benefits the IoT brings are to do with convenience & automation, without really believing it and so not identifying it in the products we discussed.

This is an interesting observation, as it suggests that they don't believe that the selling point of the IoT is really that beneficial, even if they say that is it. This position aligns with the features and direction of the products that they developed based on their personal objects

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### Mental Models

The participants were asked to develop an IoT product based on their personal object that took into account what we had been discussing and that reflected their understanding of the current IoT and the way they would want an IoT product to work with their personal object that plays a part in their daily practice.

I also asked them to draw a mental model of the IoT and their product within this system. This would help to show how they understood the IoT to work and also help ground their product in this understanding.

The products were all Smart versions of the items that they had brought - Smart Toothbrushes, Smart Rings, Smart Cushions etc. Some focused on improving the effectiveness of the routine act (Smart Toothbrush) others aimed on improving the experience (Smart Cushion, Smart Earphones, Smart Diary) one looked at automation, efficiency and data sharing (Smart Socket) while another looked at improving data capture and organisation (Smart Diary.) There was a focus on intuitiveness, natural interfaces (as far as possible), emotion, social interaction and an improved experience of use - not necessarily on an increase in speed, convenience.

The mental models have been discussed in depth elsewhere. I think the most useful thing to summarise with this element of the workshop is the sheer confusion that this brought. There were a range of approaches (IoT in general, specifically for the product, supply chains etc) that all arranged the elements of the IoT in different ways. However, the majority contained the key elements of Person, Object, Data, Internet, Servers, Business/Capital, Advertising etc. Outliers included animals, plants.

The relationship between these elements was always different, with some showing a better understanding of the connections than others. However, there tended to be critiques within these models that pinpointed how the interactions between elements could have a negative impact. For example, in one model the IoT is fed by collected data from the person, which then feeds back to them as "apparent needs," which are driven by capital. In another model, the data is generated from "hosts," casting the data collecting companies as parasites. Finally, another model labels the link between the person and object as "efficiency/human interaction to person - Remove or rely on."

This shows that the group's understanding of the IoT as a system considers the commercial elements and drivers, not just the structure of the functional elements involved. There is also a large amount of criticality towards the IoT, in terms of business involvement, the promises it makes and whether they're necessary, the loss of social/physical interaction and the dependence that could be engendered in it. On the whole, this exercise shows their understanding and attitudes towards the IoT more than the list of positives and negatives.

### Pros & Cons of participants products

I asked the participants to list the positive and negative aspects of the products that they had developed so that I could later compare them to the positive and negative lists that we had written earlier. I also felt that this was a particularly useful exercise, as it involved a personal object from their home they had a routine/ritual with - so any ideas that they came up with would be situated in this context.

I used this information to make two large lists that collated all of the positive and negative aspects across all of the products. I hoped that this collection would help to show what the participants really thought about the IoT in terms of benefits and harms it could bring, rather than parroting the benefits that they'd been told about. Themes from this list were then identified, as common areas of interest and concerns started to emerge. This theming brought up six key positive topics and five key negative topics:

Positive - EASY, INTUITIVE, AUTOMATED, ASSISTIVE, EMOTION, SOCIAL

Negative - DEPENDENCE, LOSS OF SOCIAL/PHYSICAL INTERACTION, CHANGING PRACTICES, SECURITY/DATA OWNERSHIP, BUSINESS EXPLOITATION

The positive aspects have some commonalities with the earlier list - easy, intuitive, automated, assistive are all the language of convenience and making life easier. (NB there is a clear distinction between AUTOMATED and ASSISTIVE - one does it for you, the other suggests, guides or physically helps) However, the last two elements of EMOTION and SOCIAL didn't come up on the positive/negative list - these were revealed through this analysis.

The negative aspects echo the negative list - SECURITY/DATA OWNERSHIP, BUSINESS EXPLOITATION and LOSS OF SOCIAL/PHYSICAL INTERACTION were key parts of this list, but this exercise revealed the worry of DEPENDENCE and CHANGING PRACTICES. In the first instance the concern lies in relying upon a system or object to mediate life/physical world, while the second instance is about systems and methods imposed upon the user in the system, rather than the system changing for you. These are linked - as the user becomes dependent on the system/object, this changes the way in which the user interacts with the system, and so the practices they have.

## Themes

I also conducted the same analysis of the themes that I had asked the participants to write down re: their product, which resulted in the following themes: ADVERTISING, CONTEXT AND ENVIRONMENT, INTERACTION, DATA, OBJECT DEPENDENCE, EMOTION, SOCIAL, TRUST.

There are clear commonalities within this set and the previous set of themes.

ADVERTISING & TRUST have parallels with SECURITY/DATA OWNERSHIP, BUSINESS EXPLOITATION.

CONTEXT AND ENVIRONMENT have parallels with EASY, INTUITIVE, EMOTION, SOCIAL, LOSS OF SOCIAL/PHYSICAL INTERACTION.

INTERACTION has parallels with INTUITIVE, ASSISTIVE, DEPENDENCE, CHANGING PRACTICES, LOSS OF SOCIAL/PHYSICAL INTERACTION.

DATA has parallels with INTUITIVE, AUTOMATED, SECURITY/DATA OWNERSHIP, BUSINESS EXPLOITATION.

OBJECT DEPENDENCE has parallels with DEPENDENCE, LOSS OF SOCIAL/PHYSICAL INTERACTION, AUTOMATED, CHANGING PRACTICES.

EMOTION has parallels with EASY, EMOTION, LOSS OF SOCIAL/PHYSICAL INTERACTION.

SOCIAL has parallels with SOCIAL, DEPENDENCE, LOSS OF SOCIAL/PHYSICAL INTERACTION, CHANGING PRACTICES.

These two different sources of information for theming (granted, in the same exercise) led to very similar lists of themes that represent what this group of participants really felt about the positive and negative aspects of the IoT in relation to the use of their personal objects in their daily practice within the domestic space. I think that this is really useful, as it shows that the big selling point of the IoT doesn't seem to fit into this understanding, as shown by the discrepancy between the IoT product analysis, the list of positives and negatives and then the themes that emerged from their own situated scenarios and products.

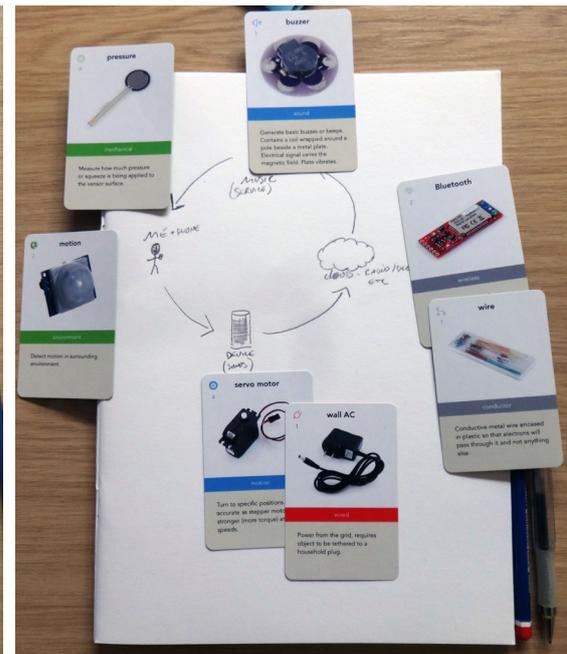
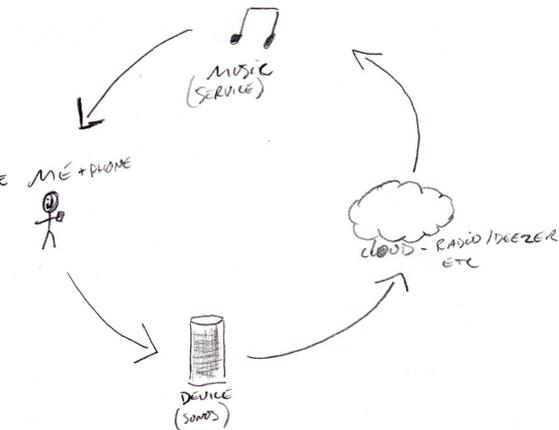
From this I can develop a list of specifications that should help to direct the next phase of the work in developing a "qualitative, experiential" IoT object that fits within the domestic space. This is also really useful in proving the value in a design workshop of developing mental models and products that are contextualised into the participant's daily life. The next workshop will use the KnowCards and another mental model that hooks ritual/routine into the IoT through a phenomenological framework to show how alternative understandings of the IoT system can shape how we understand and can design for this field.

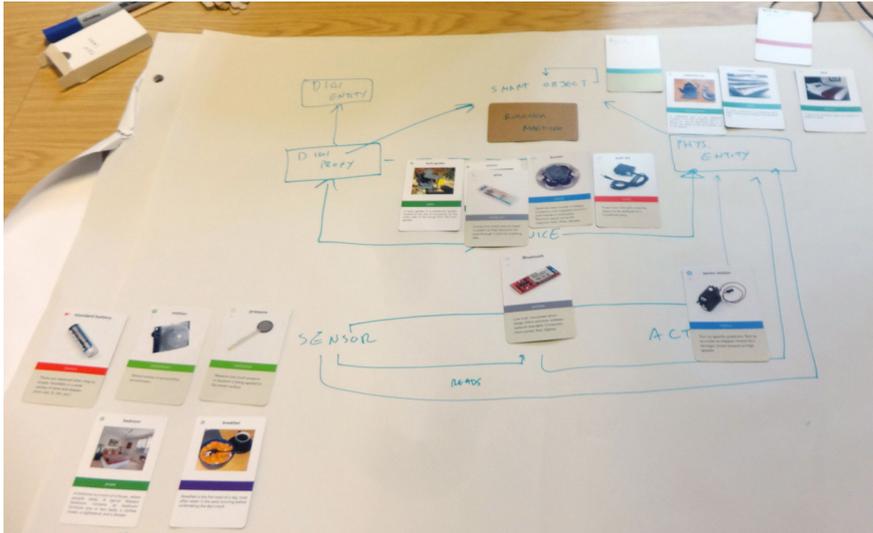
## Appendix K - 5.3.1.2: RCA Design Workshop Responses

Participants in Exploring Practice-Oriented Application brought an object representing a Domestic Practice, explaining these and introducing themselves during ice-breaking exercises. These provided the foundation of their domestic IoT concepts developed through the workshop. Participants selected suitable KnowCards, chose a model of the IoT from a provided range and mapped their cards to this to detail technological implementation. This was repeated using participant curated Practice-Oriented decks to identify important Practice aspects and how these were supported by their concepts. Finally, participants used Practice-Oriented decks to map technical and Practice elements into the proposed Practice-Oriented model in Discovering IoTUGV; afterwards they discussed how the decks mapped into this model. Responses were recorded through sketches, photographs, notes, voice recordings and transcription, later analysed to understand participant Practices, IoT understanding and concepts

### Participant A

LIGHTER / CLIPPER LIGHTER  
 13 YEARS  
 HE LIKE THE FACT TO MAINTAIN  
 WAKE UP AT THE MORNING COFFEE + CIGARETTE  
 15 MINS / MORNING  
 ALWAYS WITH HM  
 NO EMOTIONAL CONNECTION  
 USING ANOTHER LIGHTERS  
 DISPOSABLE ITEM  
 SENTIMENTAL LINK / CONNECTION W THE LIGHTER



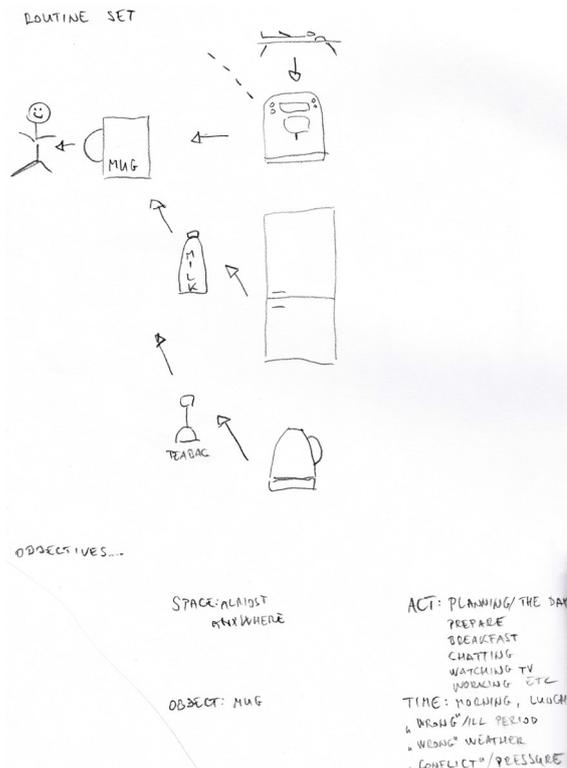


## Participant B

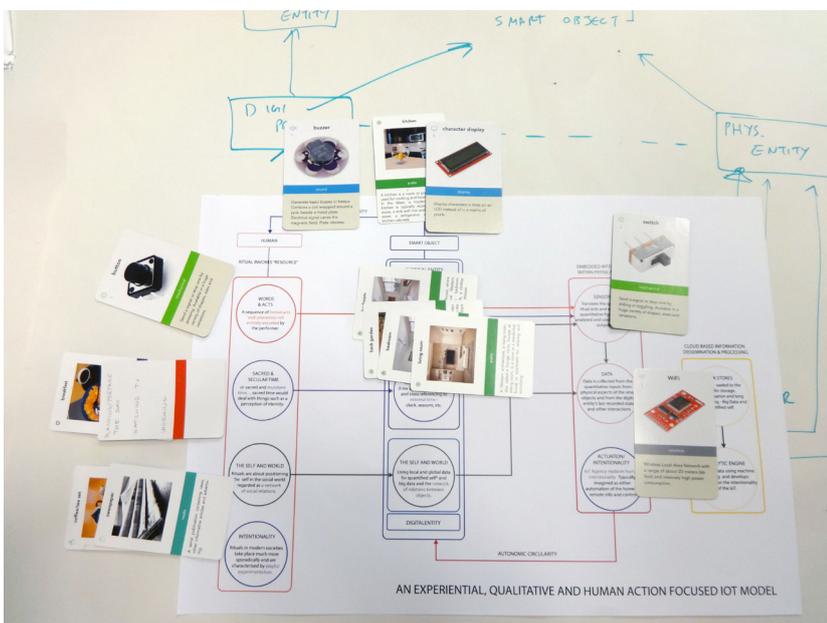
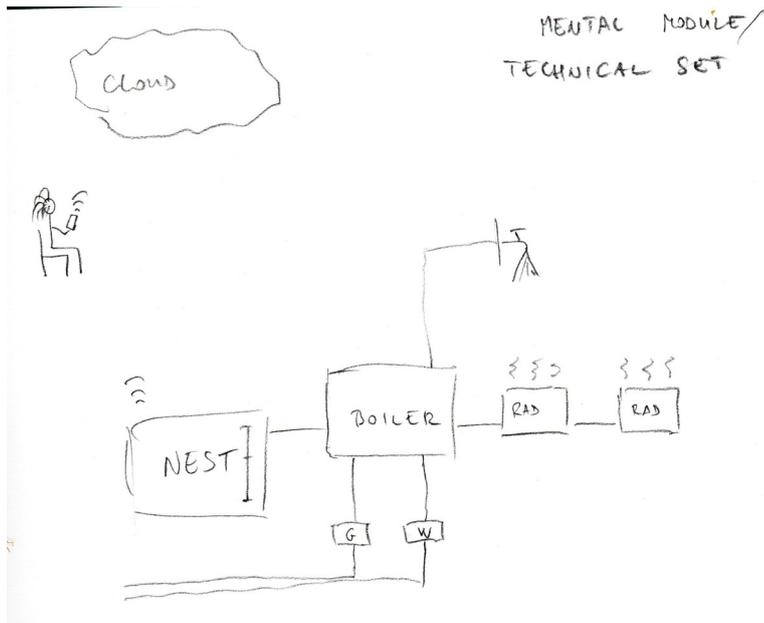
Mug

using all day round - coffee - water - milk - juice -  
meaning liquid.

use different mugs/cups/glasses depending on time of day.  
few of them are objects, and have emot. and abstract.









## Appendix L - 5.3.1.2: RCA Design Workshop Analysis

### Participants

#### **PA - All sessions**

Personal Object - A clipper lighter that they've had for 13 years and kept running by replacing parts and refilling.

Likes the fact they've had it so long, but not any specific emotional attachment. Uses everyday within 15 minutes of getting up to light cigarette. Doesn't like the fact that it's so important to their day. Can feel its absence.

Familiar with the IoT - "I have a few devices."

#### **PB - All sessions**

Personal Object - Brought a range of objects including a pen, envelope, toothbrush and mug. Mug was the chosen item.

Uses the mug all the day round for coffee in the morning, water/milk/orange juice during daytime and tea in the evening.

Also used to measure liquids etc in the cooking process. Uses a range of mugs with different sizes, colours and shapes.

A few of them are gifts and have emotional attachment.

Familiar with the IoT - "I know a lot of these devices."

#### **PC - PM Session**

Personal Object - Diary/notebook.

Uses the diary everyday because they like to have interactions with a real object. Routine is using the diary/notebook and supporting her photography with it (making notes?)

Unfamiliar with IoT - "How do I get the Internet to my diary?"

### **Conclusions**

Objects to do with the body - consumption/maintenance & management

Context of act with time, object, weather etc to determine outcomes

Objects used outside of acts for other purposes

Feel the absence of objects and enjoy interaction - physicality is important

Primacy of morning/early day?

### IoT Products Review & Discussion

#### **Nest**

*The Nest is a family so that you can attach inside and outside camera, carbon dioxide detector and whatever. When the guys compared to the Hive they voted for this one because they more like the design of the nest and they more like this family option rather than the Hive.*

#### **Goodnight Lamp**

*The light for example isn't necessarily about convenience - but in some ways it could be though cos it's a convenient way of knowing that your buddy halfway across the world is awake or alive or whatever without having to log on to whatever computer...you just glance over to the corner and say "Oh look it's turned off recently..."*

#### **Dash**

*More often than not where it's being implemented the main thing is convenience, such as your Amazon buttons and your thermostat.*

#### **IoT in general**

*Is a bit of a catch all term and being applied to pretty much any everyday object that is network connected in some respect. Specifically something that's not usually or traditionally networked. It's about convenience isn't it?*

actually going to, is there going to be a net benefit that consumed in actually creating these things?

#### **Data**

*It's big data isn't it?*

*But it's personal this data. IT's your personal...it's belonging for your person. I mean its kind of privacy, so the Nest collected data is not belongs to the gas company or...so they don't analyse in this case my personal routine or my savings. That's mine.*

*Well, we share data every day in everything that we do. I mean all three of us are probably sharing data with Google or whoever as we sit here through our phones. And it's this big data that's everyone's going on about. And there's no really getting away with it and as much as you might want to own that data you don't own that data and if you want to use those services there's not a lot you can do about it. You are the product, that's how they make their money, off data.*

*Goes to the cloud.*

*Yeah, it's a big question mark this data privacy.*

*The thing is that when you get these devices they all come with a EULA that no-one reads that says that these companies can collect your data and do what they want with it and everyone just scrolls to the bottom and clicks accept.*

*The other part is the data collection – I really like this graphs and spreadsheets and analysing and the IoT device are collecting a lot of data and I would like to improve somehow our house with this devices.*

#### **Trust**

*The thing is that when you get these devices they all come with a EULA that no-one reads that says that these companies can collect your data and do what they want with it and everyone just scrolls to the bottom and clicks accept.*

*In some ways it doesn't really make so much of a difference, but it makes a difference in my mind which company that is. Whether I think I can trust that company or which of those companies is less evil.*

*I have a Google phone and I know that Google are tracking pretty much everything i do with that phone including where i go in the world – I have location on. But I won't put Facebook on my phone as I know that FB are doing the same things. I'm happy for Google to have that info but I don't want FB to have it.*

#### **Existing IoT in the home**

*A couple of IoT products I have at home, such as my speaker system. They'd come under the guise of an IoT device cos it's all interconnected.*

*It's a Sonos systems, and it's all interconnected and I've set it so that it turns on in the morning with my favourite station and it turns off at the time that I'm due to leave for work, so if my music's off I know I'm going to be late for work.*

*And that sort of thing I quite happy to have because I know that it's not collecting too much in the way of data about me or anything like that.*

*A friend of mine at work has one where he has it set up so that if someone rings his doorbell he can open his phone, he can talk to them. He can look through the camera so he can see who it is, if it's a delivery person he can tell them "Oh it's a parcel leave it in the box next to the door." But also he has it so it has a motion sensor and he has the Hue light bulb so that if he's out, if it senses motion at his front door the lights come on, so it's a security device.*

#### **Families of Objects**

*The Nest is a family so that you can attach inside and outside camera, carbon dioxide detector and whatever. When the guys compared to the Hive they voted for this one because they more like the design of the nest and they more like this family option rather than the Hive.*

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*I just got the Wallace and Grommit reference. In my mind this is going a bit like a Rube Goldberg machine and I got where the Rube Goldberg reference comes from!*

#### **Initial Mental Models**

##### **PA**

Model for his Sonos/Sound system that he has set up as described earlier, rather than the routine and personal object of the lighter.

The mental model contains the user, a phone, the device, the cloud and the music.

This model places the person within the system, as their actions links unidirectionally to the Sonos device, which in turns leads unidirectionally to the cloud, which in turns leads unidirectionally to the music and then this leads unidirectionally back to the person.

This implies that the user instructs or is detected by the Sonos device, which then instructs/transmits to the Cloud and a music service, which in turn transmits to playing music, which reaches the user.

This discounts a few things - the user's phone would go to the cloud directly, the device plays music directly, the Sonos can detect the music directly. A few missing links, directions and complexity in the connections detailed.

This mental model is very focused on the service provided, rather than the physical interaction between device and person/services. It shows more of the feedback loop that the system has, but less detail of technical elements and doesn't really follow any logic in describing the ways in which the data/user/objects relate to each other.

##### **PB**

Model for an IoT coffee/tea/drink making device based around the personal object of a mug and the practice /routine of drink making/drinking throughout the day and in different spaces of the home.

This mental model contains: The user, a phone/mobile device, the cloud, the IoT device (Nest), the boiler, resources of gas and water and the outputs of hot water and radiators.

This model has only the faintest connection between the person and the system. The input of the smartphone to the Nest is the only interaction - they are not even explicitly shown to be affected by the temperature as there is no circularity indicated.

The "Cloud" element is also disconnected from the rest of the system - presumably it receives data from the user to transmit to the Nest, but if these links were shown you could also demonstrate that the Nest also sends data to the cloud.

The Nest is connected to the boiler system and receives WiFi info from the cloud, but this doesn't show that it also detects temperature, light, motion and direct user inputs to make changes to the temperature. The fact that this object was situated in the domestic was something that we had discussed, so this should have been clear.

From this point on, the system is a central heating model that doesn't rely on any circularity or feedback. As the Nest would depend on this, as well as the human element that this system is supposed to serve (!), this is really the whole point of the system!

The mental model that the participant drew is incredibly focused on the task involved, rather than

the system that the object/himself/etc is situated within. It is really quite flawed, with no feedback loops, a disconnected and isolated human element and a lack of attention paid to the physical side of this interaction between the person and IoT device and the IoT device and its environment.

#### PC

Missed this part of the workshop

#### Conclusion

The mental models that the participants developed after our initial conversations were of a low quality in both system and detail. Not entirely surprising that this would be the case, but the first workshop group were able to develop much more accurate models that reflected the system - or just showed more imagination in the development of the system. These models also lacked the capital element that the previous group were focused on, reducing the IoT model to the system that affects the user directly through interaction, rather than the larger scale, systemic concerns that the previous group had.

These understandings of the IoT are very simplistic in terms of how the system responds to use and inputs - the models and products they suggest are very much based in a cascade model: if I do this, and the weather is like this etc. then do this. An IFTTT model? This might not be so inaccurate, but there was usually an explicit input into the system to reach an end goal. These are goal focused approaches, where the end result for consumption is the aim.

#### KnowCards and models of how IoT devices inspired by personal object work

##### PA

Using the same model as detailed previously but with the idea of developing an IoT cigarette rolling machine so participant can make coffee etc while the cigarette is rolled.

KnowCards are used to show which components would be useful in developing this system and highlight anything that is missing. For this, the participant used a motion detector, a servo motor, a wall AC PSU, wires, a Bluetooth transmitter/receiver, a buzzer and a pressure sensor.

The motion detector and pressure sensor are positioned next to the person.

The Servo motor and wall AC PSU are positioned next to the device.

Bluetooth TX/RX and wires are positioned next to the cloud (local cloud?)

The buzzer is positioned next to the music (presumably a speaker)

Participant's explanation:

#### Overall

*I've always smoked rollups, it's about not having to worry about trying to roll a cigarette first thing in the morning when you're still groggy and you haven't had your first coffee.*

*So, it senses that you've got up using a pressure sensor, so your feet hit the mat by your bed and it knows Oh ok, [PA's] up, better start! So, pressure sensor sense that you're up, you can also have a motion sensor or whatever if you can't have a pressure sensor*

*I've put them on battery so they don't need to be wired in specifically to anything, you can run them off battery*

*That then sends via Bluetooth information to a device by my garden door, cos I don't smoke inside, and that device would then using a combination of servos and things like that would make me a cigarette.*

*It would roll me a cigarette! (Laughs) and then a buzzer would sound once it's ready and then I'd go make my coffee, I've got my cigarette, I've got my coffee and cigarette and wake up.*

(MK Note to self - why automate cigarette and not coffee?)

#### Benefits

*So, mine is about making the process of having my morning cigarette easier.*

*Just making things more convenient, more easy, I don't have to think about it and I can wake up at my own pace rather than having to force myself awake to go and do something that's dextrous and I can just get on with it.*

*Automation and convenience*

**Data**

*I would see this as something that's completely local, which is why I've just left it on Bluetooth. The only data it might possibly want to collect is whether you're from when it starts to when you actually take the cigarette and go and smoke it, so it could be measuring, I don't know how long it takes you to wake up and start your routine in the morning. I don't really know. I'm not too sure what kind of data would be collected from this.*

**Criticism**

*It's a product that noon in their right mind would actually develop! The more I was thinking about it the more it was this Rube Goldberg kind of thing A happens, which makes thing B happen, which makes thing C happen...*

**Families of objects, local networks of objects**

*And could be linked up with coffee machine, lights whatever*

*Happily link in with everything – it could tell you when to buy more baccy, papers or whatever.*

**PB**

Model of a drink making IoT device. In this model everything leads back to the user, but the user has no direct input into the system. Instead, the trigger for the device to make the drink is the user getting out of bed. This ignores the other objects used and the other times or day, drinks and uses for the vessel that the participant described earlier.

The user in bed links directly to the device, which also links via WiFi to the cloud (presumably, this isn't detailed.) The device then feeds into the mug, which is also fed independently from a fridge (milk) and kettle (hot water) via a teabag. This model implies that the device doesn't automatically put in milk, tea/coffee or even hot water - so what does it actually do? In this model all it does is detect when the person gets out of bed.

KnowCards are used to show which components would be useful in developing this system and highlight anything that is missing. For this, the participant used a WiFi card, a switch card, a buzzer card and a character display card.

The WiFi card was positioned by the device's link to the cloud.

The switch is positioned by the device, along with the character display.

The buzzer is positioned by the person.

Participant's explanation:

**Overall**

*So, my one is less about the sensors and more focused on the manual controlling. And it means in my case manually switch on the coffee machine, choose on the display what I would like in the morning, tea or coffee – cappuccino whatever. And again just press the button, create the coffee and just a sound is a buzzer is beeping when the coffee is ready. Kind of. An improvement could be collect some data by Wi-Fi in the cloud, I don't know about what? The temperature of the water, the amount of the coffee – I don't know what kind of data would be collected from this.*

*I prefer stay control. (Even when it has the ability to learn patterns)*

**Benefits**

*It's saving time and comfortable*

**Data**

*Yeah, maybe again it's improve the coffee machine maintenance of the thing. About the resources and sustainability to keep the product working?*

*Well, I don't have the knowledge of about how can I measure or collect data about the coffee quality, but maybe if somehow measuring the amount of caffeine?*

### **Participant discussion on projects**

#### **PB on PA**

*I just...I see the similarities with this morning, starting easier way process and...*

*I'm still confused saying...mystery about the coffee thingy, what can we do with this kind of data and how can we measure.*

#### **PA on PB**

*I really want a smart coffee machine! But I...with the Smart coffee machine, I think your idea of a smart coffee machine would be more my sort of thing, but it's down to personal preference.*

*So I think one that learns about you rather than you putting in and telling it exactly when you want it, it learns your habits, it learns whether you like it hotter, or cooler or stronger or weaker or whatever, it learns about you. That would mean more data collection and it would mean more stuff behind it where you're sharing a lot more of your data, so you have less control over it in that respect. So I can totally see the privacy vs. the convenience side of the argument as well.*

#### **PB on PB**

*(I comment that his could be more efficient with big data etc)*

*Yeah, cos there are consumable elements to it you could quite happily hook it up to an amazon button or something equivalent to that that says ok when I get below a certain amount of such and such consumable go ahead and order me some more.*

### **Practice KnowCards**

This session involved looking at the practices that the participants had been developing an IoT product for in greater detail, breaking them down into elements with my practice set. We then used these cards and the card sets that the participants had made for the technical elements of their IoT product and refined their earlier model by transposing them onto a model of the IoT that they chose from about 8 different options.

Participant 3 joined for this session.

#### **PA**

Space - Bedroom, kitchen, back garden

Object - Coffee/tea set, newspaper, bed and they write: Cigarette & Rolling machine

Act - He writes: Waking up

Time - Breakfast

#### **PB**

Space - Kitchen, Dining Room, Back Garden, Bedroom

Object - Coffee/Tea set (mug)

Act - Sharing a drink. They write: Planning/preparing the day, Watching TV, Working.

Time - Breakfast

#### **PC**

Space - Kitchen/Living Room

Object - Diary

Act - NONE

Time - Winter/Weekend/Friday/Evening. They write Any time.

### **Conclusion**

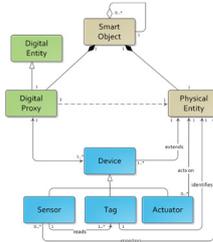
The cards were useful in breaking down the routines that the participants had into the four categories that can be easily measured in an IoT context (intentionality is left out.) This allowed the participants to see the variables that could be detected by the IoT system and how these sources of information/action could affect the way that their system/product would work in an intuitive

manner. Finally, all three participants used a blank card for an element of their routine across categories of space, object and act. This implies that the categorisation and examples included aren't broad enough, but that the inclusion of the blank cards allows for this personalisation.

### IoT Models with both Sets

#### PA

The participant chose a model of the IoT to fit their technical and practice card sets into.



At the centre of the model is the Smart object - in this case the rolling machine. This has a mix of technical and practice cards. The object is situated at the back garden and kitchen, and uses wire, a buzzer and a wall AC PSU.

This is fed information from the sensor part of the model, which is situated in the bedroom at breakfast time. This uses a battery, a motion sensor and a pressure sensor to detect when to start the process. This information is transmitted locally via Bluetooth to a servo motor which acts upon the physical entity of the smart object. The participant has placed the coffee/tea set, the newspaper and the bed by the physical entity part of the model, along with waking up and cigarette.

This model implies that the user/act are the physical entity that acts on the smart object, while the sensor detects a whole separate physical act to trigger it. This model and breakdown feels more fleshed out, engaged with and situated, but is still a glorified "fagsmade." It is overtly about taking away the process of rolling a cigarette in the morning as it's hard to do, but it allows the user to focus on making coffee. So, it's about allowing the intentionality of the user to focus on what they think is important.

#### Quotes

*For me, it's my morning ritual, it's what wakes me up in the morning. It's about waking up and getting ready for the day and preparing yourself for the day to come. SO some people have breakfast, for me it's a coffee and a cigarette.*

*So the bedroom and bed. So the act is a blank card, because for me the act is waking up and preparing myself mentally for the day and...start to work over my mental to do list if you like.*

*And it's in terms of object it's things I've picked out a few things that it can be combined with or regularly combined with such as a newspaper, coffee tea, so stimulants in a way. Coffee, obviously stimulant, the newspaper is a way of helping to wake your brain up as well, starting to think and process things, find out what's going on, so not necessarily a newspaper as such but maybe an app on your phone or something like that.*

*Quite often I would be stood at the back door having a cigarette with a cup of coffee looking at apps on my phone, whether it's twitter or Facebook or the guardian app or whatever. So they all contribute to the same ritual, although some of them aren't necessary, so I might not have my news or source of news, but I'll always have my cigarette and I'll always have my coffee.*

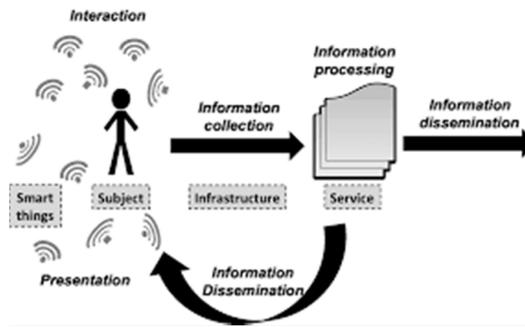
*The actual device itself that makes the roll-up would be in the kitchen. That's just specific to my house because my kitchen backs onto the back garden and that's where I go and smoke. I did have some more esoteric things? I don't really know how they fit into it?*

*They link to waking up I guess – coffee, newspaper, cigarette in the morning. All part of the same routine*

*Breakfast was to represent time, so it's the time of day. So it would know that its morning and that's when you're more likely to use it. Just the cigarette rolling machine using this info – that would go there cos that's essentially doing the physical work to make the device work, I guess.*

**PB**

The participant chose a model of the IoT to fit their technical and practice card sets into.



On the left of the model the spaces are placed above the INTERACTION, as if this is the context of the rest of this section. Within the Interaction and next to Smart Thing are the button and character display from the technical set, presumably for the coffee machine to have an input and output. Also as part of the smart thing is the tea/coffee set, implying that this is also a physical part of the coffee machine thing (or he is just saying the function of the smart thing.)

By the arrow leading from subject to information collection is the time card for breakfast, which doesn't reflect the info they said earlier that they use the mug at all times of the day. This arrow leads to information collection, which has the technical elements of the switch and wifi. This implies that the information is transmitted via wifi, but the switch perhaps symbolises that he would like to be able to control how/whether this information is shared. This information is processed and flows back to the user/subject. Along this path is a buzzer, which will alert the user that their coffee/tea/drink is ready.

Two cards are left outside of the model - sharing a drink and planning/preparing the day, watching TV and working. I would have placed these cards within the Interaction part of the model, as this could provide further context to the smart thing/system.

Overall, a model that doesn't really show the capabilities of the IoT in the physical and focuses on the efficiency and convenience of a machine making coffee for you at the touch of a button. The participant is more interested in saving money and resources, and in this case I think he is thinking of time as the resource to save. There isn't a huge amount of IoTness to the product or concept - more of a jumped up teasmade. This participant is also worried about data sharing and would prefer to analyse the data in a local system themselves, rather than allow the data to flow from the home. I would also say that the experience of the process and act of sharing a drink etc is not considered part of the process and cannot be affected by the system in this instance.

**Quotes**

*So starting with this here – the space almost anywhere, I mean drinking coffee in the morning, whatever. Kitchen or living room or we have some small balcony.*

*The time is usually morning but also I could imagine...I lost a little bit in the details and was thinking too deep.*

*Drinking coffee, not just the morning, drinking all day round, so for lunch or just ordering the wrong...but I'm ill or the weather is wrong, it's miserable, misty something. A good coffee could help to improve the mood.*

*Also when we have conflict or pressure on public transport or just bad news or something like that could help to improve my feelings.*

*The act is planning or preparing the day, which could include to producing the news or just think about the daily actions and preparing but also this coffee moment or this hot drink drinking moment can fit a chatting period if someone visit us and make a link between us to offer a hot drink and a prelude of conversation.*

*But also it's matching with watching TV or watching a movie or something, or working on a notebook from home, or working on a DIY project and it could help in this period. The object part is just a mug.*

*The same with the cards, it was hard to start. The red one was act...yeah because the empty one for another was just...the chatting, watching TV, breakfast, the planning the day so it happens there.*

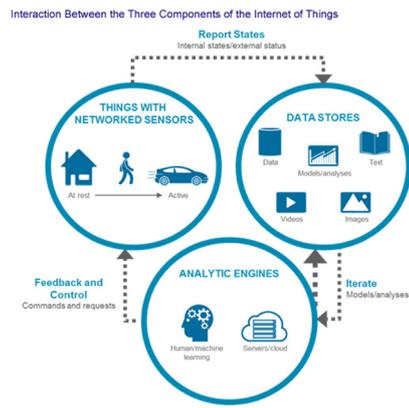
*In the kitchen...so we start the story...the coffee set as the smart thing. And afterwards...the time was breakfast...coming somewhere here...and it's again the when.*

*We talk about improvement...I couldn't find a card or fit here. I told you prefer a manual control but I'm open to something automatic offered from the system and just confirm manually. It figures out in the morning you are drinking coffee but in the lunch time you are more drinking latte and the weather is miserable you are drinking tea or hot chocolate and this kind of...*

*Kind of...I want to feel in control, I don't want to make something with this product(?) I think it's more complex than just one model. It should be different models in different situations?*

## PC

The participant chose a model of the IoT to fit their technical and practice card sets into.



At the centre of the model is the diary object, even though there is no category for it to fit into in the model. Around the left of the model are the time cards, which relate to the feedback and control of the smart object. At the bottom are the technical elements of monitor/screen and wifi, which seem to relate to the analytic engines. At the top right is the diary data, situated at the data stores, while the space that the interaction takes place in is also placed there.

The cards are placed in slightly confusion positions in relation to the model. This is partly due to the model itself having little space for people and the ways in which the use their objects in the home. In fact, the person is only considered as a thing with a networked sensor. The positioning of the cards is really odd and reflects confusion on the subject by the participant and a systemic issue of how the model relates to real life - i.e. it doesn't.

## Quotes

*I use my diary every day because I like to have interactions with the real object*

*I use the technology for my work for my design for my research for saving my data and information and using all the software and everything for my...whatever I'm doing.*

*My routine is to everyday I will do some photography which is related to some idea which I have in my mind. I want to keep my ideas and everything alive and I find photography is a very good way to keep the idea alive*

*It is in my main table in the house when I go home I take my diary out and put it close to my laptop.*

*My main table is in the corner between my kitchen and living room. It's not a hallway, it's an open space. My kitchen, I have so many red things in my kitchen...(selecting pen colours)...*

*how can I use the body temperature for my diary? It's very important because it's kind of human emotion and reaction about the dates or event which are going to happen later. I mean we are thinking about the future, aren't we?*

## Quotes from all

*I think that all of these things are all very, let's boil human action down to its simplest forms and take some of that toil away from people, whether it's managing your own thermostat or making your own coffee you don't have to do it, something else does it for you. It doesn't have that element of, that emotional element. I t doesn't take any of it into account.*

*I'm lost a little bit in this theory. For me it's a little bit too overthinking this part of the design.*

*I think for me emotional things will be involved with that. There was the conflict between the internet doing all these things for me and my own feeling that I want to keep it. I can't have it if the*

*internet and technology would do it for me. The model is coming to do everything and connect my diary, but still I think it's not me, it's something different doing this for me. It might affect my mental model to make it in a way in which some certain things I have to...the human interaction has become over the internet. I would design a model that allows this, this part is more important.*

#### **Conclusion**

These models are clearly better for understanding the IoT than the models that the participants drew. However, there are still some elements that caused confusion and didn't show where the elements that are relevant to daily practice and routines should go. There is still a lack of a human and of human experience in these models, and I think that the fact the participants are talking about emotion shows that. They seem to think these models of the IoT are reductive of human involvement and feelings. There is room for improvement.

There is also the element of control that needs to be looked at - the participants want to devolve some of what they do (coffee & cigarette making) but want more control over the data that they generate and where it actually goes and leads to.

Consumption. Planning and preparation. Primacy of the first acts of the day? All common themes.

#### **Practice Centric Model with both sets**

The last part of the session, where we used the same card sets with my model of the IoT which engages the system with human acts in context. My intent is that this will allow for the system to be more legible to the participants and allow the system itself to be changed by the way it is used, rather than changing the user to the system.

#### **PA**

The participant placed their waking up and cigarette cards by the words and acts in the human section of the model. They put the breakfast card by the left of the time bubble. On the left of the intentionality bubble they placed the objects newspapers and coffee/tea sets. Self and world was left blank.

This links to the physical entity of the Rolling Machine. This contains the technical elements of the servo motor, wall AC PSU, wire and the kitchen & Back garden. There is also the physical entity of the sensor in the bedroom represented by the space of the bedroom and the technical elements of the motion and pressure sensors and the battery - however these could be positioned in the embedded interaction within digital entity section (which would make more sense.)

The information from the cloud based/machine intelligence section feeds back through actuation/intentionality to the user via the digital entity through a bluetooth connection that triggers the buzzer. This lets the user know that the cigarette is ready.

#### **Quotes**

*(Re PC) I would even argue that this kitchen/living room thing is sort of like your office space as such, would go in with the sensors and embedded intelligence in the physical object, so maybe it would behave differently when it's in that home environments than when it's out and about on the road. You may want it to behave very differently when you're at home working or when you're about on the road.*

*The coffee and the newspaper and stuff I put between intentionality and the world because I wasn't sure where they went. The more emotional stuff I've put over on the individual, the human because that's where the emotion comes into it. The technical element...obviously the machine can't be emotional or detect my emotions*

*The machine in its intention as an IoT device is a lot more straightforward and simple, there's less of the emotional element to it. It's not trying to pick up on too much from you, it's you tell it what to do and when to do it.*

#### **PB**

The participant placed a button card next to the words and acts circle - representing his overt input. The breakfast card is placed next to time, while the self and world has the newspaper and coffee/tea set next to it. Finally, the intentionality circle has the "Planning the day/watching TV/Working card" beside it.

This leads to the digital entity element, where the space cards are all placed over the words and acts circle. This flows to the embedded intelligence part of the model, where a switch is positioned by the sensor circle and wifi is used to transmit this data to the machine intelligence element.

Finally, this all flows back through the physical entity to the person. At this point the user has placed the kitchen, character display and buzzer cards - as the object is in the kitchen, the user can see the options or outcomes on the display and the buzzer alerts them their drink is ready.

#### Quotes

*In mine there was the control, so that's the button for what I would like to make. There's the timing, very wide – not just the morning, watching TV, working, bad weather thingies. The place was anywhere and just select on the screen what I would like from the machine in the kitchen and collect the data just for analysing through wifi.*

*I think it's the same thing. Maybe I can physically be more detailed with more switches and sensors, but I don't want to make it too complicated. I worry about being too messy.*

#### PC

The participant placed the time cards on the left of the Human interaction element, along with the Diary card and a new card with the word Feeling written on it.

The technical elements were added to - the battery, motion detector, USB, bluetooth and solar are new and position below the Digital Entity that detects the inputs from the user. This section of the physical entity has the Diary Object Card at the top.

This links to the embedded intelligence section, via the monitor or screen - presumably this is the input part of the system? Or is it the digital information presented by the physical entity! (Yes, more likely to be this.) There is also the Kitchen/Living room card positioned in the embedded intelligence section, placed over the bubble for sensors. This is a little out of pace in my opinion, as I would place this by the self and world of the Human element.

Finally, this information via embedded intelligence is transmitted via wifi to data stores etc in the machine intelligence section of the model, which is actually pretty spot on.

#### Quotes

*That's playful experimentation...Time, err...Where should I put the kitchen and living room...where should I put my place, which is important? I leave it outside the margin as it not fit it?*

*What about my senses, my connection to my objects, my feeling? I want to put something to represent my feeling. Let me see if I can find something here.*

*As I said before it is more detail, you can put more into it but it's relevant to the object you choose. For me maybe there is a limit for PB maybe he can put more into it, but that is a possible it can give you space to put more into it. It is more in detail.*

*This space is very important to me because I can get connected to my actual object in a sense of reach to my object.*

*For me I think it is much more...to get things in their right place; it's more connected to the idea. It's going to go through the map. I can see it from the others, I can make more sense of this ...*

#### Conclusions

Model is more effective than the others in showing how the IoT works - the participants are able to build a model of their process with more accuracy and place the elements into areas and elements that make more sense to them.

Where the data lives is really clear - and also people's attitudes to this.

User generated concepts aren't really fully IoT - the balance between automation and control becomes clear (PA wanted it for cigarette so they could concentrate on coffee, PA didn't want it at all)

The physical interaction between object and person is apparently fuzzy - PB included this is embedded interaction AND words and acts. This is understandable, but perhaps this needs x2 of the same card to make it clear? PA however, shows his act as waking up, and the system responding passively to this, while the intentional elements are situated in the embedded intelligence section.

Improvements to the model?

#### Debrief

**What want from IoT object?**

A lot of IoT products are trying to find a solution actually thinking of the problem. They're finding an answer...oh people want a fridge that scan everything that you put in them and all that stuff sort of thing without thinking do people need these, do people want these, is it actually going to make people's lives better?

I think what is internet for me is to be able to integrate my needs and ideas and to action them. There is some element which IoT needs to hover, not to go over it, not to lead me, just fit in with what I need. I don't know if the moment the IoT is doing that or not.

I just can repeat what we talk about in the beginning in general about the IoT, things what are the positive. Save energy, resources, time and comfort.

#### **How do people really want to engage with this network of objects?**

*It's the same...that's why I worry about this next thingy which controls the temperature and learning. I didn't buy yet, I prefer to set up the temperature rather than trust in the machine which is...I mean the Nest thing, I don't trust it's control.*

*You don't trust it because you don't have the actual experience, if they are too inaccurate or they are too accurate in the way that you wanted then you couldn't use it? You don't trust it because they are not doing that at the moment in your opinion? If they do it how do you feel about that, do you simply go and use it?*

*I just want to keep the control. I spent 20 years in IT I saw lot of things what could happen when you things about the automation. I had a community radio station, in it we tried to play in the music automatically, tried to figure out something pattern, how could we playing good music. And I always have to listen to the music because I have control, so and always think about "Oh why playing this and that music, what's happened, why happening this and that?" and I remember how it was kind of a child who I always have to control what it is doing. SO it didn't make my life easier, it made my life miserable to always listening and always controlling and always improving.*

#### **(This Re: Nest)**

*You go on holiday and it's 35 degrees and burning 100 cubic m of gas just because he or she thought somebody was at home and cold.*

*How about if the IoT would go that far to create a new interactivity and to bring your emotion, everything that is inside your thoughts in term of making sounds? What do you think about that? Not just singing, making the music. A piece of music which you know that...your habit, but no one else has write that before.*

*The diary is connected to my mood and predicts my moods and I will be kind of making the time and whatever it needs from myself and put myself in the right place, the right mood...*

*I want it to do – like if I want a task done I want it completely automated for me, but I don't want to give over all the information to big data. I don't like the idea of all of my data going up to the cloud and then some company making assumptions of me or then selling that data to some other company who aggregates it with every other user. So I want one thing but i don't want to give back that the companies are after, which is this big data, which is where they get...where they make a lot of money.*

*I like the idea of having things automated for me, but I also like the idea of being able to do it so that I can take that automation back and say, for example with making coffee, sometimes you want the system to make you a cup of coffee, you just want a cup of coffee, but sometimes, say at a weekend, you want to take your time over it, you want to do it properly, you want o to do it in your special way. Whether it makes a difference to it or not is beside the point. It's about giving control to the IoT but also about having the ability to take that back and also not giving away the big data.*

*If talking about user experience as an experience, the people that do that the best are apple. I'm not even talking about the computers and hardware, just even something as simple as opening the box to your iPad or new mac, they design everything specifically to the nth degree so that when you open the box and take the cellophane off it has a certain feel to it, the box has a certain gap so the air suction in a certain way, it has a certain feel the way the two halves of the box separate, so it's getting that tactile element right.*

*So even though you're disjointed from the act of making the coffee as such it's still having that integration with the device so that it's doing what you want it to do and you still feel part of it while at the same time being disjointed form it. You're not actually participating in the act but the sight, smells and sensations of having that coffee made or making that coffee yourself are still there.*

## Overall Conclusions

Participant engagement in acts

Coffee making vs cigarette making

Diary/coffee - physical

Control over machine agency

More convenient

Use of methods: mapping, know cards, practice cards etc

## WS02: Quotes and Observations by Workshop Stage

### Personal Objects:

**Objects flexibility and time variances** - Use of mug at different times of day for different tasks.

**Loss of social/physical interaction** - Use of objects to measure liquids etc.

**Emotional Attachment to objects** - Some have meaning, some don't.

**Dependence** - On objects (i.e. lighter) is disliked, although this is due to the end it serves. Can feel its absence?

The participants selected objects that were important to the process of starting their day or served as an element of preparing and planning for the day ahead. Automated elements of this process, but left other elements to do themselves. Emotional attachment to the objects - not really.

### IoT Products

**Families of objects** - Confluences of information or ease of one ecosystem of objects (Nest vs. Hive)  
Doorbell and phone? But the phone...Rube Goldberg...

**Convenience** - Not only through automation, but through pervasive info (Goodnight lamp is more convenient than logging on to PC etc.) "The IoT is about convenience." Savings resources through systems. IoT comes down to automation and convenience.

**Emotion** - Checking in on friends; Upset with family in domestic - having to turn off lights etc.

**Social** - Checking in on friends

**Changing Practices** - IoT would change this running around after everyone practice - this is a positive change of practice; SONOS sounds system, used to regulate time to leave for work; Remote camera/doorbell - deliveries.

**Automation** - Turning off lights when no one is around

**Intuitive** - Knowing if people are around - turn off lights

**Security/Data Ownership** - IoT device collects data to improve house; It's your personal data; As much as you might want to own it, the IoT companies do; Data privacy is a big question mark; Happy to have Sonos, not collecting too much data.

**Easy** - IoT is about making life easier for the consumer.

**Exploitation** - You are the product, they make money off data; EULA - no one reads and gives over rights to companies to do what they want with your data etc.

**Dependence** - Sonos sounds system, used to regulate time to leave for work.

**Loss of social/physical interaction** - He can tell delivery person - leave in the box...

### Initial Mental Models & KnowCards

**Loss of social/physical interaction** - Less on sensors and more about manual controlling; It's about not having to worry about trying to roll a cigarette; Using a combination of servos and things, it would make me a cigarette; Have to force myself to do something dextrous; It learns your habits.

**Automation** - Press the button, create the coffee, a buzzer sounds to let you know it's ready; It's about not having to worry about trying to roll a cigarette.

**Security/Data Ownership** - Collect some data via WiFi in the cloud. I don't know what; The data it collects is from when it starts to when you take the cigarette? Not too sure?; Mystery about the coffee thing, what can we do with this kind of data?; This (Intuitive) would mean more data collection.

**Assistive** - Saving time and comfortable; It's about not having to worry about trying to roll a cigarette; Making things more convenient, more easy, I don't have to think about it.

**Intuitive** - Coffee machine maintenance and resources/consumables?; Oh, PA is up, better start rolling!; One that learns about you rather than you putting it and telling exactly what you want.

**Easy** - The process of having my morning cigarette easier; Morning, starting process easier.

**Changing Practices** - The process of having my morning cigarette easier.

#### **IoT models with both sets**

**Assistive** - Drinking coffee all day round; If the weather is wrong, miserable a good coffee would improve the mood; It figures out in the morning that you are drinking coffee but in the lunch time you are drinking latte; Whether it's managing your thermostat or making coffee you don't have to do it.

**Intuitive** - If the weather is wrong, miserable a good coffee would improve the mood; It figures out in the morning that you are drinking coffee but in the lunch time you are drinking latte.

**Emotion** - If the weather is wrong, miserable a good coffee would improve the mood; If there is conflict or pressure on public transport, could help to improve my feelings; Human emotion and reaction from the dates or event which are going to happen later; It doesn't have that emotional element, it doesn't take this into account; I think for me emotional things will be involved with that.

**Changing Practices** - Fit a chatting period if someone visits and make a link between us to offer a hot drink; It's my morning ritual, it's what wakes me up. It's about getting ready for the day; There's a conflict between the IoT doing these things for me and my own feeling that I want to keep it.

#### **Loss of social/physical interaction**

Fit a chatting period if someone visits and make a link between us to offer a hot drink; I want to feel in control; I use a diary every day because I like to have interaction with the real object; Human interaction has become over the internet - I would design a system to allow this.

**Social** - Fit a chatting period if someone visits and make a link between us to offer a hot drink and a prelude to conversation; Human emotion and reaction from the dates or event which are going to happen later; Human interaction has become over the internet - i would design a system to allow this.

**Automation** - I prefer a manual control, but open to automatic offered from system and confirmed by me; I want to feel in control; Let's boil human action down to it's simplest forms and take toil away from people; There's a conflict between the IoT doing these things for me and my own feeling that I want to keep it.

**Families of objects** - A few things that can be combined with it or regularly used with it such as a newspaper, coffee, tea etc. – stimulants; It is in my main table in the house when I go home I take my diary out and put it close to my laptop;

**Dependence** - To do everything for me and connect to my diary, but still I think it's not me, it's something different doing this for me.

#### **Experiential Model with both Card sets**

**Dependence** - In mine there was the control, so that the button for what I would like to make.

**Assistive** - What I would like from the machine.

**Security/Data Ownership** - The data for analysing through WiFi.

**Intuitive** - Maybe it would behave differently when it's in the home to when it's out on the road.

**Automation** - The machine in its intention as an IoT device is a lot more straightforward and simple, there's less of the emotional element to it.

**Emotion** - The machine in its intention as an IoT device is a lot more straightforward and simple, there's less of the emotional element to it; What about my senses, my connection to my objects, my feeling?

**Loss of social/physical interaction** - The space is very important to me because I can get connected to my actual objects.

### **Debrief**

**Changing practices** - The IoT for me is the be able to integrate my needs and idea and action to them; A piece of music which is from your habits that no one else has written before; I like the idea of having things automated for me, but I also like the idea of being able to do it so I can take the automation back.

**Dependence** - There is some element which IoT needs to hover, not to go over it, not to lead me, just fit with what I need; I worry about the Nest which controls the temperature - prefer to set up the temperature rather than trust in the machine; It's about giving control to the IoT but having the ability to take that back and not giving away the big data.

**Automation** - I can just repeat what I say in the beginning in general about the IoT, save energy, resources, time and comfort; If I want a task done I want it completely automated for me, but I don't want to give over all the information to big data; I like the idea of having things automated for me, but I also like the idea of being able to do it so I can take the automation back.

**Assistive** - I can just repeat what I say in the beginning in general about the IoT, save energy, resources, time and comfort.

**Emotion** - I can just repeat what I say in the beginning in general about the IoT, save energy, resources, time and comfort; (Automatic radio station) It made my life miserable; How about an IoT would create a new interactivity and bring emotion?; The diary is connected to my moods and knows my moods; The sights, smells and sensations of having that coffee made or making it yourself are still there.

**Security/Data Ownership** - I worry about the Nest which controls the temperature; If I want a task done I want it completely automated for me, but I don't want to give over all the information to big data; It's about giving control to the IoT but having the ability to take that back and not giving away the big data.

**Loss of social/physical interaction** - Automatic radio station - A child who I always have to control what it's doing; It's about getting that tactile element right; It's doing what you want it to do and you still feel part of it while being disjointed from it; The sights, smells and sensations of having that coffee made or making it yourself are still there.

**Exploitation** - You go on holiday and it's 35 degrees and burning 100 cubic m of gas...; The company making assumptions of me or then selling that data to some other company;

**Intuitive** - You go on holiday and it's 35 degrees and burning 100 cubic m of gas because it thought someone was at home and cold; The diary is connected to my moods and knows my moods.

### WS02: Final Themes & Combined Quotes

#### **Loss of social/physical interaction**

Use of objects to measure liquids etc.

They can tell delivery person - leave in the box...

Less on sensors and more about manual controlling

It's about not having to worry about trying to roll a cigarette.

Using a combination of servos and things, it would make me a cigarette

Have to force myself to do something dextrous.

It learns your habits.

Fit a chatting period if someone visits and make a link between us to offer a hot drink.

I want to feel in control.

I use a diary every day because I like to have interaction with the real object.

Human interaction has become over the internet - I would design a system to allow this.

The space is very important to me because I can get connected to my actual objects.

Automatic radio station - A child who I always have to control what it's doing.

It's about getting that tactile element right.

It's doing what you want it to do and you still feel part of it while being disjointed from it.

The sights, smells and sensations of having that coffee made or making it yourself are still there.

#### **Emotion**

Some objects have meaning, some don't.

Checking in on friends

Upset with family in domestic - having to turn off lights etc.

If the weather is wrong, miserable a good coffee would improve the mood

If there is conflict or pressure on public transport, could help to improve my feelings

Human emotion and reaction from the dates or event which are going to happen later.

It doesn't have that emotional element, it doesn't take this into account.

I think for me emotional things will be involved with that.

The machine in its intention as an IoT device is a lot more straightforward and simple, there's less of the emotional element to it.

What about my senses, my connection to my objects, my feeling?

I can just repeat what I say in the beginning in general about the IoT, save energy, resources, time and

comfort.

(Automatic radio station) It made my life miserable

How about an IoT would create a new interactivity and bring emotion?

The diary is connected to my moods and knows my moods.

The sights, smells and sensations of having that coffee made or making it yourself are still there.

### **Dependence**

On objects (i.e. lighter) is disliked - although this is due to the end it serves?

Can feel its absence.

I prefer to stay in control

Sonos sounds system, used to regulate time to leave for work.

To do everything for me and connect to my diary, but still I think it's not me; it's something different doing this for me.

In mine there was the control, so that the button for what I would like to make.

There is some element which IoT needs to hover, not to go over it, not to lead me, just fit with what I need.

I worry about the Nest which controls the temperature - prefer to set up the temperature rather than trust in the machine.

It's about giving control to the IoT but having the ability to take that back and not giving away the big data.

### **Families of objects**

Confluences of information or ease of one ecosystem of objects (Nest vs Hive)

Doorbell and phone? But the phone...

Rube Goldberg...

A few things that can be combined with it or regularly used with it such as a newspaper, coffee, tea etc - stimulants.

It is in my main table in the house when I go home I take my diary out and put it close to my laptop

### **Convenience**

Not only through automation, but through pervasive info (Goodnight lamp is more convenient than logging on to PC etc.)

"The IoT is about convenience"

Savings resources through systems

IoT comes down to automation and convenience.

### **Social**

Checking in on friends

Fit a chatting period if someone visits and make a link between us to offer a hot drink and a prelude to conversation.

Human emotion and reaction from the dates or event which are going to happen later.

Human interaction has become over the internet - i would design a system to allow this.

### **Changing Practices**

IoT would change this running around after everyone practice - this is a positive change of practice.

SONOS sounds system, used to regulate time to leave for work.

Remote camera/doorbell - deliveries.

The process of having my morning cigarette easier.

Fit a chatting period if someone visits and make a link between us to offer a hot drink.

It's my morning practice, it's what wakes me up. It's about getting ready for the day.

There's a conflict between the IoT doing these things for me and my own feeling that I want to keep it.

The IoT for me is being able to integrate my needs and idea and action to them.

A piece of music which is from your habits that no one else has written before.

I like the idea of having things automated for me, but I also like the idea of being able to do it so I can take the automation back.

### **Automation**

Turning off lights when no one is around

Press the button, create the coffee, a buzzer sounds to let you know it's ready.

It's about not having to worry about trying to roll a cigarette.

I prefer a manual control, but open to automatic offered from system and confirmed by me.

I want to feel in control.

Let's boil human action down to its simplest forms and take toil away from people.

There's a conflict between the IoT doing these things for me and my own feeling that I want to keep it.

The machine in its intention as an IoT device is a lot more straightforward and simple, there's less of the emotional element to it.

I can just repeat what I say in the beginning in general about the IoT, save energy, resources, time and comfort.

If I want a task done I want it completely automated for me, but I don't want to give over all the information to big data.

I like the idea of having things automated for me, but I also like the idea of being able to do it so I can take the automation back.

### **Intuitive**

Knowing if people are around - turn off lights  
Coffee machine maintenance and resources/consumables?  
Oh, PA is up, better start rolling!  
One that learns about you rather than you putting it and telling exactly what you want.  
If the weather is wrong, miserable a good coffee would improve the mood  
It figures out in the morning that you are drinking coffee but in the lunch time you are drinking latte.  
Maybe it would behave differently when it's in the home to when it's out on the road.  
You go on holiday and it's 35degrees and burning 100 cubic m of gas because it thought someone was at home and cold.  
The diary is connected to my moods and knows my moods.

### **Security/Data Ownership**

IoT device collects data to improve house.  
It's your personal data.  
As much as you might want to own it, the IoT companies do.  
Data privacy is a big question mark.  
Happy to have Sonos, not collecting too much data.  
Collect some data via Wi-Fi in the cloud. I don't know what.  
The data it collects is from when it starts to when you take the cigarette? Not too sure?  
Mystery about the coffee thing, what can we do with this kind of data?  
This (Intuitive) would mean more data collection.  
The data for analysing through Wi-Fi.  
I worry about the Nest which controls the temperature  
If I want a task done I want it completely automated for me, but I don't want to give over all the information to big data.  
It's about giving control to the IoT but having the ability to take that back and not giving away the big data.

### **Easy**

IoT is about making life easier for the consumer.  
The process of having my morning cigarette easier.  
Morning, starting process easier.

### **Exploitation**

You are the product, they make money off data.  
EULA - no one reads and gives over rights to companies to do what they want with your data etc.  
You go on holiday and it's 35degrees and burning 100 cubic m of gas...  
The company making assumptions of me or then selling that data to some other company.

### **Assistive**

Saving time and comfortable  
It's about not having to worry about trying to roll a cigarette.  
Making things more convenient, more easy, I don't have to think about it.  
Drinking coffee all day round  
If the weather is wrong, miserable a good coffee would improve the mood  
It figures out in the morning that you are drinking coffee but in the lunch time you are drinking latte.  
Whether it's managing your thermostat or making coffee you don't have to do it.  
What I would like from the machine.  
I can just repeat what I say in the beginning in general about the IoT, save energy, resources, time and comfort.

## WS02: Final Reflections & Takeaways

### **Personal Objects:**

Objects to do with the body - consumption/maintenance & management.  
Context of act with time, object, weather etc. to determine outcomes.  
Objects used outside of acts for other purposes.  
Feel the absence of objects and enjoy interaction - physicality is important.  
Primacy of morning/early day?  
The participants selected objects that were important to the process of starting their day or served as an element of preparing and planning for the day ahead.  
Automated elements of this process, but left other elements to do themselves.  
Emotional attachment to the objects – in some cases.

### **IoT Products**

Families of IoT objects are more attractive than single ones.  
IoT is positive in terms of convenience and making life easier for the customer.  
Convenience is through automation.  
Saving resources happens through this system.  
IoT allows for long distance relationships/connections – there's some social element.  
Data ownership and what is collected is a concern. There's a sweet spot where data collected isn't so bad if it's not too personal/granular.

Intuitive IoT does things without express inputs, but based on conditions in the space.  
Our activities and the associated data is the product that IoT companies want.  
IoT mediated services to regulate time and acts

#### **Initial Mental Models & KnowCards**

Mental models of the IoT affect understanding of the system.  
Participant mental models are poor and lead to confusion - based on:  
Current model leads to automation - life easier.  
Also models lack feedback, but have people.  
Assistive qualities are slightly different - still focuses on convenience and saving resources.  
This also leads to loss of social/physical interaction?  
Intuitive elements involve replacing consumables, taking actions based on conditions or learning patterns, rather than being told.  
Takes control away from user.  
Changes practice of the space it's in.  
KnowCards are useful in making the whole thing less abstract.

#### **Practice KnowCards**

Practice Cards were more useful in identifying elements of the routines that participants had.  
Practice Cards set had many missing elements that participants had to create - this is probably a good thing.

#### **IoT models with both sets**

Use of existing IoT models gave greater clarity of the IoT as it stands.  
Focus shifts from automated to assistive & intuitive.  
Intuition based on information within and outside of the domestic (people & activity / weather & transport)  
Use of IoT to change emotional states through interactions.  
Recognition that the practice changes due to IoT.  
Focus shifts towards physicality, human interaction and social benefits of IoT.  
Focus shifts slightly from automation=convenience to automation needing some boundaries.  
Interrelations and social life of objects - confluence of information from paired objects  
Elements of dependence on this type of system are recognised - agency or self/system.

#### **Experiential Model with both Card sets**

Control over the system - overt input?  
System serves users desires  
Data is available for analysis via wifi  
Object/system could behave differently at home or on the road - contextual.  
IoT device is straightforward and simple - less emotional element. (Except satisfying user's desires? Comfort?)  
Loss of senses and connection to objects through use?  
Situating connections with objects.

#### **Debrief**

Participants understanding of the IoT has developed through the workshop activities.  
IoT should integrate my needs and actions to it.  
The IoT output could be expressive and represent how you use the space and objects  
Automation is fine, as long as control can be taken back when wanted.  
IoT should fit to user, not lead.  
Lack of trust in objects and system.  
IoT is still interesting in terms of saving time, money etc.  
Automation is fine - but big data isn't.  
IoT could make life miserable if always having to correct it.  
IoT could create new interactivity based on emotion.  
Object could know moods.  
The sights, smells and sensations of the process being automated should still be present.  
Get the tactility of the system/object/experience right.  
Expensive mistakes re: Automation are possible.  
Our data and information could be sold on.

#### **Final conclusions on WS02 Outcomes**

This workshop took a different form to the first and had a different and smaller group of participants. As the first workshop was mainly younger design students, I intentionally advertised away from these institutions to try to get a different point of view. Unfortunately, this meant only 3 participants took part (4 signed up.)

The participants said that they knew about the IoT at the beginning of the workshop. We started with the product analysis to gauge their attitudes towards the IoT. At this point the participants were generally positive towards the IoT, discussing the automation of the system leading to convenience and saving resources. This would be achieved through intuitive inputs and families of objects, leading to activities regulated by the IoT. There was some concern about the role of data ownership and use by companies. One insight was that they positioned themselves as customers of the IoT companies, rather than users or participants in a system.

Following this I asked them to draw their mental model of how the IoT worked with their product and add the technical elements needed to make it work from a set of KnowCards. These models were of a pretty low standard, representing some of the elements of the IoT (nowhere near all) and generally lacking circularities, feedback of actions, data sources from outside the devices etc. - generally an automated system based on a discrete input, rather than confluences of data from objects of outside sources. However, they all did contain people! These models were based on similar assumptions that we discussed in the last part of the workshop - automation is the central crux of IoT; that the assistive nature of the IoT is in the convenience of saving resources; that intuition of the system lies in learning patterns or ordering consumables for the system. There was also some recognition that the IoT could lead to a loss of social/physical interaction (framed as a positive in not having to roll a cigarette), that it takes control away from the user and it changes the practices of the space that it's in.

We then looked in greater detail at the practices that the participants had discussed previously using a set of parallel Practice based cards I developed, based on elements that constitute practices. These were useful in breaking down these into granular elements of time, space, acts, objects and allowed participants to reframe how they understood their practices in some detail.

We then used both of the cards sets that we had curated in concert with existing models of the IoT. I printed a range of options for the participants to choose from and then asked them to place the cards wherever they felt that they should go. This was useful as it made the participants situate their acts within the context of both technical sensing/transmission/output methods and an overarching system that was more representative of the structure of the IoT than the models they had developed. This led to a greater clarity of the IoT as it stands and helped to shift their understanding of the system from automated to intuitively assistive, where the "intuition" of the system was based on information inside the domestic and from data sources outside. This was combined with some closely related subtle changes, such as the shift towards physicality, human interaction and social interaction enabled by the IoT, a mention of the interrelations of objects developing some of this "intuition" and recognition that the IoT could have an effect on the practices we were discussing. These shifts in understanding led to a change in the position of automation equating to convenience, to automation needing boundaries, as there was recognition that dependence could be nurtured by this system.

We then used the experiential model of the IoT that I had developed and conducted the same mapping exercise. This led to a few outcomes: the model of the IoT included elements that participants didn't understand (not surprising as it's quite a high level) and the cards were placed with less confidence due to this. However, this model helped to clarify further the experience and human elements that could be included in the IoT and that weren't shown in most of the other models we used in the last section. From this exercise, the participants were more aware of how a mental model can affect the entire conception of a system, opening up new possibilities and showing an alternative understanding of the same topic. They discussed how the system as modelled served the user's desires, how they could exert control over the system (PB wanted to press a button and let the system make coffee) how previous IoT devices were straightforward and had less of an emotional element to them and that situations and contexts were key drivers of this system.

Finally, we discussed the day's activities and debriefed on the value and outcomes of what we had just done. The participants understanding of the IoT had developed through the workshop, not only at a technical level, but on a systemic understanding level and situated practice level. They felt that the IoT should integrate their needs and actions to it, not the other way round - that it should fit to the user, not lead them. Perhaps this could be achieved through new interactivity based on emotion and objects knowing moods. Automation was still fine, as long as control could be taken back and the data generated was kept "small." Participants were still interested in the IoT for the possibilities of resource management, but were also aware that the IoT could be expressive and represent how they used their spaces and objects or create new forms of interactivity based on emotion. There was a general lack of trust towards the objects and systems of the IoT and concerns about the IoT having to be corrected constantly if it made incorrect assumptions, which could lead to expensive mistakes (heating too high etc.) and also about the selling of data. There was also the suggestion that automated processes could be fine, if the sights, smells and sensations of the original process were still present and the tactility of the system/object/experience were right.

#### **Final conclusions on WS02 Methods**

The methods used in this workshop included discussions, examples of products, developing mental models, curating card sets of technical elements, developing card sets of practices, applying these sets to standard IoT models and applying these to my experiential model. These methods were useful in leading the participants through a complex field that was made more complex by my additional models etc. I think that this was a successful collection of methods, as it allowed for the incremental development of complexity, meaning that participants could engage with the IoT on quite a high level by the end of the process and identify issues that could affect the system, objects and themselves.

Open discussions were useful in establishing the participants underlying attitudes and understanding of the IoT. This was ok, but giving this the context of the products across a range of the IoT helped to generate more specific feedback, both positive and negative. This was important, as it established a baseline of understanding for us to move forward and work from.

The initial models of the IoT that I asked participants to make weren't great - this is a complicated area and

structure, so I wasn't expecting a huge level of detail or accuracy, and I wasn't disappointed. The models were bad, lacking key elements and showing a misunderstanding of the IoT on the whole. This was useful to me, as it showed that these self-selecting participants who said that they had some knowledge of the IoT had no real conception of how it worked in either local or global scales. This was useful to the participants, as it showed that the IoT is far more complex than they had considered and that mental models of systems are key to understanding what is actually happening. At this point, the attitudes of the participants started to change slightly, with the implications that the IoT could have on spaces and practices becoming clearer. (Sidenote - the models in WS01 were on the whole much better, even if they were also inaccurate in terms of global/local scale. They all included people, devices, business etc. and were more imaginative. This is probably due to disciplinary bias and expertise of a group of designers vs. a group of users - even if one of those users was a technical expert.)

The use of technical KnowCards within the self-developed models was useful, as it not only made an abstract system more tangible, but it also showed the limitation in the models. Following this, participants developed storyboards and practice KnowCard sets to try to make this notion of practice in the domestic less abstract too, so that they could place this within the context of the IoT. This allowed the participants to break down their personal routines into smaller subcategories based around the elements that make them up. These card sets provided guidance and were representative of things that the participants were familiar with - the times, spaces, objects and attitudes of their own routines

Once we had done this, we applied both of these card sets to a model of the IoT that had been developed by experts - I provided about 8 models to choose from. Participants mapped the technical and experiential elements from the KnowCards onto the model as best they could. This showed the participants current understandings and models of the IoT and how the technical elements could fit relatively easily, but the practice elements were harder to situate. This lack of space for practice meant that the participant's discussion of this focused on how practice could take place in this type of system, how automation could become backed into the system and that dependence on the system was encouraged within these models. This was effective in showing the participants that existing understandings and models of the IoT are fine on a technical level, but when the practice/human element is added the models are lacking.

These card sets were then applied to the experiential IoT model that I developed. The mapping and positioning of the cards was easier again, with the practice KnowCards fitting into the model directly. However, there was still a little confusion about where some elements should go. I think that this is due to the complexity of the model, which is useful in considering practice as the key driver of the system, but more confusing in terms of technical elements. This model was useful in showing that the participants had developed their understanding of the IoT and that the original models that they had were severely lacking. It also demonstrated that models contain biases and interests and leave out elements that can be key to its successful implementation. This is backed up by feedback from the participants in the debrief session, where the focus of the IoT shifted from a purely automated system to a system that included controllable automation and resource management, but also took in assistive intuition, emotion, expression and physicality.

# Appendix M - 5.3.2.1: Professional Design Practice Toolkit

<p> <b>Shaving</b></p>  <p>self</p> <p>"I go and brush my teeth and sometimes have a shower and shave, get dressed, have a cup of tea. I'm always late so I do it all super-fast."</p>	<p> <b>Dressing</b></p>  <p>self</p> <p>"I go and brush my teeth and sometimes have a shower and shave, get dressed, have a cup of tea. I'm always late so I do it all super-fast."</p>	<p> <b>Brushing teeth</b></p>  <p>self</p> <p>"I go and brush my teeth and sometimes have a shower and shave, get dressed, have a cup of tea. I'm always late so I do it all super-fast."</p>
<p> <b>Washing</b></p>  <p>self</p> <p>"So, brushing my teeth with my electric toothbrush, washing my hair and my body, generally in that order."</p>	<p> <b>Making a hot drink</b></p>  <p>food/drink</p> <p>"Of the three people in my house who drink coffee in the morning I'm the first in the kitchen and I will make coffee."</p>	<p> <b>Checking emails on mobile</b></p>  <p>media</p> <p>"...and if I've got emails and admin stuff to do I do that then, the most sober time of the day [morning], when you're going through stuff and reviewing what you have to do."</p>
<p> <b>Looking in the fridge</b></p>  <p>food/drink</p> <p>"...come back in open the fridge, close the fridge..."</p>	<p> <b>Lighting a fire</b></p>  <p>environment</p> <p>"I light the fire now and then, and then I'll cook something."</p>	<p> <b>Reading a book / e-reader</b></p>  <p>media</p> <p>"The reading a book thing is a cultural thing - I find myself with spare time and think that would be a good thing to do."</p>

👤 Listening to the radio/records



media

"I'll always listen to the radio, I guess. I do have one routine that I've developed recently which is listening to records in the evening."

👤 Washing up



environment

"Well washing up I do constantly, and I mean constantly. I hate the idea of coming home to a massive pile of washing up."

👤 Playing an instrument



self

"Actually, while I'm making coffee I'm on the piano. Very recently I've been trying to do breakfast, and that's miso soup and I actually use the piano to time the soup."

👤 Leaving / returning home



environment

"I might go out for a walk... If I'm working from home I have to leave the house at least once or twice. "

👤 Looking at bookshelf



media

"If I go into someone's room I look at their bookcase. If I have a second I go over and stare at it."

👤 Watering plants



environment

"I water plants to grow vegetables, and going and watering them, which is something that you do three of four times a day is something...when I wake up I go and do that."

👤 Taking out the bins



environment

"Taking bins out on Wednesday, pretty straightforward."

👤 Adjusting TV volume



media / environment

"They go to bed around nine and around that time we'll turn the TV down. But when she isn't there the TV stays on loud extra late, almost like we're overcompensating for it."

👤 Putting children to bed



misc

"Putting my child to bed is the thing that I do the most. He usually likes me to lie down next to him and read him a story in his bed and fall asleep with him while he twiddles my hair."

<p> <b>Calling relatives</b></p>  <p>media / self</p> <p>"My mum will call every Friday evening, even though I almost never answer cos I'm out doing whatever. 7, 8 o'clock on a Friday night, she'll call, leave me a voicemail and then I'll call her back over the weekend."</p>	<p> <b>Meditating</b></p>  <p>self</p> <p>"I used to meditate, but I stopped doing that. If I could, I'd meditate but I never do. I'm too flighty."</p>	<p> <b>Having a family meal</b></p>  <p>food / drink</p> <p>"...to do with the relatives and everyone where every Sunday we all meet and have lunch. And my granddad who I never met set that up..."</p>
<p> <b>Going through photos</b></p>  <p>media</p> <p>"...we sit there and flick through photos; that feels oddly meaningful, looking back over the last couple of years and two kids have arrived."</p>	<p> <b>Diary</b></p>  <p>media</p> <p>"I use my diary every day because I like to have interactions with the real object."</p>	<p> <b>Lighter</b></p>  <p>misc</p> <p>"It doesn't have any specific emotional attachment but I just like the fact that I've had it for that long and I have kept using it and maintaining it. It's very important to my day. I don't like the fact that it is..."</p>
<p> <b>Extension Plug</b></p>  <p>misc</p> <p>"The extension cable is standardised and integral to my daily life for so long."</p>	<p> <b>Cushion</b></p>  <p>misc</p> <p>"It has two functions - it's decorative and practical. It can be used to seat friends and make them more comfortable."</p>	<p> <b>Ring</b></p>  <p>misc</p> <p>"This ring has no function, but it feels strange if I'm not wearing it. It's a Napoleonic ring that used to be filled with poison and was passed down through my mother's family."</p>

<p> <b>Face Scrub</b></p>  <p>misc</p> <p>"I use these objects twice a day, morning and night. I am trying to fix a routine of cleanliness. I use them in order and they make me feel refreshed and on track."</p>	<p> <b>Formula &amp; bottle</b></p>  <p>food preparation</p> <p>"I use this to make my daughter's milk five times a day. As a full time father for six months this is an important part of my day and has significant emotional connotations".</p>	<p> <b>Religious Objects</b></p>  <p>misc</p> <p>"I have an attachment to the rituals we use in Jewish stuff. My prayer book was from my grandfather's bar mitzvah. The candleabra we got was bought for us on our wedding by my cousin. They have emotion..."</p>
<p> <b>Curtains</b></p>  <p>misc</p> <p>"I put some nails on the wall and got a cloth and cover it when I need to have the curtains on and I take it off every morning. The light comes into my room and I'm beginning my day."</p>	<p> <b>Rocking Chair</b></p>  <p>furniture</p> <p>"We've got quite a lot of sentimental objects around us in the house...there's my grandfathers rocking chair that he would sit in every night."</p>	<p> <b>Tablespoon</b></p>  <p>food preparation</p> <p>"There's a particular tablespoon – three dollops of that gets a good amount of coffee."</p>
<p> <b>Stovetop Coffee</b></p>  <p>food preparation</p> <p>"My brother moved out and took a stovetop with him; I need to get another one. It's a stovetop with enough espresso for one cup, but we halve that..."</p>	<p> <b>Laptop</b></p>  <p>media</p> <p>"I don't want to read the newspaper anyway. I use Reuters...usually in the morning I go to my laptop and see what the headlines are."</p>	<p> <b>Key Bowl</b></p>  <p>misc</p> <p>"This is a bowl that sits in my hallway. It was given to us for our wedding. Slowly it became part of our daily routine as it's where I leave my keys when I get home from work. I know where important items are."</p>

<p> <b>Cafetiere</b></p>  <p>food preparation</p> <p>"I know exactly how much water goes into the kettle and when it goes into the cafetiere it gets swilled around halfway through and then stirred thoroughly when it's full."</p>	<p> <b>High Chair</b></p>  <p>furniture</p> <p>"Well, the high chair is important! The first thing I'll do is put him in his high chair, get something for him to eat. He likes to sit here, he has a particular place at the table that's his favourite spot."</p>	<p> <b>Mug</b></p>  <p>food preparation</p> <p>"I use it all day round. I drink a lot of liquids, starting with coffee, in the daytime drinking water, milk, orange juice and in the evening tea. I also use the mug for the cooking process, for measuring liquids..."</p>
<p> <b>Record Player</b></p>  <p>media</p> <p>"So the record player is my most important physical object in the house. Music is very important and so is the quality and having it in a physical form..."</p>	<p> <b>Piano</b></p>  <p>musical instrument</p> <p>"Obviously the piano downstairs is important to me. I work upstairs, run downstairs, compose...that gives me some distance."</p>	<p> <b>Bookcase</b></p>  <p>furniture</p> <p>"The only ritualistic routine I've got is to make sure the bookcase looks nice. The value of my intellect can be seen more in my bookcase than it can in anything else that's visual in my life."</p>
<p> <b>Knife</b></p>  <p>food preparation</p> <p>"I cook a lot, so I definitely have sacred pots and pans and a knife."</p>	<p> <b>Desk</b></p>  <p>furniture</p> <p>"...my shrine is my desk, which I've purposefully got and put in place and set up and made work. I've positioned it in exactly the place I want it to be and everything is within reach."</p>	<p> <b>Photos</b></p>  <p>media</p> <p>"I have some pictures of my family, my grandmother and they've been there for a while."</p>

<p> <b>Art Pens</b></p>  <p>media</p> <p>"My pens are very important. I'm very possessive of the pens that I use when I draw. I actually don't want people to touch them because they're mine and I don't want other people's energies!"</p>	<p> <b>Toy Chest</b></p>  <p>furniture</p> <p>"This toy box is now mainly used as a prop when dressing the kids. It used to be where I sat to feed the kids. I have had it since I was a child myself. It is a connection to my past."</p>	<p> <b>Book Stand</b></p>  <p>food preparation</p> <p>"I bake on weekends and this book stand is part of this routine. I spend most of the week thinking about what I'm going to bake. The book sits there patiently waiting for Saturday to come. Just looking at it makes me smile."</p>
<p> <b>Headphones</b></p>  <p>media</p> <p>"I use these everyday when in motion. I use it to listen to three regular podcasts and lots of music. It is wireless so I can take it running or use it cooking. I like the intimacy of sound so close to me."</p>	<p> <b>Guitar</b></p>  <p>musical instrument</p> <p>"This is my guitar. I use it to improvise everyday, compose most days and improve technique."</p>	<p> <b>Toothbrush</b></p>  <p>misc</p> <p>"I travel a lot and live in different countries, but brushing my teeth twice a day is one of the only things I do that has stayed the same."</p>

## LOSS OF SOCIAL & PHYSICAL INTERACTION

Analysis of human interaction could be to remove it!

Can't turn a page or cross through things –  
important interaction

Capable of modifying habits

Has an influence on your daily routines

Individualistic - doesn't encourage social interaction

Information provided may be directed towards  
making new products that we don't need

You might start to believe the apps more than  
yourself

## CHANGING PRACTICES

Analysis of human interaction could  
be to remove it!

Can't turn a page or cross through things –  
important interaction

Has an influence on your daily routines

If it's automated to delete emails when it thinks  
they're "done" (the event has passed or email read)  
it would be bad ("I want control")

If the system does things in a way decided by others

User could become dependent on it

You have to be organised to use it

## DEPENDENCE

A sense of loss if it's forgotten somewhere

Analysis of human interaction could be  
to remove it!

Has an influence on your daily routines

If the system does things in a way decided by  
others

It's only accessible to a select group of consumers,  
so it drives stratification

Objects may fail

User could become dependent on it

You might start to believe the apps more than  
yourself

## SECURITY/DATA OWNERSHIP

Data breaches

Data can be sold for personalised advertising

Data collected in current system is for the company  
and would probably give falsified information

If it's a shareholder owned company, then it's likely to  
be made unsustainably to make cost of production  
lower and drive future sales

If it's automated to delete emails when it thinks  
they're "done" (the event has passed or email read)  
it would be bad ("I want control")

If the system does things in a way decided by others

Information provided may be directed towards  
making new products that we don't need

It has control over what kinds of data is produced

User could be locked into the manufacturer's  
ecosystem (Apple/Google/Samsung etc)

## EXPLOITATION

- Analysis of human interaction could be to remove it!
- Data can be sold for personalised advertising
- Data collected in current system is for the company and would probably give falsified information
- If it's a shareholder owned company, then it's likely to be made unsustainably to make cost of production lower and drive future sales
- If the system does things in a way decided by others
- Information provided may be directed towards making new products that we don't need
- It has control over what kinds of data is produced
- It's only accessible to a select group of consumers, so it drives stratification
- User could be locked into the manufacturer's ecosystem (Apple/Google/Samsung etc)

## AUTOMATED

- Automatically deletes duplicated information
- Automatically limits to the proper sound levels
- Can collect information without the need to communicate it explicitly
- Can wake you up
- Changes "X" depending on environment (working out, walking, working)
- Tracks your data
- Uses monitor to understand emotions and change "X" to suit it
- Warns if there are unwanted things on it

## EMOTION

- Can be removed if user doesn't like it or the objects don't learn properly
- Connected to IoT - can bring people closer together and send emotions
- Easy
- Uses monitor to understand emotions and change "X" to suit it

## DEPENDENCE

- A sense of loss if it's forgotten somewhere
- Analysis of human interaction could be to remove it!
- Has an influence on your daily routines
- If the system does things in a way decided by others
- It's only accessible to a select group of consumers, so it drives stratification
- Objects may fail
- User could become dependent on it
- You might start to believe the apps more than yourself

## SOCIAL

- Can provide a greater scientific understanding of the human element of this
- Connected to IoT - can bring people closer together and send emotions
- Provides more choices and information into our lifestyles and routines
- Shared across mobile devices

## INTUITIVE

- Changes "X" depending on environment (working out, walking, working)
- Tracks your data
- Uses monitor to understand emotions and change "X" to suit it

## EASY

- Convenient
- Easy
- Quicker to "X" than "Y"

## ASSISTIVE

Can collect information without the need to communicate it explicitly.

Connected to IoT - can bring people closer together and send emotion

Convenient

Detects and gives feedback on use

It can analyse the products that we use that have power supplied to them

Provides more choices and information into our lifestyles and routines

Recommends specific products

Reminds you to...

Suggests changes to your routine to increase your health

Uses monitor to understand emotions and change "X" to suit it

Warns if there are unwanted things on it

## SPECIFICATIONS

**Develop products/experiences/systems that:**

...increase human interactions (5)

...are private (4)

...increase access to technology, so leading to less stratification and greater equality (3)

...are convenient (3)

...have automation (3)

...advance science and knowledge through data collection (patterns we don't realise, how people influence environment) (3)

...save time (2)

...are accessible and can be controlled (2)

...encourage individuality but with knowledge of consequences in the world (2)

...have minimal impact on environment/resources (1)

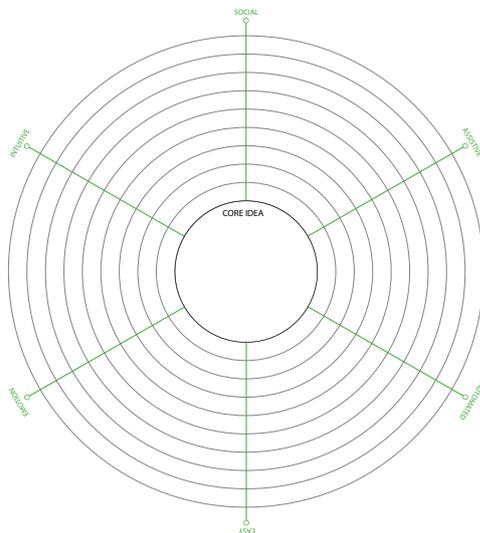
...save more time than they consume (1)

...have no failure states (1)

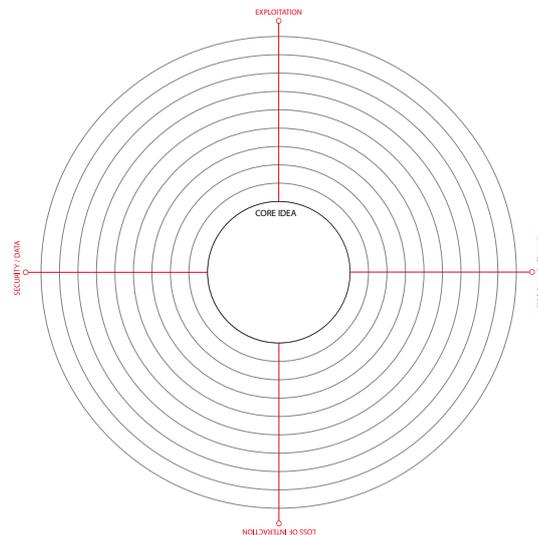
...have no subscriptions or continuing payments (1)

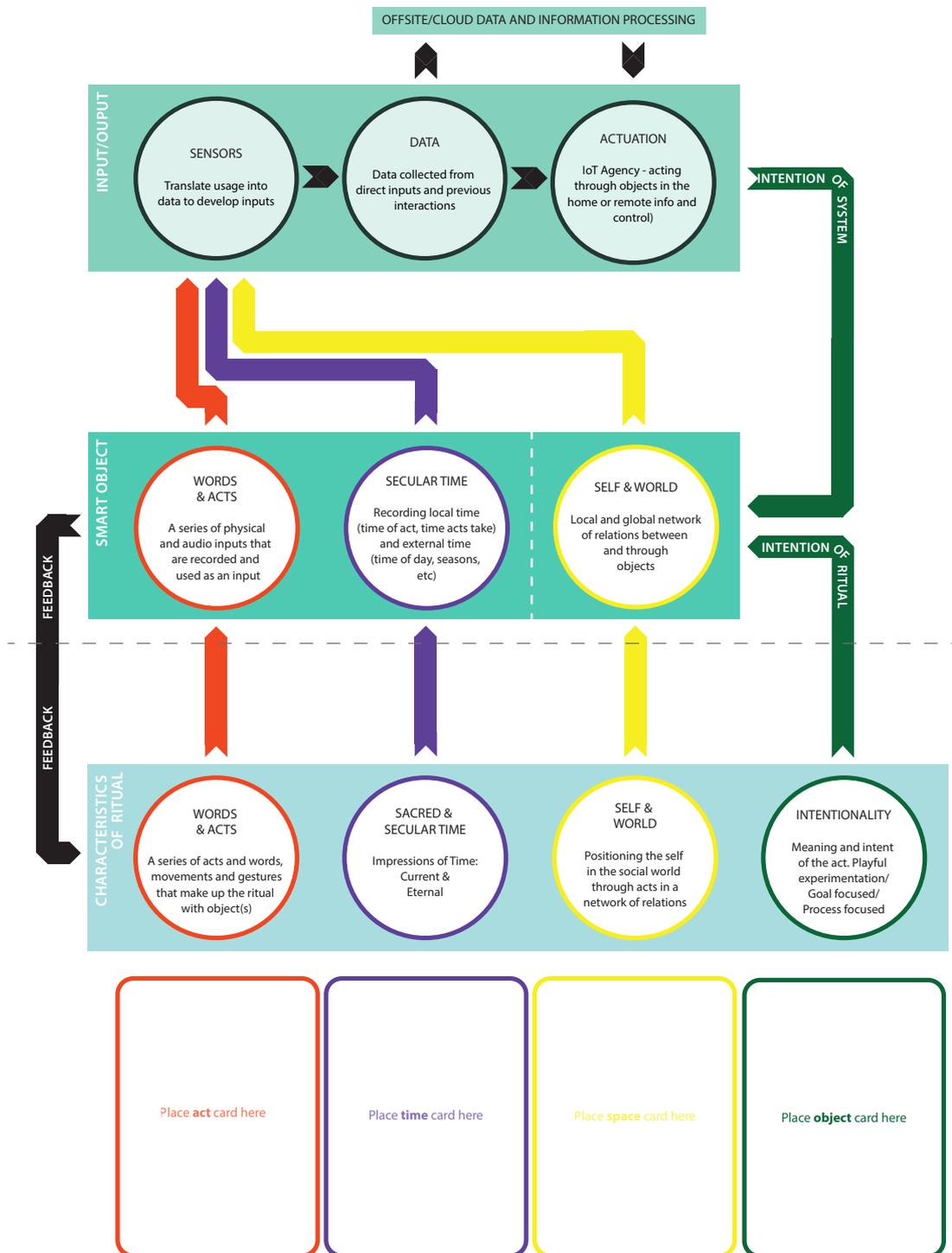
...are like Wallace and Grommet (1)

## DESIRABLE IoT QUALITIES



## UNDESIRABLE IoT CHARACTERISTICS





Use the Ritual KnowCard Set to position human experiences, domestic acts and reflective practice as central to the development of domestic IoT products that engage with "thinginess"



**Royal College of Art**  
**RESEARCHRCA**

For further information  
 Supervisor:  
*Prof. Ashley Hall,*  
*Innovation Design Engineering,*  
*ashley.hall@rca.ac.uk*

DATE:

*The Internet of Things in the Domestic Space*  
**CoDesign Session Consent Form**

I (*please print*).....have read the information on the research project The Internet of Things in the Domestic Space, which is to be conducted by Michael Kann from the Royal College of Art, and all queries have been answered to my satisfaction.

I agree to voluntarily participate in this research and give my consent freely. I understand that the project will be conducted in accordance with the Information Sheet, a copy of which I have retained.

I understand that I can withdraw from the project at any time, without penalty, and do not have to give any reason for withdrawing.

I consent to:

- Take part in the Co-Design session, which will take about 4 hours.
- Give personal information if required.

I understand that all information gathered from the survey will be stored securely, my opinions will be accurately represented. Any images in which I can be clearly identified will be used in the public domain only with my consent.

Print Name:.....

Signature.....

Date: .....

This project will be conducted in compliance with the Research Ethics Code of the Royal College of Art.



For further information  
Supervisor:  
*Prof. Ashley Hall,*  
*Innovation Design Engineering,*  
*ashley.hall@rca.ac.uk*

DATE:

*The Internet of Things in the Domestic Space*  
**CoDesign Session Consent Form**

Dear Participant,

I am Michael Kann, a Research Student in Innovation Design Engineering. As part of my studies, I am conducting a research project entitled The Internet of Things in the Domestic Space. You are invited to take part in this research project which explores the future role of technological artifacts in the home and the impacts they could have to the way we use this space, our routines and rituals in the home and our relationships to our curated possessions. You are invited to participate in this research.

If you consent to participate, this will involve:

- Taking part in the Co-Design session, which will take about 4 hours.

Participants are invited to take part from across a spectrum of ages, socio-economic backgrounds and family statuses from amongst a network of peers and associates.

Participation is entirely voluntary. You can withdraw at any time and there will be no disadvantage if you decide not to complete the survey. All information collected will be confidential. All information gathered from the survey will be stored securely and once the information has been analysed. At no time will any individual be identified in any reports resulting from this study.

If you have any concerns or would like to know the outcome of this project, please contact my supervisor, Ashley Hall, at the above address.

Thank you for your interest,

A handwritten signature in black ink, appearing to be "Michael Kann", written over a light blue horizontal line.

Michael Kann

**Complaints Clause:**

**This project follows the guidelines laid out by the Research Ethics Code of the Royal College of Art.**

**If you should have any concerns about your rights as a participant in this research, or you have a complaint about the manner in which this research is conducted, it may be given to the researcher or, if an independent person is preferred, addressed to the Research Ethics Committee of the Royal College of Art at the above address.**

Royal College of Art, Kensington Gore, London SW7 2EU, UK T: +44 (0)20 7590 4214 E: [research@rca.ac.uk](mailto:research@rca.ac.uk) [www.rca.ac.uk](http://www.rca.ac.uk)

## Appendix N - 5.3.2.2: Professional Design Practice Workshop Analysis

### Co-design workshops etc

Aim of the workshops is to:

**Test my toolkit that comprises of:**

- Map (based on understanding of domestic practice, with user made driver of IoT and responses)
- Card Deck – Using template of Know Cards but refocusing from technical elements of IoT to HCD elements.
- Specifications – Based on past workshops, list of specs that users want and have agreed on.
- Characteristics of IoT – Positive and negative qualities of IoT, based on past workshops and user input.

**Explore how (or whether) an experiential, design driven model of the IoT can help to develop alternative IoT products that:**

- Refocuses on an assistive system that is driven by users, not leading them or removing agency from domestic practices.
- Can help to develop home IoT products that use materiality and form to express use/data/information/feedback, rather than screen and data/graphic representations.
- Can reposition the IoT from a resource management tool to a system that allows for the continual development and evolution of communities of practice, based around how people use their homes.
- And whether this can help to promote the idea that a domestic IoT should have different priorities within the home, as it is such a different space to “normal” IoT applications.

**Discover whether:**

- Design position as 3<sup>rd</sup> culture allows design to understand the problem of the IoT in the home – from a constructivist (etc) understanding rather than positivist
- Design research allows for problem framing/solution by synthesis to find out what the problem/question is and whether it's the right question – i.e. failure of IoT in the home not to do
- Toolkit developed to see if design sensibilities and approach to IoT could help to develop concept and products that are more suitable for the home.

## Participant A

*To Do  
IoT*

**BACKGROUND:**

LG - Korea hired straight from undergrad at Manchester.

Working on TV design, a lot of work with Tangerine - microwave ovens, washing machines, dishwashers, a lot of OA stuff like computer monitors and right through to digital playback platforms like CD-i, 3DO and commercial products like predecessors to current mobile phones and lots of other communication equipment like standard PABX phones. So the entire gamut of consumer products.

Left after 8 years to join the RCA in 1999. I pursued 3 different areas of activity. 1 - inclusive design, primarily with people who found it difficult to use remote control systems for TVs and other domestic entertainment equipment. 2 - pollution and CO2 emissions regs - big news in 1999. 3 - Older generation reincorporated back into the field of current communication - I felt they were being left out.

Left and setup my own private practice in High St Ken - first client was lattice group, later the National Grid, who bought all the CO2 emissions final degree show piece. Then went on to use in house design services from LG to private clients. RiM, Philips, Boots were early clients. Then Sky and subsidiary responsible for set top box. Went through all these tech centric companies, at the same time doing work on healthcare products. Progressing into packaging reduction.

Concentrate on 2 or 3 areas - lighting started coming on the scene, but in the last five years IoT became more bigger. IoT came through lighting and LED design and now kickstarter every second project on Kickstarter seems IoT related, so had several Kickstarted products.

2 live IoT projects at the moment and one is the top of a hand dryer and the other one is a type of domestic security device. These are all small - very few of the larger enterprises are into this - it seems to be opportunities for new market introduction through layering up an IoT service onto a standardised part. Not all are C2C, about half is B2B. The end user isn't the consumer a lot of the time, it's a facilities manager for example.

#### **MK: IoT in domestic?**

Yes, 3 projects. When I say domestic I mean home security. Domestic lighting as well. 2 in home sec, 1 in lighting.

#### **Explanation of session by MK - Tangibility, physicality, user experience and delight**

I can see where the trough of disillusionment bottomed out which is a speaker system that one of my friends bought which is a voice activated system. A California product. The company went bust and the speaker was no longer operable at all so he ended up with a piece of plastic. Not a gradual loss of functionality but immediate landfill.

**Explanation of design research vs engineering practice. Importance of domestic, material culture, bodily extension. Situated acts, communities of practice, going beyond the physical. Practice/routine and IoT. IoT as witness and first model**

Would an example be if you came home and you had a reasonably difficult day and you arrived back at 3pm as opposed to 5 and then you sat down and did nothing except relax and the system at home could detect this person's home early, that your heartbeat is extended, could be beating a little bit fast - do you think that it could respond in some respect by lowering the lighting system. Is this what you mean? I know it's not practice but there's a level of it looks at your behaviour and maybe feedback back?

**Good example - previous example of interview. Object meaning vs designers putting meaning and trying to get people to buy in. Allowing product to develop in relation with you rather than imposing it. Home vs factory model. Reflective model and cards. Test model, assumptions, toolkit and past characteristics are useful to develop IoT and representative of opinions.**

When I've done workshops before on the IoT they've been very short. The level of detail that we've gone into wouldn't be as high as the level of detail that we're going into now. It's very much an assumption that there's a market without going into the depth that you're going into this. I mean we've had lots of workshops and development sessions, but we would not be going into the philosophical aspect of whether people actually need this. It's fundamental to ask these questions and I'm not sure that my clients have done.

**Product examples. Model. KnowCards. Random or curated practice. Explanation etc. Picks Good Night Lamp. Choose practice elements with deck.**

Object - Toy Chest as presence detection with more feedback than presence. Act is Reading a book - looking at the context of the goodnight lamp I'm thinking about what happens at the end of the day. Time - Sunset. Place - Children's Room.

## Explanation of map. Start of sketching/generative work.

The way I look at it is that when you're not there can you enjoy that experience or participate in it perhaps in some way.

### Like a telepresence reading

Looking at the Goodnight Lamp I have, not directly working with systems like that...there is a version of this which is a presence sensor for a refrigerator and when you open the refrigerator your daughter's IoT system can see that "Oh grand mum's up, she's got the munchies, it's two am." It's like that but it's got a higher level of feedback, because that means something in itself that somebody's in the house. BUT when they open the fridge, you know they're in the house, but "they've got the munchies, oh that's interesting." For example, in my house my daughters bedroom is here and ours is here and my office is here, so we can obviously hear her against our bedroom and our wall is there and we can hear her through the wall. So the idea of that connectedness physically is pretty amazing, but it would be amazing if that could be reflected when either myself or my wife are away from eh ouse. But at nighttime...when I'm looking at the Goodnight Lamp it actually reinforces a nightly ritual irrespective of whether you are the in the house physically or not that you can participate in it as long as you're in a time zone where it makes sense. If you're at a meeting in Korea and Europe is half a day away it's nice to be able to have some feedback in a slightly disjointed location like a meeting room. I see a correlation between the goodnight lamp where I don't think each lamp has to be mounted domestically. You could have one part of it that allows you to travel back to that type of environment without having the IoT device in that environment. We can hear her and our bed is actually touching the wall, so we get physical vibration if we kick the wall. She's got a bunk bed, so the idea of having vibration or noise is cool. So the actual in a timeline where she has to tidy all of her toys away in the actual tool box, which she has to do because the place is a mess. In the summertime we have to have blackout blinds to make sure that the sun does go down.

**Time selected is sunset, but it may not be sunset cos don't want going to be at 10 in summer.**

I remember as a child myself thinking mum, why do i have to go to bed? Bedtime would be more appropriate.

So the practice then is reading. the act of tidying them up ... it's going to be. When she's asleep at sunset for half an hour when you go to bed you can hear her sleeping on that wall ... you can hear her tossing and turning sometimes in bed and it gives you that reaffirmation that she's actually quite healthy and she's having a dream and ok. So the trigger point is 9pm, then go through this ritual and by 11 she's snoozing away and when you go to bed you pick up again on that loop by listening in.

I look at it as presence and even if i was away from that environment I think that's where the smart objects would come in. Is there a way of putting all of these events into a timeline? That's the way I look at it. Oh she's tidying up her toys, mum's reading to her, she's off to bed now. So maybe it's a two hour section at night time where it goes from tidying up all the toys to that point at 11 o'clock when she's going through REM sleep. So I think that two hours is an interesting time, especially for a parent who's away. Unlike the GNL it's for a fixed period, of course this could go on all night but you're not going to be monitoring your children when you're away on business for the entire 8 or 10 hours they're asleep. But it's nice to know that that's practice is happening. It would be nice to get involved in it.

**SO five minute concept. Sketch products around that - connected storytime, toy box type thing.**

Gender neutral.

### More for the parent?

Yeah. Making them more fulfilled that everything not pink.

### Experience more for them? How design product? Still use book typology?

Cuddly toys - stuffed carrot from Ikea. Books on bookshelf at bottom. Stuffed toys in bed. Water next to her. Facing books is something that attaches to toy? An accessory for a toy she has already. A necklace for a doll or bracelet on a bear. May just have a microphone or accelerometer or a light detector...

### Away from tech, more towards exp... Words and acts?

Person reading there in the room. Child. Telepresent person also getting involved but at the lower level. Just to enjoy listening to the child reading back or seeing which book you're reading to the child.

### What about reading down words and acts to get insp for interaction?

Stage 1, 2 3 stages of reading. Sentences of five words, two vowel - football instead of ball. We are reading 3, she might be reading back 2. Not necessarily in the book, but how good is she at reading abc and her comprehension. Significant level of education in this for concerned parent who wants doesn't want to be a helicopter parent but who wants to keep an eye on their development. I think it's a developmental tool if you look at the underlying drivers. If both parents want to get involved, if the other wants to make a comment. I don't think it's solely something to do... why would I want this? It's not just about participating in a child being put to bed, but looking at child's abilities while I'm away.

### Physical interaction with book? Toy chest and book - hinged? Think of object away from practice.

A sentence - I saw the ball, which is stage 1 for reading. I kicked is a trickier word, the football. Stage 2. If they read that sentence and the system knows that's a book on page one of fifteen, going up in complexity. Other parent rates child's ability and remote parent can see rated as being high/competent. Book can listen in? Have the rating of the child at data points along that the other parent can see. Either a book based sensor to rate child's reading capabilities. A level of difficulty that's been ramped up. If child reaches points along the pages gives positive reading feedback. More subject matter? A layering up, can you find the mouse on each page?

### Educational tool as well as being involved in kids. Sunset - teaching rather than go to bed. Eternal time?

Recontinuing a broken chain. Parent remembering the way they were treated by their parent and doesn't want that to happen so they overcompensate. There might be a negative connotation of that, a negative aspect where you want to compensate for something that didn't happen in eternal time.

Sense of self skewed when some else in the world with half your DNA. In this context the sense of self becomes slightly different when you become a parent I believe. Depends also on your social skills - do you prefer to be on your own or part of a network. I think Facebook plays a part too.

### Trying to give meaning to the connection?

I covered a little of this in my CO2 project, where I looked at the idea of adopting your local electricity substation. Everybody locally had to treat it well and you had a rough record of who was spiking the grid and looking for more electric than they deserved at that time of the day. Everyone behaviour helped to calm what could be a monster.

### Visibility and involved rather than passive consumer.

Self and world better for mediating behaviour more than anything else. Flight tracking - no one does it anymore as socially unacceptable. I would look at that in terms of behavior - for example if there was a food recycling bin - wow he's recycled 50KG of food waste last month. There's possibly seeking peer recognition.

2 levels of input - that child has been read to and the competency that the child is at.

### Benefit of passing that off to system?

If voice recognition and compared to sentence. Pattern recognition and rate at 70%. Wouldn't like my feedback to say daughter at 65%. Not necessarily a bar chart, something softer. A face that's smiling or something? You might not be able to break down or allowed to look at the improvements that happen day to day. Otherwise you end up with a sort of Obsessive Compulsive behaviour.

### What if different object, time, room etc? How effect process?

Three elements really. Is child actually tidying up? It's going to bed, great, good for health. It's doing something positive.

Could have a bookshelf, and not sunset but the weekend - might be different books at the weekend, and it doesn't have to be the child's room. Then you could move that reading to a different room and maybe even move the book to a reading corner so the manifestation of the IoT might change as well without changing too much about the final output which would still be the ability to understand the child's reading

#### And the practice of reading with or to child. Further Developments...

##### Opening and closing of book. Nook in the toy chest?

One thing closing = opening of something else. EG, closing cutlery drawer signal tv time. So trigger aspect to it. The actual toys would possibly be more of a bookshelf, perhaps put up there. A lot of the books we have are verging on toys anyway. I do like the idea of retrofitting something. Having a conventional chest and a conventional book. A digital back where you place a book onto a cover and then it scans down along through it. A camera on the other side to detect.

##### Think about interactional elements, not tech

There's another way. You want to have a child that has a certain level of imagination. A square but circle - some rigid routines and grow up to be a bit ordered and so not as stressed. Going from that to the chest we have tidying up - books can go into a chest too. Shelving with books too. Then the actual floor consists of a rug and a bed and a sideboard. The room is now tidy, so when it looks at the ground it looks neat. A level of achievement - psychological events from a holistic point of view.

##### Tailoring IoT for a child?

It would be a semi behavioural semi educational. To get it to enjoy a sense of order and has a reward of dreaming when it goes to sleep.

##### Storage object and object that's being stored. Which is IoT imho digi stores analog.

Say there's a tidy sensor and once it says you're free to go and have a bit of a read it triggers to another point where mum is going to read and this will be self reading and this one will be a rewarding light show before you go to bed. Child knows if they've done a good job "Oh look the tidy robot has stuck its thumb up, Let's go and read a book." Then the reading aspect may be something that will feed back into a third party who is a dad or maybe a grandfather who is not actually physically located in the room. So there's a command, reward and then there's a third party monitoring of it. So the child is not monitored on one aspect of its behaviour. More of a holistic approach to the time between 9 and 11pm. It would be interesting if the grandad could have some feedback - "Jenny you've tidied your room! Mummy can you start reading..." Jenny my little robot has said you've finished tidying your room."

##### Intergenerational support system.

I see some of these IoT systems as sole type on input and output - like the doorbell project. You ring a doorbell and the camera comes on and it shows who it is and you can press a button to let them in. What if someone stand at the left hand side? Even if you don't ring it it will trigger anyway. There could be a sliding bar about what kind of feedback you'd want from it - private, immediate family, extended family. Giving permissions.

Toys/objects in chest = different activities? A book, ball little robot? The toy chest is a rich area because the child will have certain toys that they will never put into the toy chest. Have them in bed, put into chest on holidays. Trigger events. More important is the fact that a standard toy chest would function fine but entry and exit of things into it mean you can use any type of toy chest. Describes his toy chest like a zoo with bars and pushing in and out through bars. Would have to do studies of kids and soft toy storage. Interpret the fact that each toy has persona and name. System could recognise the toy and personality and name. Recognition system for soft toys?

##### Does that fit with framework of element leading into practice?

It could. Make up story during role play. Add writing to storytelling and using characters in the toy chest as actors in a play. Tentative relationship between book and toy chest. Tell a story about fluffy and stripey. Perhaps the system could understand the system and write it you. It could be externalised as a page of a story. Tentative but more complex methods of interacting where now have a story listener or compiler and teller. Could well be desirable in terms of parents cooing over something the child has done. Turns child into director - a play to be broadcast to people outside over same system.

**Try to frame this within the practice the child has and whether fits into practice behaviour? Is it educational toy, but more framing as going to bed ritual, parent checking up, focus back on core elements of routine and affect user experience.**

Bandwidth can increase massively.

**Attenuate. Focus back on three core elements - reading, tidying, third party.**

Perhaps better to have a loose feedback.

**Room is tidy - what happens at this point. Forget tech, assume it's possible. Parent made aware, story read, child made aware does good job? Is the tidy room the output or is it a step to reading the story?**

Parent in another room. Go tidy room and when sensor says I can come in I'll come to the room. Light from one state to another. Parent come to room after that. Sense of wanting to satisfy an intermediary.

Long talk about mediators staff.

Some parents might find it stressful to ask child to tidy room, could have mediator to trigger event. IoT means usually networked to outside of the house.

**Refer to IoT in the house, out the house. Telepresence is cheap.**

Image recognition offsite. More intensive interpreted off site. Interesting intercession of IoT - come into room when intermediary says. Thumbs up from tidy bug. Reading book and turns into reading bug. One object two or three personas. Literacy bug.

**But what is core of IoT - parent, absent parent, tidying up? Multifunctional because can, focus on one thing.**

Reading aspect alone, two or three IoT systems where linked modularly to each other. Can link three bugs - each one might have ability for other parent to monitor into the scene from independent location. A list for each parent of reading material through system. Progress made on calendar basis or word basis. Manifestation of how might look?

**More interested in process leading to new outcomes? Reading bug idea is nice, but going down path of how is child reading, not experience aspect of it - practice of home? Way we are discussing fits into scientific idea of management and tracking, what if think of same process in qualitative way? Experiences and how feedback.**

Other parent choose book, what book to bring back? More of a librarian function?

**Something of non present acting as librarian...Idea of having toy chest linked to time? Not even explicit? Toy chest starts to close etc? A signal to the child - hour to bed, tidy up, read one of the books on the toy chest/bookshelf? External participant to choose book?**

Like the aspect of the toy chest having central role where has extra feedback. Layering up functionality on passive device. Capture magic of traditional toy chest and add a layer of functionality that sounds like magic but sole function is to assist, otherwise a toy in itself.

**Assistive vs automation.**

Keep forgetting which books already read - book assist remind me of which books read in the last two weeks? Which unopened? Some way of books on narrow shelf - channel that goes across. Some way that an unread book could be brought to front or pushed along. Could flick a book off the shelf onto the ground. Wife travels - use of whatsapp to show her

ten seconds of reading together. Nice if some other mediator that could be that librarian function or some ability to broaden suggestions available to child.

### Opportunity for amazon data mining

Explore types of books. Osborne flap books. Opportunity without being didactic - suggestive role. Bookshelf mimicked by virtual thing.

**Bookshelf mediating reading and toy chest mediating time and teaching responsibility.**

**IoT shelf -can show book lent is being read through ghostly image, flashing? Don't know if fits into anything in elements of practice?**

Probably cut off of tracking vs responsibility. Who lent to? Lose books? Cutt off between service managing on behalf to where you end up working for it rather than working for you?

**What is intention of reading? Showing reading lent book, experience of observer?**

What if you could bias it? Venn diagrams of broadcasting? Education / borrowed or lent / broadcasting what reading - bias of move it to middle, expand radius? Loose way of increasing amount of usefulness from system. Relationships between books themselves? Some element of connectivity between books that could be IoT - rather than hyperlinks, a soft level of linking? What implications would that have?

**Think about this in context of practice and specs up there. Concepts and analyse and then discuss. Bookshelf/toy chest -in terms of specs, can this increase human int ..**

Yes. Massively, but not only - depends on bandwidth. You can focus solely on family, share

bookshelf with best mates, see which are available to loan or borrow.

Private - a non sharing shelf.

Access to tech - could buy a bookshelf for a poor child to get them to read and freinds with our child to encourage them to read if altruistic?

Convenient - yes.

Advance science and knowledge through tech - do you want to exploit children through this?

Don't want to start comparing your kids to other kids abilities.

Saving time - not necessary when comes to kids.

Accessible - no undesirable books?

Encouraging responsibility - not sure right age.

Environment -- keeping books in circulation.

Save more time - not relevant?

**Wallace and gromit - playful, but not IoT but way of interfacing with object. Otherwise IoT is a toy and trying to avoid.**

Opportunity to add services in that specific space. Don't really need it in a laundry for example - who is cleaning the clothes or genre of tv they're watching. Ecosystem with specific set with inputs and outputs that hinge upon this idea working. **But i think you might find it difficult to expand lot into the house it's impossible to not have services designed as part of the offering.** Doorbell project - custom silicon and software - ultimately that is going to have it's own ecosystem where have auto opening daii that somebody from delivery company can automatically trigger door to open to place package in the lobby, whole ecosystem unrelated to one in child's bedroom but due to door opening. **Different ecosystems from different parts of the house - interpret from this model.**

Not massive amounts of cross nor want it - limitation due to human inability to comprehend complexity. Doorbell so neighbours not encumbered - so services design would have two different functionalities here and in door opening. Also think expectation of the life of the product would be different - doorbell to last for long long time 10 years. This would come in at different price and last for 3 years? So you talk about lifespan of products and danger physical manifestation could start looking old fashioned quickly if not carefully designed apple quite good at looking reasonably timeless. If cant match you could expose product to early demise. So product manifestation - do you want it manifeste at all or embed it?

In this product - "smart" shelf, tidying toy box. Generated from process? Picking book from shelf? Trigger avatar of blank book, Ipad case with animate facetime? Point is to develop further need a couple of weeks. This is about generation.

Library shelf is self contained within a part of the house.

Story telling, writing, distance reading. Sense of order. Self generating stories through toys? Toy box and book together and role plays - books writes itself.

- Like earlier - or assistive to you writing. \_What if toybox when lid folded back the lid could be used as a writing desk to write about...then we are going into toy design...

Fair point, community practices.

- Favourite books - maybe the shelf could grow with the child. App or IoT can reach a level of adolescence where adapts to growing brain of child. As opposed to being chucked out. If grandparents in Spain an always using whatsapp and facetime. MUm in CHina, I'm here. Interested parties who want to talk to her too. Interesting relationship between them all. Core group. Nieces and nephews. IoT product or network moderator?

Accordion book with LED built in. MObile day pop up book? With a level of interaction that is experience. Lets you feel that you're there even if not?

A tablet that the book is left on when reading to child, a selected level of bandwidth from hearing the child reading back or simply to know the child is reading the first place.

Let's do a quick evaluation. Let's see what happens. User experience map. Pink is shelf. What are stages of use of product?

Mum travels a lot. Would like to monitor child's reading capabilities at soft level. BUy a physical shelf like we have here. Possibly a device that can monitor all the book, wall mounted to shelf is already present...

But what do they do at the first stage?

- If person not there, wouldn't have trigger to know event is happening. If book is opened by child - right at beginning and positive thing.

Book opened and the distant parent has noticed and the present parent is there as well?

- The child is more likely in bed, positive as well. Pretty good settled and in bed. Open book and title will come up - one parent in the room. And then you might have another that is overseas, or unfortunately separated parents. Maybe want to have some part of experience as well. Once book opened child reads. Possibly put selection before that. Fact child can select is cool. Reading can be here - i only want to read two pages. If user experience map is also looking at the parent then hearing the child's voice would be one, or else monitoring page progress. As continue on increasing maybe comments about the story, child's comments. Child's feedback on story or even recording that.

End of it, closing book, finishing story? Way of getting kid to sleep, so is that the end of it, the goal?



End asleep - finishing, closing, placing book on shelf. Then good night and lights out.

Lights controlled by shelf? Night light/ambient light in the shelf?

Yeah, could glow around the book around that book more than others. Ambient light - shelf sensitivity. Maybe the other party need to know - it could be acoustic or basically a bar chart

or how doing - more involved to do that. Maybe the light also goes down on iphone app, or physical avatar, or could be a small book on wall - something to represent. COuld end with photo of child asleep in bed. Not sure if all here. Output for other party hearing the voice, capture? On the negatives, when child is tired maybe the last pages have difficult words. You can have it having to try to have the child relax, but hyper.

#### All improving exp of person absent - is it for kid and present?

Depends on type of intercession. Person not here able to feed back in? COuld be whether or not feedback into the event. I don't know if it will benefit the child more than the parent and how parent know if it is. I don't know but then we're talking about situation where no longer IoT product but reading aid...

#### Not necessarily mutually exclusive...Not managerial, different type.

Shelf snapped to end of the bed - view of child? Mummy's away shelf.

#### Judge from specifications and themes - positive and negative.

- Could be exploitative - 3. Hi def camera? Hard to say right now as way we've designed it. Never put hi def camera in first place. Speaker might be risky. Anything can be hacked. If I knew IoT systems in my house, would be fine. If level of monitoring of hacking, be fine with going further up.

#### Change practices? Sell to children? Built in obsolescence.

Why you need secondary use, static use.

#### Drive stratification?

Could be targeted at schools to encourage reading. See more positives.

#### Interaction - quality up, down?

- If one partner with heavy schedule, better. Some sort of soft feedback when get into wifi area. See more negatives in changing practices. Pre landfill. Would like it to grow with child. Interrupt parents abilities to talk with the child.

#### Positive - made things social in better way?

Yes, if designed correctly. Grandparents would be intrigued to hear child reading in spanish. Amazing potential. 7-10

- Not massively assistive to child itself. Assistive in a passive way - tracking read books, but potential to be incredibly annoying if goes wrong.

Imaging tech if it has a camera that only focuses on book. Could be automated in that respect, but role of it is not to automate. Not onerous on parents to have library in books. Automation would be to tabulate books and remind people to take lent books. Resource management - child wants to have an aspect of responsibility too.

Not necessarily easier for child to read. DON't see it have a massive role in improving child, larger audience. Less than automated. Pedagogical element to it will fail - down to parents. High emotion - so many people involved. Main reason why esp if ability to record child reading or parents to take copy of that. Most important. Intuitive - use of product - everybody pushes that onto dashboards. Not in product itself.

#### Analog from GNL?

Could be photo of grandparents on the shelf as bookends - could look at affordances of books associated with bookshelf. If book is facing down already read, showing a level of progression. Could be high intuitive but always with some level of confusion. If encourages reading a massive benefit. More positive through parents interaction.

Brainstorming in different way to normal. If coming up with own design for IoT system and given blue sky i'd like to brainstorm it in this way, whereas if you are an in house company responding to pressure to a product that's already out you'd end up having a me too product. Would give significant advantage if shown to be beneficial in final form. Would be interesting if went down four different routes and then saw what the cross overs where from them all. That would reinforces the hypothesis. Certainly as a product design you are always questioning whether it will be needed by anybody. Afraid of IoT - can we expect companies to exist in 5 years?



**Think leads to meaningful practices?**

Yes, it makes them more meaningful as allowing an extra level of bandwidth for people outside of the home to interact with the child and add as small bandwidth of their choosing. You are encouraging people who may not - you can give this product to someone and it modifies their behaviour which is a positive thing. You will see if you've not used it, you'll not see them on the network



**Automation ends assist begins?**

Automation ends when something in the setup stage - when you actually have your bluetooth products and a phone scanners to find the interfaces. That setup is the automation phase and the assistive phase is when you start to use them. To set up temperatures that you prefer or tv channels you like or mood lighting for certain times of the day,



**How think user centred mapping change designed for it?**

If i was a blue skies thinker and no predefined category of IoT product that wanted to design for, as a brainstorming tool this is excellent. It's a real good guidance tool but it's incomplete as a tool. You'd have to have far more cards, far more inputs for it to encompass all of the possibilities involved. You don't want the cards to limit your possibilities.



**Look at their product but look at the practice surround it? Use this to redesign based on 4 elements.**

Absolutely valid. Would say the act and times are more limited, i think it's possibly the intentionality that might need to be expanded. The self and world might need to be as well. I think the words and acts are ok but you don't want to be limited conceptually by the cards.



**How think inc user generated values effect dev?**

If I'm assuming my client is extremely concerned about sharing data and privacy settings set to maximum on fb and phone, I would be designing for that - the lowest common denominator?



GAME FEED BACK  
- SPAC & FOR SPEC  
FOR PRODUCTS?

**You think having practice in this model and workshop has helped to shift understand from IoT?**

Absolutely, you can have a totally unstructured way of brainstorming and miss a myriad of different inputs that would be very important for making a decision.. If you approach brainstorming for IoT opportunities in an unstructured way i'm sure you'll make a lot of mistakes. I'm sure you'll make less mistakes by using this approach and cover more possibilities.

**Help to inform more tech minded to help for design the home?**

I think it can, but sometimes too clouded by preconception as to what solution for the home are and look for coding or hardwards aspect rather than what the requirements of the user themselves. You need to be careful, some technologists are more broad minded than others but I wouldn't like the technological to dictate the possibilities at an early brainstorming phase.

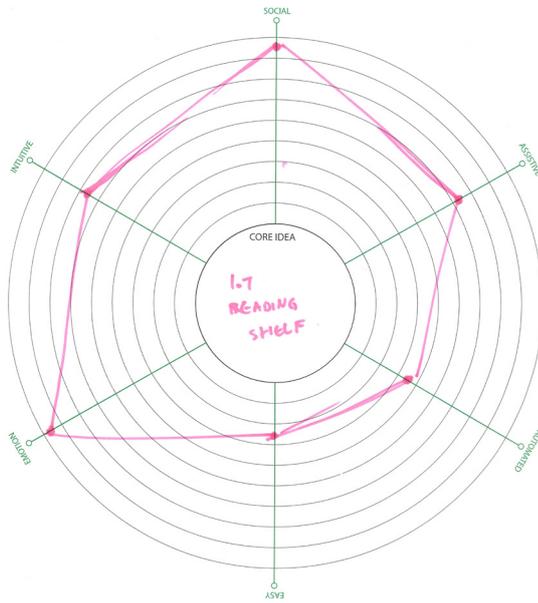
**You think toolkit helped to make user act explicit and central to IoT?**

I do think if you want to trace the activities of a typical domestic client throughout the day, whether male female or child there are a limited number of things they would be doing in a domestic env anyway. To have those activities predefined on a card based system like this can only be assistive because you have all the cards in front of you and some of them are left blank for filling out additional ideas later. If it's correctly design and it's there or almost there you are limiting the possibilities fo not covering a certain act,so the chance s of you overlooking a certain acitivity are slim.

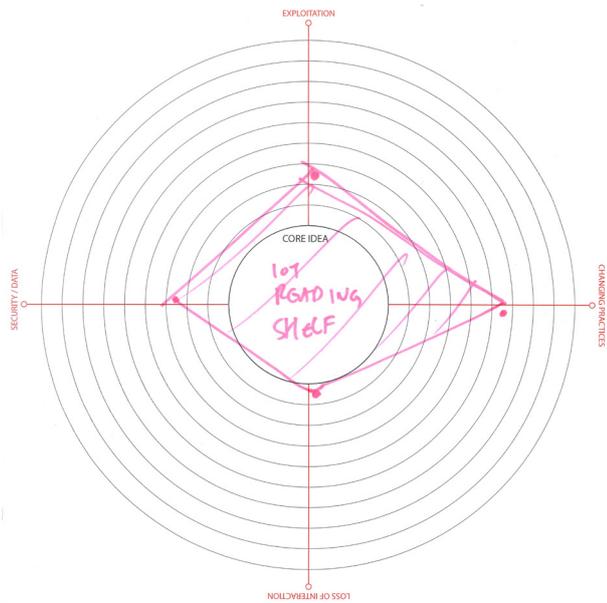
**Boundary and qualitative and quantitative?**

I think the boundary is possibly going to be in the way the output manifests itself towards the actual use in the iot system, Quantitative can be stressful, you don not want to have unnecessary feedback when there's nothing you can do about the results themselves - like if you are getting a lot of high readings on your power and you're living in rented accommodation, but the insulation is bad. Inversely and IoT system and you live in a rougher neighbourhood and been given a very good security system and you are 70 years of age and there have been reports of people acting anti socially in the area. Perhaps a police service or neighbourhood group has given you advice to make your home more secure. The only feedback might be idea acces to 1 of 5 neighbours to reassure you..Tahs a face to face thing where somebody advancing in years can immediately relate to by pressing one button for contact Instead of a list of crime stats. I think quant can be useless info that thinks it pertinent, but you've been given this IoT product..

## DESIRABLE IoT QUALITIES



## UNDESIRABLE IoT CHARACTERISTICS



## Participant B

**EXPLANATION OF WORKSHOP IDEAS AND BACKGROUND. Practices, IoT explanation. Previous workshops. Domestic consumer IoT.**

TK

Disconnect between card set and map - object and intentionality and colours to cards.

BOARD GAME FEEDBACK

PB chooses **Nest**. We attempt to play a game with the cards we have by choosing and playing them against each other.

My hand is washing and instrument playing. PC is listening to music and reading a book. Record player and lighter / bed and toothbrush. Winter or birthday / Sunday afternoon and sunset. Living room & dining room / hallway & family/kids.

TK

PB chooses reading a book. I choose winter. PC space - hallway not work, so forced to go to family / kids. Object is bed. Reinterpret what the bed is.

**Explanation of map.**

TK

**User intention and system intention? How does this need clarifying?**

**Reminder of use of nest and discussion of what it does and how it works and the intention of the system. Temperature, light, movement sensors, control heating, controlled by phone, learning etc. Agree?**

Perhaps how user sees it, not how Google sees it! To measure activity from Google's perspective, whereas for the user it's to make the house comfortable. I would say the intentionalities quite different. Google sees this person as a data point, more than a person. It's about personal comfort. There's almost a disregard for the person here is my kind of view of what. As a business model it's about generating data, whereas this is about personal comfort so there's a clash of intentionality. Which I often think is bound up in these object is the at the business model is operating for a different set of intentions than the user. It's interesting that's not made clear through the design of this map.

TK

**Back to the card set. Book, winter, family/kids in bed.**

Interesting contradictions in this. Reading a book is kind of a static activity, so arguable you'd get cold if you're not moving around, which might throw off its motion sensors. But if there's kids you would have activity. There might be a contradiction in those two things, and in the winter you've got the heat. Again with the bed, do you need it as warm in the room, so I guess I kind of...maybe I'm overthinking!

**Remember, using it as a model, not necessarily function. EG, bed work as IoT objects at this time?**

You could say that the bed becomes part of the sensing of activity.

**So, a smart bed?**

Potentially. Can measure is someone on it, is someone moving around? If the kids are active you might not want the temperature to be as high, or if you're static and sleeping you would want different temperature than if people were moving in the room. There's an element that you can draw from that in thermostat activity?

TK

**Reading a book?**

Reading alone or with kids? Could be reading to you kids which is a different experience to reading on your own. So the context...Reading with kids around. So static while movement around. It would be harder to create because you've got two people doing two different activities. Maybe the winter one is the obvious argument for winter is that it's colder outside so you'd make it warmer. But if you're static, if you're reading to the kids they'd likely to be still so would want it perhaps warmer than if they were jumping around. Here an interesting how to do you get that nuance of the practice from a purely sensory measurement here is perhaps the difficulty. SO it might be that the bed itself wouldn't need to be smart, it's more about knowing who's in the room and how activity those people are.

DIOT

TK

TK

**What about linking bed with act of reading?**

That would be for the reader. You've got one interaction between the reading of the book and the bed for a single user, but then you've got a context between the person and their kids and their relationship with these might not be the same. **The social construct is what perhaps is missing from this?**



GAME FEEDBACK

### The social network through objects...

There's a user and then a secondary order user. Say, designers tend to overthink things.

XT

### Contextualise into a specific ritual...

Kids in room, almost playing around in the...just in the room to make it somewhat simpler, If not reading to them could be playing on the floor, or whatever. In this context, if static on the bed and it can tell you're reading the book it might adjust the temperature to try and be optimal. I guess the difficulty is this...(Again you want think how does it feed out to the bigger constellation of things well - probably adjust lights as well as temp fro reading...

### Self contained practice that affects itself?

If we're thinking in purely comfort terms, it would be things like light and heat. What might be the bed allows you to adjust position so you're semi propped. The lights accordingly and the temp in terms of the room takes account of the conditions. Because the more static you are the colder you would get.

### Think about enhancing the quality of experience of reading with kids, or about ?

A quality of reading, not necessarily with the kids, cos if kids in the room you'd want it hotter for them and as a parent that where your priorities would be.

### Standard bed, how tech added, form of interaction?

Not necessarily in the bed, I'd prefer to do something that monitored the bodies in the room, some sort of thermal detect camera, cos then notice both movement and temperature, which might allow it to optimise the setting for all the individuals, Can see the core temperature of the person lying down and the people up it might come up with a happy medium.

HAVE TO BE SO EXPLICIT.

Temp adjust the room to occupancy and activity? Closely to nest - try to move closer to reading of book involving books etc, not env control. OR swap out items to find something more appropriate.

7.10

CHANGE!

It's thinking is there something about reading or a bed that is a personal act. So what does it think when you read a book. We all have our preferences in terms of text, light levels, the position you read. Do you like the physical? There's something there between the book and reader in terms of the physical nature of the thing. What is the difference about reading the book at home is the question... is it something about reading in that space?

### Think about the form of the interaction with the book, and how that could be cues for things to happen?

If a kids book it becomes more - you're expanding eh notion of the ritual outwards. For me it's a personal ritual, but if you're reading the the kids that changes the space. Whereas that become the focus of the interaction when you're reading wit the kids. The book. You're drawing the space outwards.

01.07

### If reading yourself disappearing into it

SHift here about how the space operates.

LEt's try another. Bookshelf? More to do with choosing, look at someone else's bookshelf? Likely to have a bookshelf in a family, kids room?

Probably. Likely to be more loaded with kids books. Children have favourites, as an adult you often don't go back to the same book in the same repetition of it. Kids often have favourite books that they've read. So the date on what you you would read would not

necessarily be about things that you haven't read for a while, but the favourites as well. Things we haven't looked at for a while. Thinking of the conversations i have with my child they would have a fixed notion in their heads of what they want - a particularly book. And other times it was what haven't we read for a while and they'd look and choose.

### Physical interaction with shelf. How inspire object...

What you touch, where you look. Essentially it's what catches your eye but they're an elements of history in that. I guess that's where data mining come sin in the sense that it's what's gone before isn't as important as what's happening now. There's an inherent time aspect in the practice.

### Tie in to time. Happening in winter? Diff to birthday or sunset?

Probably afternoon does. It may be that if you've been out and it's a way of winding the kids down. You do develop practices with kids, we used to do bath pajamas and story was a kind of practice or actions that we went through every night with them so that they knew... It might be that you have specific routines around in the winter or the night when the sun goes down. I guess it the the notion of sunset. It's different. I know when I lived in Australia the sun went down the same time every time. That's what I missed in summertime when the days didn't get longer. It's one of the those background things that you're not conscious of until it's not there any more.

### Idea of information periphery to centre of attention and how it works at doing that?

It's the foregrounding and backgrounding, so it could be the kind of foregrounding and backgrounding of what you've read and when and maybe you colour code the spine to the books so that they reflect the kind of pattern of reading, so how often you've done it and not done it - if a book's gone cold... It giving you a visual indication of what the meaning is behind the data. I think would be interesting.

### Explained past book projects...Like the idea of a book going cold more.

Notion of use. Some days it's saying that the data is valuable. You have to show how it's valuable and it has to get that sense of value to the data that you're providing. If it's indicated directly...

### More interesting act than what we were looking at.

I guess it's because it's more ambiguous. I think the case of reading is quite defined and context dependent, which is perhaps why I was struggling with the notion.

### Bed also doesn't fit, so swap this out? Curate this ritual...Guitar chosen.

I guess are you looking of music or is it something...play guitar is inspired by one of the books? Not necessarily for reading, it becomes the focus for this rather than you. Cos if you're focused on that, the bookshelf is the kind of thing that the guitar then takes over in some respect.

### Context of nest again?

In context of heating only - noticed that when you talked before, you mentioned the notion of data storage.

### Move away from heat as not relevant to this

So just history of what you've read, the history of your interactions, which is what this. A history of interactions while you're looking at the bookshelf, But that changes when you bring the guitar because then it becomes a search problem. It's kind of interesting that that's suddenly changed everything

### That's the point - context is everything, can't have catch all.

Context is the most complicated thing. In some ways that's the problem with the lot - it tries to operationalise context.

Idea of shelf for history based around idea of nest. Of pov of IoT of nest designers,

what would shelf do? Choose new object?

I think the object here is producing a particular focus of this. A diary. In some ways that's what we're talking about here - the memory of activities and the notion of things to come is quite interesting.

**Eternal Time. What info useful to self and companies of looking at smart shelf? What detect and what sold on to interested parties, come to you to inform you?**

Externals then it's probably the types of books, the number of books and the particular areas that you use on a regular basis, so essentially it becomes some sort of suggestion mechanism. Form a personal perspective it would need to provide more meaning for how you use the bookshelves and that comes back to what element of discussion of what the intent is. If we're saying here there's a business model driving this then the driving model is probably to sell you more books, whereas your thinking is how does it make my use of the books...

Prob from  
D1.7

Business vs smg use

Not mutually exc



You can provide functionality. It's an interesting question of whether you should be aware of them though?

**YES! Haha.detects reading history?**

How often you read them, you interact with them, who does that and interesting one it eh communal. An e reader would save the position. Reading to children you come back to the story. As they get older you tend to read longer ones that takes a few days to get through whereas as you're little you want one that finishes. That was the noticeable change.



When who's in the house, read at certain times of the day, or when it's quiet and on your own. Is the nuances of each particular reading thing. There might be different patterns to reading.

D1.7

**Info detecting similar to nes tinfo. So, with that info it would use that along with contextual elements in the smart object bookshelf. Intention of the system, would it change smart object to feedback to you. What digi/physical happen of interaction?**



Depends on what you're doing at the time. If you're choosing the book then it may be that it's offering you a choice. Another point it might offer you a time to think about that you've read all these books so many times, maybe you need to think about getting new books. If they're electronic it recycles them. Some are dynamic, they can be changed. Surprise book that's always different. One of the books is a box of delights where it gives you something you've never read, which you could do with electronic books.

**Personal librarian? Info useful to self and companies? Turning into physical amazon in some ways.**



Isn't that the intention of the IoT?

**Say using for 1, 2 5 years. How does the feedback change how use object or ritual with it.**

A lot would come in the representations because it's how you respond to the algorithms given to you. We were talking about hot and cold. It depends on the individual if sometimes you go for the hot one, sometimes you go for the cold one. I think those are the points where it would potentially break...a lot of things with data is it looks for patterns and when the patterns gets broken or you don't want to do what the pattern think you should do is where a lot of things break down and where the tensions occur. It show you then give control...it's; the level of smartness. "What haven't we read" Does it start with that sort of question? Shall we get into detail?



D1.7

Are we thinking it's smart in the sense that it tries to anticipate or persuade or is it smart in the sense that it allows mne control in smart ways. — SMARTNESS — anticipate or control smthly

Corresponds to assistive vs automation...Fine distinction.

Intention  
of  
IoT

A lot of problem with this space is the notion of manipulation and exploitation, which is where the intention of the system becomes key, because if you don't make that fully aware then there's a tendency that you feel that you're being manipulated or it breaks very easily. Examples of bad publicity about IoT is when the intentionality is revealed outside of the control of the things., Suddenly the Samsung TV has been recording your voice. It's that notion of transparency which is some ways linked in with your adoption curve, because providing a lot of the problems with current IoT stuff is it's kind of meaningless and connected to the internet without any understanding of why interconnected and why that level of connection...certainly in the nest. The conglomeration is only valuable for Google, not for the individual.



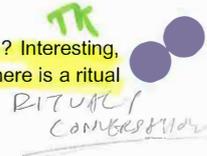
**IoT at structural level. Idea getting to is the opposite from IoT come from.**

Then it's a slow technology argument of causing you to reflect on the act. Which goes against the intention of the system, a lot of this is designed to make things simpler. Reflection would argue simplicity is a bad thing. Heidegger's notion of ready to hand in that it's invisible, but if it's invisible then you're not reflecting.



**Not in the moment, but after event?**

But if only reflecting on the act, then dissolving self with the act in the system? Interesting, but there's a tie in between the two systems and I'm struggling to...I can see there is a ritual here, but for me it's embedded in this,



**Yes, a construct to allow us to look at it within the IoT...**

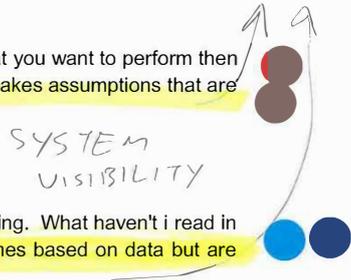


These feel conversational to me. In that your interactions here are in conversation with the interaction it provides., We're shaping our tools and then our tools shape us. there's a conversation going on it's not static. The practice is inevitably going to be manipulated by the system, the system manipulated by the practice



**Exactly! No crystallisation of acts, dead culture.**

More likely to break cos if you crystallise the act and this isn't what you want to perform then you give up. My experience with smart systems is that when it makes assumptions that are no longer valid then you question what the system is for



**Point of person driving system. On same page.,**

In this sense how you then get control of what the bookshelf is doing. What haven't I read in a while might then highlight so the interaction to give you becomes based on data but are driven by the context you're defining at the time.

**Nighttime and little and big, kids book**

Might be that it's the way it presents it is the key to this. It asks you whether you want them, so it feels different.



**Try to get some touchstones of user experience. First to last act and in terms of loop, physical interactions, outputs.**



The first...is why we want to read. It's maybe where you start. You might be looking for a response or that you simply browse. Two different entry points. If I'm looking for something it's specific, but if I want to browse...

**Goal oriented**

What haven't we read for a while or what would be good to read? Would make the user experience better if you got the choice. If automatic suggestion...that would probably feel less good. Then it would be the system highlighting the options. Browsing would be manual. This would be automated without me clarifying, this one would be driving.



How would the system highlight those things to me. A visualisation...based on earlier parameters. A positive experience...could be either.. Might be that you're quite happy with it as an automatic suggestion. But it could easily if it does it when you're not bothered...



**Gone to shelf, actively browsing.**



Visualisation for these two. This is the system detecting what you're doing.

### Physical interaction>.Stood in front for five mins and then suggest?

If looking at it it could be your eyes, whereas the other would be a voice command that you give. Browsing might be it detecting where you look. Automatic might be the same thing - it sees you looking at the bookshelf. Model of the system - do you prefer to be given suggestions or prefer to be able...

User choice

I would see it as that, or at least learn what your preferences are. Because if don't like suggestions or i ignore them it might be it just lets you browse.

### Gone up to bookshelf, visual. Next stage.

A cyclic thing of how it detects how it's chosen. You pull it off the shelf and move away. Bringing it back - in the home context you know where it goes. I guess there's a return or it might highlight that you should put that back, have you given up on this story, do you want to try again. It's interesting that even reading book can turn into something incredibly complicated. I guess you would say you put back and it's positive. Then the system could suggest something new. It loops back and asks whether you want another book. A nuance there.

### Digital?

All the recording of the interaction is where the digital element comes in. That's what we're doing, we're recording interactions and its how you records that.

### Implications of ritual feedback?

What it implies from the data that you're providing, which I guess most recommender systems do. Lose notion of serendipity in these type of systems. Becomes an enforcing loop of you watch the same things and read the same books. The notion of randomness gets lost, I like the ideas of leaving books on the tube, there's something quite magical about that sort of chance.

### Perhaps if not based on Nest

It's harder to reduce it. Choosing a book is much more complex act. Used to setting temperature and never thinking about it again. A book is a much more personal...You can understand why the thermostats done realisable well, because it's not embedded in many people's lives in many respects.

WHY NEST + OTHER NON-EMBEDDED PRODUCTS WORK USE PERSONAL...

### Final evaluation...Desire...

Individual thing. Is it sharing what doing in reading the book? Sharing with others it could be social, but wouldn't want to say I'm reading this. It's a personal thing.

### Exploitation?

Potential for it. How it's using data and their intention. Store locally and it becomes less of an issue. If offsite more towards exploitation.

### Quality of data?

How amalgamated with other things. Other innocuous bits of data and something can be inferred.

Will change practices, practices will always be changed. Comes back to whether it limits what you see. There are unintended intentions.

### FULL VERSION - SECOND RUN THROUGH

Same again to develop smart IoT products etc from card game. Think about cycle of IoT system. Think about changes in object/time/act etc... Criteria from past

participants...feel free to argue, redefine etc. Derived from non expert users...Physicality and info conveyed through this...Benefits of IoT - quality etc. **PUTTING UP THE SPECS AND CHARACTERISTICS.**

Choice in the future - might be that you can only buy a product of such a type. Certainly I think televisions...

**Ownership of product and leasing.**

Practices - going back to rental model - we used to rent TVs and the notion of buying things doesn't make sense in a service driven model that most of these things are going for. Hiv they charge a fortune for the device and then 9 quid a month to use the services!

**Game development - idea generating technique - not a game with a message? The game function is there the drive the output, not just of itself...**

**Act card**

Family meal...

**Leaving a note – I'll build my own to get two different things. Time card...**

● Evening – works together! Kids room space.

**Leaving a note in workshop...**

Object is mug

**I got a chair! Concepts and ideas – I'll sketch/draw...First things that comes to mind? If anything? What practice could be?**

Wi-Fi blocker in the mug to stop people reading their phones at the table! Which isn't in the spirit of the IoT!

**If that's where you want to go – that's the core of the idea? A metaphor for this product – to encourage people to not look at phones**

Making evening meal more sociable – perhaps the mug is the way of randomising the data on the phones – that would be funny. So you get messages for the other person. I kind of like that idea.

**Kids room is bit weird? What situation has family meal in kids room – if ever>?**

No, you want it all together and you don't want the kids hiding in the room, so it seems a weird contradiction having that space there.

**Choose another space to fit better – the other three works...Toilet! Doesn't fit...family room...makes sense. IoT locus is mug/drinking vessel... Break down bit by bit – in family meal words and acts?**

Notion of sharing the space and the time. It's the interaction between the people. SO it's how does the technology not interfere with that or enhance that.

technology coherence  
acts/space/time/technology  
mug  
Wi-Fi blocker  
+ IoT!

3D  
www

TK

**So looking at IoT system that enhances dinner time**

Or interaction is the point and doesn't detract from it – something that takes people out of the space and separates them. Argument against techs that taking people out of the space.

**Family meal and acts to enhance interaction at meal. Serving each other, filling cups, passing water, salt etc...**



I like the idea of this might be the display of the day. Each person gets their own mug and it's a recording of your day. It highlights what you've been doing – a timeline that all the other people can see. A way of sharing your day.

**A prompt rather than completely readable>?**



Highlights of what doing during the day. A starting point, a questioning this – oh what were you doing? It's kind of playing back the daily data of your life. A way of triggering the social interaction. It's less about recording and more about replaying in that sense.

**How display?**

A traditional timeline – flickering series of images like a flipbook. You flip through and get snapshots of random points in the day.

**The idea of the mug being a conversational prompt.**

To encourage social interaction and discussion.



Variables? Self and world, time and words etc.? How impact upon the intention or the object act with intention?

It would be detecting who is hiding it or whose mug that is. Each mug might take your recording and say this is mine, my day. It wouldn't necessarily need to be my mug.

**How fit into context of networks of people/objects?**



Part of ritual of meal but also your context within the world and how your activities feed into this. I think family meals are a ritual – where you get together and have discussion of the day, chat and understand what been doing. Having this prompt – might say "I don't know, I don't remember!"

1 idea – let's get more. Come back to this again. What about words and acts to inspire more ideas? What acts happen during a meal that could be good to record interactions, starting social interactions or showing elements of ritual through drinking vessel?

The interactions are the ones between people. Is it the meal that's important – I suppose the time and how often people are there in the same room and how much conversation goes on is interesting.

**Think in terms of interaction between people in family meal involving the drinking vessel?**

I'm interested in the motion of what it could trigger in terms of conversation of what you've been doing and if it opens up your day at all. I think that there's a lack of specificity – it might introduce random things that you're not conscious of. You reflect more because it opens those conversations broader. Maybe it foregrounds things that you consider background?



**Thing that came to mind is pouring water for people...poured first etc.? Anything in that that could feed in?**

Totally dependent on the people and what they do and whether they're drinking the same thing.

**Let's say for arguments sake – all water. Anything interesting? Coaster? Glass flashes? Who pours what for whom?**

I guess it's for the people whether it's meaningful. In some ways it depends on where the jugs placed and the handles pointing. Rather than reach round you'd ask for it. It's hard to say how that would become a formalised thing. I think in some cultures they have that thing of the order you fill – especially in some Asian culture. In Japan you fill the other persons, you never fill your own. Some cultural conventions that might be in play.

**Work with IoT to respond to that?**

I might highlight those conventions that you're not aware of but how do you make that within

## Japanese rituals – very proscriptive.

Built on societal issues of honouring people – conventions of showing respect and culturally very different, whereas some of this – there's a cultural aspect to this. In some cultures that level of knowing or indicating that might be interesting but other cultures it's almost background noise.

### Maybe noise to foreground?

Then what is the value of it – is IoT the value of what drinking or the people in the room. What is the data giving you and what's meaningful about it. Is it the fact that you're filling glasses up or is it more interesting to see who's in the room, how long for and who's taking. Is that too fine? Or it's a blunt way of getting something that actually what you want. That's a question about the whole IoT – is it a way of getting other data that's more useful. Which is why they write in the T&C's that they gather up everything that's possible.

### Respect – keyword? Encourage respect or too blunt?

Seems like it – giving lapel badges! Who's in charge for the day. Perhaps a nice way to show whose turn to wash up! Or a game where it randomises who washes up although it could cause a lot of arguments. You can bet on it!

### Think of physicality – conveying info through material, shape change, colours, etc...

You could show heat. Whether that's necessary in terms of contents. But we've already talked about it as a display.

Yeah, think about it as a prompt for conversation = physical info rather than lights/material etc?

If you're displaying the context of what's going on in the day you have to do it clearly or people will guess what it means. Again, that requires a bigger interpretation of whether that would then defeat the purpose.

As soon as said talking of day and looked at mug - circle there is a lovely way of communicating time. Maybe don't get your own mug - it's someone else day and have to explore.

I like the idea of the info being on the inside so you can watch it and it's not visible to everyone else.

Or time and revelation - the idea of not being able to see - start at top can only see the morning?

Notion of drinking as part of the act and revelation. The notion of discovering something. That's nice in the sense that it's not universally broadcast and it forces the person drinking to be proactive.

Info display - in or out, lights or physical. Act of drinking? Filled up and then drink. Off table, to mouth, tilt and put down. What could that trigger?

Might be on the bottom of the mug in that case. There's a kind of... You can't see what is being shown, it's an interesting snapshot of what's happened. Could be linked to volume - the more you drink the more you show.

Use of objects impacts on how used again in future? Cycle of using objects and learning how work etc?

Could potentially. Would be interesting if started to learn what is displayed and whether there's a kind of element of being able to curate and manipulate.

### Adjust behavior during day to adjust the display?

Or something in there that is surprising or amusing and almost it becomes a kind of game in itself - you try and manipulate the screen.

Think about going through 10,100 cycles? Does it change? Blank at start and end of each day?

MO  
PF

still stuck in this realistic but have change  
data driven action

physicality suggests  
action/revelation  
design

DIOT

DIOT

TS10

ts10

Develop over time novelty

It Might be that it shows you previous ones. But whether interesting? Or maybe that's the way to keep it interesting/ Not always the same day, it might show last week, last year?

**Show random days from the past? HOW adds?**

Only in that potentially refresh the usage, after a while it might become like a display that you switch off from. There's often that thing that we don't see public displays as they're in the periphery. The danger is that this disappears into the periphery of use. How do you break it from novelty?

PF D1.07

**Physicality? Form could change? BubaKika - bad day = rough and horrible shape? Shape as reflection?**

I guess that gives more chance for consideration, but it's how that...it's how you would maintain the value of it. A lot of these things is where is the value going to be in the long term. It's easy to come up with one off short term interactions but that's where the notion of practice is interesting - how do you turn that into a practice?

**That's the point**

In some ways we're changing the practice by adding conversation, whereas the driving is a practice that happens.

**Use mug to prompt interaction, which is part of meal. Positioning self? Beyond home, family and kids? Global network through these objects?**

Shows linkage with outside world. Whether need to link with other objects is interesting. Use it for keeping someone in the room who isn't.

D1.07

**Time? Takes place, time to do?**

The thing is that useful? You would be away but is that relevant to the smart home or to this. You probably have standard times when you know everybody's in the house, although that becomes more difficult as the kids grow up.

**Eternal time?**

Displays things from meals of the past and whether a way of remembering past family meals? Might not be the ones...notion of memory is interesting - our memories aren't recording devices. A recording device records certain activities that happened, but your memory reinterprets it every time. The notion of storage and memory are tricky. The notion of prompting...

3RD

**The notion of grandpa's mug and he's gone - do we retire it?**

Or you might want to use it!

non constant use

**And add to history!**

My wife have a teacup and saucer from her grandma that she uses on occasion as that's how her grandma drank her tea. If she's in the cupboard she sometimes uses it. They trigger thoughts, but that's always the trouble with the notions of data when you replay it. There's a reason we can't remember everything - our brains naturally filter out the things that are not good for us.

**Good idea of what happening and output. Intention of system matches interior of action - prompting questions?**

Not sure if intention of system. It would need the data of the day to record it. They've got data of your day that displaying through this. To provide the interaction - that might be the excuse that they give you why that might be a good idea.

**But not about resource management etc?**

Not, might be about providing service. That'll often come down to the business model. A system that sits behind here that has a presence and influence without being seen as part of it. It's kind of a gravitational object that has this affect on the dynamics but not necessarily

VISIBILITY

D1.07

form an obvious part. There's often these things lurking that we never quite fully...

**Swapping out time...Family meal at end of day so reflecting. What happens if morning? What happens on birthday?**

Acknowledgement for birthday? An electronic birthday card! I guess it's a very specific instance, maybe it's the general notion of sitting down and eating together. You don't necessarily want it to be in the birthday party.

**Perhaps same idea on not reflective device?**

What is it that you want to know about that birthday. In some ways you would think the system would know it's your birthday.

**Depends on kids birthday, adult? Who's drinking too much? System model that doesn't work, resource management?**

Lots of things about kids and water to keep interested. Could be into health and wellbeing potential to make sure drinking enough. And with old people in the hot weather...Do you then turn it into a well being activity where hydration is the point. Recording what - how often you drink?

**Again, a resource model..**

No, but the home would be one context of it. It's not particular home orientated.

**Or experience. If consider water to be resource managing supply to body rather than thinking about it.**

Part of a larger system of water usage in the home. If metering water and an increasingly scarce resource is there a value to monitoring how we use water in the home. Think about the bigger resource aspect of it, like we would with energy? In some countries that might well be...In some ways you could say that you're looking at general influence on the environment, Do you go down to cups, toilet flushes, washing machines?

**Fit with privacy, human element?**

For me it's about knowing what you do. It the argument of smart meters - by knowing it you become aware of it. Whether you can do anything about it? Would you want to encourage people not to drink as much? There's interesting things that play out with these if you over-reduce it.

**Try a new set of cards? 12.34 in workshop with chair, leaving a note. Increases human interactions.**

Workshop in the home?

**No, hallway instead.**

AN interesting point of people passing through, it could be like having a noticeboard in the hallway, utilising the space to leave dynamic notes.

**How chair involved?**

That's the interesting one - is it the trigger cos that's where you take shoes off? Suddenly the messages - it becomes a mini social network of the family. It could be that the chair is the point where it initiates that something happens.

**How info contained and note is metaphor? Considering physical, material etc.**

What is that note? Why would it be with the chair? The hall's interesting as a transitioning space?

**It works if think about it as telephone bench with notepad? Kind of works, but doesn't exist anymore. Using similar concepts?**

It's what the chair becomes. It might be that you take off things - shoes. It might be the point where things are dumped on, generally male! What they're actually used for isn't the

function.

**COuld be seating space, step etc...physical acts of leaving a note? Write, stick on wall to make visible?**

Could be verbally done as leave or enter and made visible. If leaving quickly leave a verbal note - might be an interesting thing. Notes that you want people to be aware if you're going to be late. The point at which people become aware that there are notes but don't know until they get home.

**If paper note - visibility is imp. Recording in writing or verbal**

Variety of ways whatever is convenient. Notion of visibility and awareness of note would be part of entering the house. It's the hallway. It implies that it's in the context of coming in.

DIY

**Quite public. Do you want the notes to cancel? Time impact?**

Sometime knowing when things were done is useful. Often with information when it happened can tell you as much as what's said. If we're talking about notes the temporality of notes is important so you can see if someone's left a note and it's past that time it has implications.

**Amount of time to write note**

Indicative of people in a rush...it's hard to say whether that. Sometimes you forget something and you leaving the door - do you quickly want to say something.

**Season, time of day, light?**

I guess we judge those times differently. The kids were little when it was dark outside you were more concerned than in summertime. They do have an impact but not sure if the notion of the note would make it much more different.

**What if 12.34 AM?**

I guess it's what you would imply from it, it's the way I'm thinking of that. If 12.34 and someone's left me a note? What's the context? Would I get it in the morning/ would it be too late? Don't know! These are very bound in time and we draw inferences from time.

**It would personal and internal? Inference could not be detected or impact on object?**

Hard for system to make inferences, so personal inferences?

**After 10/100 times - learn inferences?**

It would need to know what you're inferring, you want to record the note, not what you've inferred from it.

**Chair? This idea of locating object as a note object.**

It's leaving something in a specific location embedded within the object.. Where the chair alert if there is a note.

**How leave a note? Verbal, written, morse code?**

Verbal would be easiest - don't want to be putting writing surfaces on a chair. It might be that it alerts you that there is a note somewhere. Why would you want to leave it specifically in a chair?

DIY

**Equivalent of a fridge?**

Does it, sit down? Does the act of sitting in the chair trigger the notes. Maybe that's the way you listen to it. You come in, sit down and it replays the notes that are relevant at that time.

**Display to show notes?**

Vibrates or ripples. Does something not necessarily visual. It might be that it vibrates the chair to get your messages at that point, or it alerts you light an answering machine with a

light on. Maybe it's the chair that's the indicator.

**How in physical form? Material?**

Could change the form in some ways to see visible that the chair has changed.

**What if chair like a swivel chair and orientation means different things?**

**It turns round and shows you it's back if there's a message to be displayed?**

**Thermal printer? Why not just write note?**

Leaving or receiving of notes should be convenient?

**S**omething that fits into domestic routine in domestic IoT - difficulty is that very specific but goal oriented. More about how ritual changes through time with qualitative IoT. So, maybe ritual doesn't fit with it?

Probably too specific a goal with the note - to get information over. Maybe that's where we're struggling with the ones that have that real specificity of the outcome. I think we talked longer about the family meal because it was so ambiguous. A note implies urgency or is useful if someone reads it.

**How about - let's choose. One thing - how change if context moves from hallway to bedroom communal to private space.**

The implication of do you - is it a space for private message between people who use that room, whereas the hallway is a communal space you would expect everybody to be able to read them. With The bedroom there's an implication even within the home of privacy. A hall isn't universally private, so in essence you've switched from a family public to individual private.

**How change object?**

Who can use it, who can access it?

**Permissions or access to room?**

You might use it to leave general messages but only certain people can read it. I suppose it likes a DM or broadcast on twitter. A way of challenging object.

**If moved to bedroom - more private. How change the messages that are being left?**

Who can leave them and who can listen to them.

**Change experience of type of object?**

Potentially you want it to be more intimate and contained.

**More attenuated. My mind went to love chairs. Change from**

Night lamp with pillow. Some scottish designer.

**Changing it to a loveseat idea - form instantly changes the use. A bit on the nose.**

Potentially that's what a bedroom would suggest to me. I think people treat the bedroom as more private spaces within the home. Loveseat is for a very specific type of bedroom too. Not a kids bedroom, that implies there's a couple. A very specific form for a type of bedroom. It has certain implications that loveseat. There's something kind of sinuous about it and you

can almost see it changing shape if there's a message to be received. Interesting that you're facing away from each other! Like spies having surreptitious conversation.

**Might be something in that as a metaphor as another way of thinking about a messaging system for two people in terms of changing the idea of leaving a message to a personalised conversational thing. It's one directional.**

Maybe it's not about the note in itself. It's the fact that you're in contact, which is what the

SOCIAL  
Grooming

goodnight lamp tries to do. It's not the act or the message, it's that fact that you're there. It's that instant of shared recognition rather than what you say. It the notion of I'm thinking of you. That's interesting in terms of communication, it's kind of why we have slightly...talking and gossip is social grooming. It's that notion of connectedness that is the more powerful part. That kind of joined in the same thing.



**Any of this feeding into specifications?**

GAME



Notion of privacy is interesting. We've certainly touched on that with the notion of space. Convenience is the notion of leaving the message.

**More convenient way of leaving message?**

DI-1

Potentially. That's why the voice hubs have a certain value in the home than in the streets. We're more comfortable shouting things around the house than we are in the street. Voice might be the acceptable way of doing this in this context.

**Choose idea to evaluate with tools. Mug or chair.**

Mug. Both very different in the sense of potential evaluation.

**Timeline first - process of using it.**

1st point - neutral and not do too much. Would you want to make it obvious - does it need to be? You'd pick it up as you would do an ordinary cup.

**Pleasurable picking up?**



More about cup rather than service. Reading data somehow. Depends on going for one displaying on bottom or internal. The one on the bottom might be your own, the one internal might be someone else's - which is interesting. Reading someone else's day. Both are doing that, but in different ways. The inside one would be a personal reading, that one is public. In terms of family interaction the public might be better. Go with public.

**Positive?**

Hopefully!

**Display is generated in whatever way, not important.**

The opportunity to trigger things. I guess what's next is how this changes. Is this changing with volume, with use?

**Bottom of cup mean visualising is hard if not used?**



Part of the normal thing? I guess that's changing with use, isn't it? The changing of use - as you drink more out of it or use the cup more it becomes displaced time to that in some way, which gives a kind of dynamism rather than as a kind of...the longer it goes one the more it reveals. That brings in the notion of time. Stay at the same level.

**At full display now - used through whole meal. What next?**

Gradually fades or finishes. It's how you trigger that finish. Does it fade as the activity in the room become less? Once the cups empty and put back on the table does it fade until it's filled again?

**User experience**



Hopefully in the conversations - I'm assuming in this map there's a gap where there's social interaction. That's what the intention is.

**Good or bad conversations - skipped school?**

That's always the thing with social interaction, they can really turn. The notion of transparency of yourself, how much you want to reveal, which comes back to where they get the data from I suppose.

**All done - cup washed and put away/ Anything else?**

Glows and a pulse that gradually diminishes. The notion that something potentially there if you want to fill it up again, otherwise it's ephemeral. Perhaps once it's faded you couldn't replay it. Always the tension - the notion of ephemeral was interesting with Instagram but backtracked. D107

Then Evaluation via negative and positive characteristics.

Increase interaction, possible exploitation of data to create map of the day, might have an influence on interactions, but good or bad?

#### Negative impact on daily routines!

Not losing interaction - again negative?

#### All negative and needs to be changed! Desirable?

Towards assistive. 320 Social as designed to be. Intuitive as it's a cup. I think there's an emotional aspect - it would induce. Easy. Not automated as not doing it for you. It is automated but to assist not automation drinking.

320 Compare the +ve and -ve maps - very similar! Much more social and a bit less emotional.

Is that my intention will always be similar? My intention was to always design like that.

#### Negatives.

I guess the exploitation here is risen - essentially because the notion of what you could do. Again there's an element of me in there. It would be interesting if that's more reflective of the person rather than the process. TK ●

#### QUESTIONS:

Think toolkit helped to think of physical product that make fortunes in home more meaningful? TK

TK I think the thing we picked up on goal oriented made it more difficult in that regard. I think the ones with more ambiguity were slightly better and I don't know if that should be reflected in the acts being less specific. I think the notion of place and time are very important. The object I found the more difficult one to fit back in in that it's sometimes hard to fit the object into the context. TK ● 9  
TWO

#### If object and act don't connect that why it doesn't work.

I think the context - the object didn't feel contextual. There are points where there are contradictions in the game and that's the point showing where things break down. Maybe that's the point that you're making - these things need to work together and if they jar it's very hard to make things meaningful. It was a useful way of thinking about it but it's the exploration of the home as the context that's really useful. Not sure if i need to think about it in rituals or if it's the contextual mapping that's more in play? TK GFB ● D107 RITUALS VS CONTEXT MAPPING

#### Did the use of practice and inclusion of elements shift how consider IoT and outputs?

DEFINE ● ● Notions of practice? Things that are habit or actions? If actions, then in some ways the practice is associated with an act apart. The notion of practice has an implication. P

#### Communities of practice or shred practices - mundane too.

That notion of mundanity and everydayness is what you're getting at. I don't know if my connotations of ritual...

Think of practices...

Yeah I think so, I like the notion of domesticity in practice. It helps to think of what the point of the IoT object would be, that it makes you question how these things would naturally be mundane. I like the notion that you lean it into the mundanity. I think that's when things are adopted and that's what you're talking about. In some ways that's when they become adopted, not these magical items. Which is why I like the notion of everydayness. In some ways we're trying to embed them in the mundane.

3RD  
DL-T  
P  
WFW

**Think that this model could help inform technically minded devs to design for the home?**

use to  
Devs  
opposite  
flow

The shift from top level system down to the user would be useful to most of them as I think that it's still a technological deterministic view and a lack of understanding of everyday practices. There's also the notion of how you would integrate the two so we're offering something that is a new practice, but then how to get that to a point to how people engage with it is a slightly different exercise. We're thinking of integrating into what we have now, whereas some could create new things - new mundane things. Could you do that the opposite way. Is there a way of bringing the technology down so that people can try to mundane it? In terms of thinking with the systems people it's a useful way of doing it. In a codesign way do you also want to allow the opposite flow of travel?

PF  
3RD  
TK

**Boundary of qual and quant?**

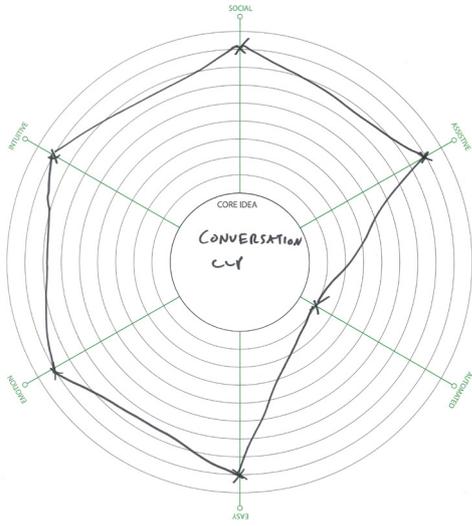
I think it comes down to the abstraction of context. I think a lot of IoT abstracted context into the variables. What you're highlight is that context is highly nuanced and socially constructed experience. I think that's the real highlight of this is that you're defining these complication contexts that immediately get very tricky, whereas these tech guys try to abstract it and I can measure this, this and this and this kit shows how quickly that breaks down.



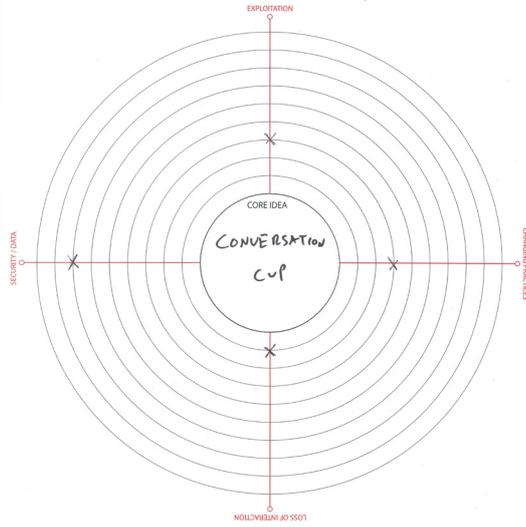
TK

h \*

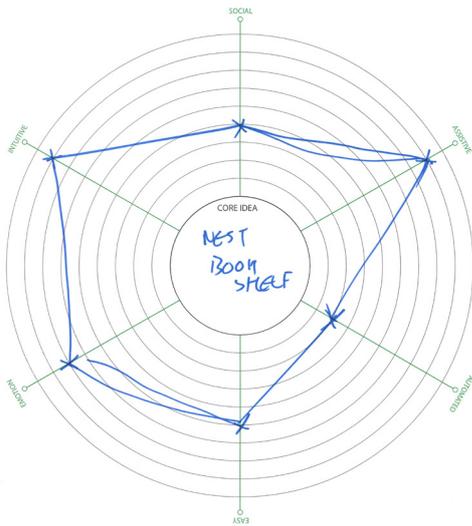
DESIRABLE IoT QUALITIES



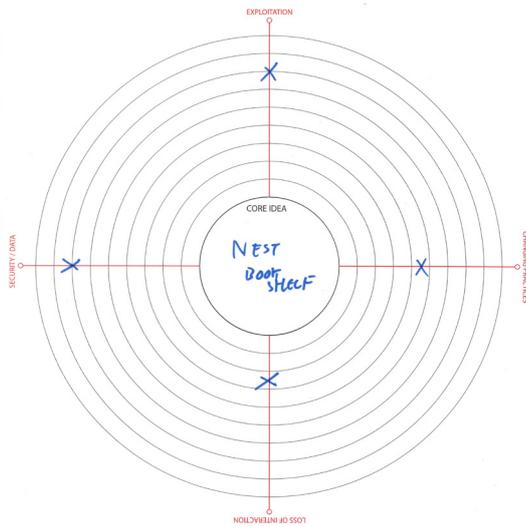
UNDESIRABLE IoT CHARACTERISTICS



DESIRABLE IoT QUALITIES



UNDESIRABLE IoT CHARACTERISTICS



# Participant C

DESIGN → Rejoining IoT DEV FROM SYSTEM METAPHOR USER CENTRED

PC Transcript – IoT Session, 25<sup>th</sup> August 2017

BUSINESS DATA FEEDBACK?

I explain point of session in getting IoT concepts and exploring different understanding of IoT from non-rationalist position, show three choices to work through the game – Mark chooses the Nest. Cards, map, four elements of cards explained – cards dealt. Use Moo for cards? Please put down first thing that fits with Nest – either works or out of character. Feel free to reshuffle/deal.

BOARD GAME FEEDBACK

Adjusting the lighting, evening. Hallway as that's where the thermostat is. Now, tableware.

Tableware is interesting. Let's discuss how that might work, be detected, user experience touch points – where and when things happen – triggered by certain acts?

↑ I NEED TO BE REPLACED!

From what I've put down here I think – I've got an assumption of returning home in the evening after work, ready for dinner and come in, maybe switch the lights on. On an end of day, after work basis thing.

How fit with Nest? New product, part of family?

One thing there is the idea of the home. If it's my home and if I'm alone that means one thing, if there's with a family there are differences – there are things happening in the home.

↑ SOCIAL

Perhaps needs expansion in self and world – always thought of as space but could be family/friends etc. So feel free to write on a card.

I'm going to put in family. If you've got kids their about in the evening time, even if with the assumption at the moment I'm going through this getting to the front door after work there's already people and activity in the home/

Everyone getting ready for dinner?

Yes, it might be adjusting the lighting.

Philips hue that automatically adjusts lighting?

Also the idea that it could adjust the heating if more people in the home...

Learning lighting, adjusting heat on amount of people.

Whole family cohort is now at home – the porch light dims because you need to light the doorway for people coming home if it's a winter evening...

↑ REPAIRS

So what does tableware have to do apart from making it a meal? Could it be part of IoT system or practice of eating and connection between people be something that could be integrated?

Hmmm. That idea of trying to eat together but often being slightly separated. Plates that are designed...I'm nearly home but the kids are hungry, the kids are going to eat, the food is kept warm – an interactive tableware set. Instead of having to stick it in the microwave, it's on the table but kept in the state...but there's a knowledge of how far you are from home.

Like Tado thermostat using distances...

Often I'll get a text from my partner going if you're at this stop I'll start cooking this bit for you so I'll be ready when you get in.

Tableware and adjusting lighting? Do they work together? ME - REPLACING?

↑ COMING THROUGH OBJECTS

Could have different types of tableware according to the situation. Dinner parties vs. daily dining changing the lighting effects in the room. IF there are multiple lighting things you might have slightly push is the wrong word. Different lighting for the dinner party vs. everyone sat down having beans on toast at the end of the day.

I suppose the space would be different.

Moving from hallway into the dining room.

↑ REFRAMING CONTEXT THROUGH DEVELOPMENT

An from Nest from defining object to tableware and Nest is example of service.

Yes, you use it for a while and then it starts to assume patterns. It would have the same possibly things as on here. Patterns of eating and dining and who it's with.

M

→ GAME MECHANIC

Dinner party on Saturday etc.? Goes with time changing. I'll choose an object of swap one to see the effect it has. Form of interaction – can we take that from next (turn dial) to play with tableware/lighting. Physical interaction? - RESTATE

NEST

It could be something like there's an object on the table which – moving the object controls the lighting. Your tables how you use the dining room, maybe you do want to switch the lights down you turn ...I'm going to say a candlestick.

Some sort of avatar?

Of thing lighting could let you play about with the lighting. It's not primary control, its secondary.

An automate intuitive system based on table ware based on candlestick controller. It's physicalisation of interface. Much more interesting than an iPhone control

We were recently at my dad's cottage in Cornwall and they've Nest and hued up the place. In a sense it's ridiculously complicated having to go through instruction on how to use the cottage which is to do with find the iPhone; this is how you do this, the Alexa responds to these commands for turning on the lights. It didn't take long, oh right I've got to do that and that, but vs. click. For basically what was going in, quickly going to grab something to eat and going out again because it's a holiday home Vs...it's going to be clumsy within the home, you have to tweak, it configure it. Eventually it gets to the point where I've put the candlestick on the table it's dinner party time, the candlesticks not on the table its dinnertime with eh kids.

SETUP PAW PAW

CONTEXT

M

G107

Interesting – sometime want quality of experience, sometimes get it sorted – cooking for kids vs. experience. Appropriateness.

ASPER PAST INTERVIEWS

Meeting a friend for coffee in Shoreditch – hi, just getting a coffee. Ten minutes later comes out – sometime i just want a black coffee. All the craft and all the barista – it's lovely but I just want a sodding coffee! I just want a quick hot drink because I'm here to chat with someone.

PLT

Having the option of experience and craft vs. automation and speed is important. Ideas – learning lighting, adjusting heat to people, tableware to keep food home, who with etc., candlestick controller. Swap out one and get new ideas. Which element to remove?

G107

GAME MECHANIC

Changing time?

Randomly – birthday? What happens? Same idea and birthday. Useful to speak about candlestick!

USP for a fancy dining room control set.

So lighting off when bring out birthday cake...A very narrow usage but candlestick holders on cake are IoT? Can detect when candle lit...One shot deal, a bit cheap and doesn't fit into next model.

NEST

Not and also there's the fact that birthday vs. the birthday party don't always occur at the same days?

And table ware might be paper plates and napkins. More disposable rather than integrate into IoT. Birthday changes from secular to sacred time – referring back to past and future birthdays?

When talking about cake and lights going off, there's at least a couple of people fussing about with cameras to try to record it. I remember the odd examples of these domestic robots which are coming out which show how they can record and capture those memories. Actually if you had a birthday cake thing and a camera in every room its busy recording, specifically recording it in night vision just to justify the fact it's got night vision! This terrifying police state of IoT! But, where it's interesting is all of these things talk about how they record your memories. I have a problem with the fact that what's it's doing in terms of how the IoT is doing it that they're mementos that can trigger your memories because obviously it's not recording anything inside your brain. What it's doing is capturing those triggers of to trigger actual memories.

A

IoT

POLICE

STATE

MOMENT

MEMORY

TRIGGER

●

●

Is suppose like equivalent to photo.

When Google glass came out I have this memory of this now – no you've got a visual memento to trigger that memory.

T

IoT object being trigger rather than the data. Physical culture is discounted form data away from thinginess. Trying to get back to this. Interesting is talking about meaning of what doing which can't be detected. Let's try to make a couple more ideas with adjusted set. Birthday discussion – what happens? How Nest work, qualities of next transpose into those events? Apart

REFLOW

M

from automatically turning off lights when candles lit...

Maybe some funny lighting effect during the game or music's playing so it's doing a mini disco while the party's going on.

Such a specific example it limits a lot of the thinking...more a constraint than inspiration. All we get is a camera that takes a photo and a lighting system to the candles. Must be more in there...

Tears, tantrums, candles, cakes, food. The other thing is how that party thing changes according to the age range of the children. They have to run around the garden, sit down for a bit, binge on the foods. Vs. an older things a birthday party will still be family thing around the table and as you get older it may be a buffet. They it might be more spread out around the table, but younger could be louder and more concentrated around the table.

Maybe peaks and troughs of activity could be to do with adjusting lighting – kids get hectic, turns red to calm them...all fits into automation rather than quality of exp. Can we make a birthday a better experience apart from no responsibility for lighting, camera or are we limited by these options?

LIMITED BY OPTIONS - GAME FEEDBACK

Yeah, I think that's a limit to that.

Ok, so let's look at the next stage. Abstracted version of IoT qualitative model. 4 elements feed to smart object etc...Intentionality is hard as given by person doing act – so needs changing as tableware doesn't fit into intention, so needs further refinement. (Further explanation of system model.) Intention of user is on quality of experience, intention of system is how to do actuation, sensing etc.

I've been describing the IoT in the home as living in a robot; all we've done is taken the sensors and actuators and embedded them in our environment. That's multiple things, with the data, but that map makes sense.

So the idea is instead of a smart home a collection of smart objects in the home that then create that intelligence instead of the whole home converted. Feeds back to how conduct the practice – cybernetic feedback loop placing the act at the centre of how it works. Let's consider some of the ideas in this context. Post it's of user experience to make it clearer. GAME BOARD?

Let's use the candlestick.

What's the input, interaction?

The first interaction is you actually put it on the table, otherwise it nothing happens

A system of candlestick and table? Placemats, some sort of dock?

Yeah, a dock. That will turn on the lights into...it'll turn the lights into dining mode.

And the first time it runs what is dining mode? Thinking about repeating systems of interaction?

I guess...eughhh...it's tough. What would be dining mode?

How would it know what that is the first time you use it, or base luminosity and it adjusted by you then learns from context of room etc.

What you've done is say I want to be able to make the lighting how I'm going to set it. I'm going to slightly subdue that end, brighter that end. The first time you use it you're going I want to teach it a kind of pattern. Because...everybody's dining room – the way, the number of lights, the way their table is, the number of seats around...they're going to want to set...that's the decision, when I have a dinner party the lighting will be like this as I want to highlight this fancy light bulb I've got there and this end of the room is, this corner there is kept dark.

Light bulbs or light fixture?

Yeah, smart light bulbs in whatever you've got in your room.

The first use you have to set it up, not intuitive. Fine for first time,

Yeah, let's go with that.

So say all set up, dinner party, the next time you come back you put it back on the table reverts to setting, but situation changed and birthday, so you have to adjust it again. Or can it learn from amount of volume – louder = brighter? If thinking about transposing Nest into it, what's the intuitive learning side or about experience of interaction with object?

REGALS

I think...if...the number of plates, you said. That would possibly change things. If you've got a family of two kids and two adults, dinner is set for that the family unit vs. having four extra plates set then; hang on there's all these other people coming as well. And the time and the date would affect it and potentially you'd have a calendar thing that you would have notification...

OBJECT  
CONTEXT  
T

TIME CONTEXT

Let's assume that it has...

Actually, then the family has a calendar where they're going to go oh were having - so I have a calendar on the wall with those key things of the dinner party get scribbled on there. It doesn't say the times on there but I know on sat 28<sup>th</sup> Sept there'll be a load of people coming over.

Time of day? Effect lighting? Dates, volumes, amount of plates, time of day,

Ambient lighting is the weather is a bit bad, so the light gets adjusted up.

Was thinking about form of interaction? Said you teach your light, how? Training it, showing it the light bulb? Just as exploration of physical interaction?

We have in our dining room five different lighting sources around the room. Now obviously, some of them are...you could touch it against them, but some are quite high up so it's tricky? Could point at it so that light, that light and that light and you can play around with how it works by turning it on the dock.

T

What about blowing on candle to turn lights off?

Yes, hadn't thought about that!

T

Culture of Use is quite rich...and learns through interaction, use, patterns of objects and their use.

So you can set it for the best lighting for that situation, and then you might set the lights for things - that's when your Saturday evening and then Monday early evening when everybody's home it's like that. You might train it to go actually, the training is the sense that this isn't there. The light just kind of is at a generally level when it's not on the dock.

A

A good way of signifying control of system or manually. One thing that lots of people complain about is not having understanding of beginning and end and controlling management, so quite interesting to show this boundary. What about different rooms? Different place on table or in each room? Next to wall means something different to middle of the table.

Again, in the dining room, we have on party occasions turned the table around and pushed it up against the wall because it is more of a buffet and we want everyone to mingle in the room. It would do the same for the birthday one. You could change the configuration of the room, you might therefore have the control...actually more of a kid's party, you might want to set the lighting and actually I want to put it out of reach cos I don't want the kids to play with it. Having a nice object on the dinner table is fine when you're all sitting around, but when you're slightly drunk or the kids are playing around it might be better to put it out of reach to stop people playing with it.

A

T

A

Is suppose that has a different meaning for the system of what's going on. We need to fit into a user experience map. Good and bad touchpoint and add stuff we missed out. So first interaction?

REFACTORS

So, this is assuming that you're using the candle stick to control the lighting for a specific thing, so what you're doing is...You've got some smart lighting, maybe even a smart dinner table, but what I'm doing is getting an object that I wanted to devolve control of the lighting system, or shift control to an object as a physical signifier, vs. the other points - not like in the Nest, once you've put this in the heating is controlled by the Nest, but this is a situational object. I might have a whole load of hue lights and they might be controlled through other interfaces.

A

A

A

T

SITUATIONAL

This is about the theatre of it?

Yeah, so actually this is an object for the fact that - it's to do with dinner parties! Getting even more nice, IoT dinner parties! So you would specifically

The first time using it, set up, no one there. Going through user exp - set up easy or difficult? Compare to screen based control for smart light bulb?

SETUP  
Theatre  
us

I think it'll be not bad, not brilliant now that I'm thing about it. In many ways it's better than the screen, it'll be more fun than the screen because you're playing about with the light in the room, our creating your stage in that theatre thing. I'm wondering whether, actually it will get a bit - hang on I want that light to stop, I want to control these lights, I want to get that light off.].

Inconvenience

I suppose still difficult to understand if something's not working, not clear.



The feedback to the user of what's happening is dependent on the light changing. You say I want

these three lights, but I want that one to get brighter and those three to go down. I think it'll be fun to play with to start with but there will be, in terms of the hype cycle – ooh, this is fun, no hold on actually, I'm kind of here (disillusionment) as long as there's enough to battle through.

Clg

I suppose once starts being more intuitive. So setup isn't great. Neutral, negative?

Neutralish – straight on the line.

Assuming all set up, now first use. Teach it a pattern? Dinner party, showing off, learning pattern from dinner party? How work – come out – put on table, people react, throughout the course of the evening adjust on time, volume, things we discussed earlier, people, plates, date?

All those things would...ambient and volume might change it during the period, the day might be I'm setting this for Saturday, my stage for Saturday, so it knows on the Saturday once the docks on here we're going into dinner party mode. Then those might adjust it during the actual event, the ambient etc. an eclipse happens, it gets a bit dark and suddenly the lights up a bit! Or volume or those other things might change it. I was just thinking about the guests, and they should change it but I was thinking in a dinner party it might be a bit frustrating if it changes.

First time on table to move this along a bit. First use place on table. Good, bad experience?

Once you put that on, it's going to be one of those ta-da moments. In Bladerunner you see the screens slide down to darken the windows; it could potentially have that kind of "Oooh." The whole environment has changed in some magical way. I think that will be quite positive and delightful for people.

8  
5

On neutral to positive scale, where precisely?

It's going to be relatively high.

Third one? What happens?

If you allow it to react over time, during the event things like ambient lighting change, and how you set those back here (first step) are probably...depends on how it's set, how you might set them. I'm wondering if the setup is quite complex – there's so much you can do physically with it and there's these extra bits that are screen based.

intuitive clarity

SETUP is WORSE!

Too complex? If allowed to react ambient light and volume changes intuitively, positive, negative neutral?

So, it's probably a little bit positive. I reckon it will either be fairly unobtrusive – not noticeable but it will do stuff, in which case no one will notice it, which is actually a kind of a success.

Neutral as no one notices...

Neutral or it will be annoying. It is actually in this context...

Neutral to negative – that for stage three.

NEST MODEL  
- INTUITIVELY  
NUDGING but  
if break you notice

It's that kind of thing that I imagine with the nest when it starts nudging the heating down, if you don't even notice it or think about it that's successful in what it's trying to do in nudge the heating down, otherwise it's bloody annoying. The idea in my mind is that if you don't notice it or think about it, that's right. But it's a neutral experience – you're not going to wake up in the night and go "Wahey, the nest has set the heating just right!" No, it's that whole thing of infrastructure, which is you only notice it when it breaks.

top

4  
5  
6  
7

Physical interaction side of it, but once set up don't want to have a physical interaction with it.

But the interactions a real step back. At the end of the party you can blow out the candle and move to the living room...

Sonos following around the house?

THEATRE LIGHTING SETUP IS COMPLEX BUT THEN RUNS

The idea of a theatrical thing...it's making me think that that's interesting is lighting is bloody complex stuff, cos it is the amount of work to make these lighting effects work takes an awful lot of engineering and design work to get them right, But once they're there you run these sets. Once it's all set up you have your theatrical, but it's not an intuitive setup

3

But not intuitive!

Nest is intuitive, not much setup. Can go onto website to setup times, or object but object is unintuitive. Sticking point of lots of IoT. Stage 4 – following around the house or blow it out

I think that brings us back to the ta-da moment.

Only a few touch points – stage 4 tada would be positive? As positive as earlier when put the dock on table.

Slightly less, but only slightly as still doing something new with it.

DEUTEROSTYLE PROMPT

So, had party, adjusted lighting, turning off or going to a new room What next – does system affect practical enough use, or next iteration of use? Next week – is it the same or these elements less

delightful every time you use it? Different for second use...

If dinner party, the chances are you won't be using that again.

In that case the first use is this placing the dock on the table,

It'll be down I think – depends on the audience. There will be some people who will be like "Seen it." But the second use... It's a bit like a magic trick. It's all very fancy, but you're thinking this is a bit like a magic trick – vs. something like that where it should subside into the infrastructure of your house? How less of a trick – magic in there is quite neat, but how to do that without shallow of being one shot. There's some depth missing.

MAGIC  
SUBSTITUTES  
INTO INFRA  
STRUCTURE  
OF HOUSE

There is as soon as you've done it once – it's a bit like a murder mystery party. Alright, we're going to go through it again I'll run the same thing but the wow factor is sort of reduced down. It'll be fine but why did I spend 200 quid on a candle that controls my lights?

What about if lights switch on and off as you walk through the house. Kids are in the dark room watching TV and the lights turn on. How deal with contradictions of what different people want at the same time?

IoT doesn't deal with commoners

This is something that nearly all IoT home things don't deal with the idea of families and communities at all. It's always attached to some owner, somebody in control. It's the same with the smart TV and things like that. Who's signed into this account, whose kindle? The amount of problems of setting up – it's not like the bookshelf where anybody can pick up the book.

Away from the idea of commons...

Even the small commons of the home, there are shared objects... COMP

Thought about in IoT in general. What about in this idea>

If it was actually to do with the plates on the table. The candle could act as a signifier for special events. It would say that this is a special thing, but it's not necessarily as...it might even then be a bit overkill. I think the idea that I put out the normal plate and only four, it's a family meal. I put out fancier plates and ten of them...or I put out these platters and stuff, and then it's more buffet type thing. It changes the dining context, so the tableware is actually able to contextualise what the dining experience could be.

7  
IoT

It learns from ambient environmental inputs as well as physical signifiers? Useful point to end with. Final element is mapping idea. Qualities of IoT -ve/+ve. Does this encourage social interaction?

Don't think it encourages it.

CLIQUE? GAME FEED BACK.

Maybe not encourage – provide a platform for it?

Yeah, ok. It's more of a formative thing. Wouldn't rate it too high – about here.

Assistive?

Not really. Down towards the bottom, one. The candlestick idea specifically.

Adjust lighting as having meal – little bit assistive. Not as much as Nest which controls the home.

Yeah, it's very tenuous. The lights have gone up a little bit cos it's got slightly darker, just a little bit.

Automation?

It does potentially automate...when you say automated it allows me to pre-set – again I'm thinking back to the theatre and performance thing. You've canned a whole load of sequences.

C16

PRE PROGRAMMED AUTOMATION

It's automated but needs programming. Not self-automating. I'll write preprogrammed. High or low

High, the idea of it then is you're putting the candle stick and twiddling it a bit and a whole load of things to do with the environmental lighting get changed.

Easy? Again in setup or use?

In setup I don't think it is at all. What we've come up with so far is difficult. Right down at the

bottom. In use I think it's really quite easy. I think you'd find some funny things, so not at the very top.

**Emotion – interaction, state, connection with or engenders emotion when used?**

If you've decided to do a dinner party there's an ambience thing, reasons you want to have a dinner party and all of these kind of things, of which this is part of the thing. Thinking of a dinner party it's a social performance there and everyone comes in and takes part in it and they might think ooh that's clever. There is a mixture of emotional things there.

You can be more specific.

Can you put a mark about here – it's not some big strong emotion but it's – you want to already be having the dinner party, this is an extra layer on top.

An extra element to create atmosphere? The emotion it generates is through that and other people's reactions. Intuitive?

USE IS INTUITIVE  
SETUP NOT INTUITIVE

Use and interaction – as soon as you say put a candlestick on the thing and the lights – I think that's intuitive. I move it from there to the sideboard and the lights change, so that's intuitive. But the setup is not feeling in the slightest bit intuitive. Put it a one – there's a few bits that are ok.

Use?

Use of it is pretty high up here.

RE-DESIGN SETUP IF NOT WORKING

Difficulty of the setup is because of how we've described it – could make it more intuitive with some thought.

IDENTIFY STICKING POINTS

And the idea if I have it this side of the room, it is a candle; it would be the light source, so you'd want the light to follow the candle. Also a candle has small cone of light so say you had your candle stick and smaller candles your place around the room so there were other pools of light to make it more consistent. The night lamp has a small one. A family of controlling candlesticks!

Negative – exploitation.

Materially exploitative

It's an electric, silicon based object, so at the moment their inherently exploitative. At the moment I have great difficulty in working out how to manage that. The other thing is like anything slightly digital it will have materials in there that will be exploitative. The other thing is it's not improving basic quality of life, its improving middle class quality of life. The whole Hue lighting is all totally like that.

Inherent at IoT as designed by white middle class guys. As much as dislike resource management of model of IoT it has benefits.

DATA DOESN'T HAVE TO GO TO CLOUD

Exploitation through the physical object is going to be high just from resources I would say. Data would be right at the top. In a way I know that all the data goes up into a cloud, which of course it doesn't obviously have to. It could do what we're talking about it has to do by just running locally within the home. It doesn't have to send, but it will. It will send back that it's dinner party setting here and then it ties in with the fact you have an Ocado account and because all the objects were talking about are associated with this – again they are not necessary objects, you get them to show you have money – he's not gone to Ikea and bought the cheapest plates because you need to eat your food. So the data is a little bit lower – all its doing is feeding that in the same way your Ocado online shopping is. Aggregated, working it out and what else they can sell you.

Changing practice?

No, I would say it's fairly neutral. I was just thinking about that...you're changing it for a situation, a context. It'll change potentially some aspects, not in a way I can picture being important.

Loss of interaction – social and physical?

I think from what we've been describing you're creating more of an interaction with setting up the lighting and it works better the more lighting and the more theatrical things you can do with it. So it might encourage you to buy more lights to play around with it, to do more tricks with it. It's increasing interaction in playing with your lighting. Social...I can imagine there being an "ooh that's clever" talking point. But when it's working there it's there...

**Ubicomp – periphery and central – perhaps not a bad thing?**

The loss of interaction – potentially things like this will allow people to think about playing around things more, with lighting which has interesting physiological effects. I think the owner will have an increase in interaction because they'll think more about the interaction, so it's increasing interaction. You're not really losing interaction and potentially you're going to gain.

**And not owners?**

Different interaction  
Periph Long + Central? Lot?

Guest! If they saw this thing here for the first time they might think – what does this do – show them, "now leave it alone!" You can imagine this idea that somebody's done a lot of this work for this dinner party and then somebody goes: "Oooh that's clever!" Can you not leave things alone, I've created this environment; now talk to the other people. Neutral lish...maybe...I don't know. It's not a loss of interaction, I think it's odd. It's a different interaction. It's unlike the Nest – here's a very deliberate things that's been put in play that's changed the environment. If you haven't come across it before you'd say "What's that?" – You might talk about it, "Oh I've got a lighting system like that, but I can't do that."

**Maybe in the same place or bottom of scale – positive interaction potential. Security/data. Product that has issues around this?**

Explanation?  
visibility?

Anything to do with lighting is potentially risky in that it shows occupancy of a building, which has potential for misuse both from people thinking of breaking in, also potentially a council could...there was another product, the sensors for thermostats for individual radiators so they could be triggered, but they were designing the system so you could switch off the data flow. I've got 50 people round but I don't want the landlord to know I'm having a party. The benefits you might get for aggregated data in there would be negligible for that period of time.

**So if a kill switch – if had this where lie or always turned on? Local network?**

I don't see the benefits in aggregating this level of control of the lighting in any sort of way. Not in resource management, because you could look at electricity of the house. I think it should be moot, badly implemented it has potential for showing risks.

GAME FEEDBACK

**PART 2**

CSM to test further MAID?

**Another session on cards – asking opinion as part of game without me to guide user.**

Immediately thinking of students at MAID, already come up with idea to build. But having a session when run the process as a n evaluation tool could be a way. Last year tried to come in to an earlier stage so could guide the ideas before got too complex and helped to change and focus their project based on focus and knowledge of Mark. Some come with vague ideas, vs. someone with a specific idea. There isn't that teaching of this stuff isn't just the object, its data, interaction all these other things. Interested but don't have this at an early enough stage to strongly drive – a bit of learning about Arduino, but not in the correct way of using it as a material, data as part of the material.

**Another set of 2 each**

Family, kids hallway again!

- GBF repetition

Take another one...I've got evening, winter table, spoon, blank, dining room, washing and listening to music. Swap blanks – more blanks! Record player...that works! It's an interesting object that came up a few times. Dinner party vs. feeding kids / music on I pad vs. record player.

Done a lot of work with Imogen (Heap) about this and one of her friends is designing a new digital service of how you connect to music – digitising the art work and all the physical tactile stuff. One of the ideas was the whole...I started digging out my CDs and vinyl from the loft. I used to have boxes & I now have 6 pieces. I don't have a record player! But there' boxes of CDS and there's something about – starting to look at tapes and how there's a resurgence in cassette tapes. Talking to friends – they're easy to duplicate so a band can make a whole load and sell them at a gig and it has the download code for band camp. It's a physical token for your music but you can get at the digital thing really easily. That's become interesting thing about the whole music thing, in the sense where the object - I don't even have a tape player! – but having them as objects, take the cd and put it on that piece of the mantelpiece and maybe your music starts playing on your Sonos. There's something around the music listening...

Physical / Digital

Compare to reading and Kindle killing books. Conveniently replace books in certain situations, but people like books and interaction and interfaces. Also, studies prove that reading off screen is less

effective in learning than printed form. Parallels between these two. Going through notes and saw the Moggridge – only way to experience an experience is to experience it. See how records works?

"Memento  
of  
moments"

There's that, there's also the mementos or memories thing. There's a bit of music on my screen on iTunes, the cover...not quite the same as the object of the thing attached, especially if talking about some music, as often associations with live performance - basically events that you've been to, even if the recording isn't from your night – I've listened in preparation.

Old record with underlined songs, name written.

History + past life?

All these things you don't get with the digital.

Record player and listening to music strong on my side. Fit with the other bits? We can use some of yours to make a practice. Will put the first down.

GFB  
- co-projects  
- make mental?

Family meal, going through photos, putting keys away...Listening to music, we will often switch on the Sonos in the kitchen dining space, but it's there in the living room. Not upstairs in the bedrooms, but it's sleep time.

Could look at how changes between living and dining rooms, so interesting, Time? Friday, evening, etc. Need more times. Could write down something...a different day?

(Slowly building the practice...choosing spaces, times etc.)

Sunday afternoon. I think there's a specific, potentially, maybe...

Winding down and winding up for week – sadness going back to work

Could be for adult also kids going back to school.

REFOCUS

Let's try to come up with stuff based around this. Music, record player, dining room & living room, Sunday. How IoT concept or product? Listening to a variety of conditions, together alone, speaker, headphones, background or centre. Music that paying attention to or background to activities doing.

GFB

Sunday afternoon, they'll be doing some sort of things but they're not like...

Goal oriented or...

I would think Sunday afternoon is that winding down. Not sitting down and relaxing, but doing a few things. I'm going to put dinner in the oven and the kids are...but I might sit down for an hour or flick through the Sunday paper. O tis slightly background, but more deliberate – I fancy listening to this while it...rather than I'm just going to switch on the radio,

GFB additional cards = additional contexts

A bit more directed. Selecting a few things to do at the same time to see if fit with what discussing. Plating instrument? Doing housework

participate?

Sometimes  
others  
don't

Yeah, a bit of tidying. Sharing ad rink or hot drink – it'll be either or both. A bit of washing up...Reading a book – no I can't read with music. Reading the paper might be different.

Lots of associated activities. Generated by Sunday afternoon more than anything – contextualised by the time, which you suggested. Super interesting. Think about it as situation for IoT product, where do you start going? Music as core activity, others situated by that, but

blue  
red

I think you've got your speakers, your Sonos and at various times you're listening to radio or a random selection of tracks. Here, what you've done is specifically said I'm going to listen to this now. Even through you might still be doing other things. So, the interface for playing, selecting, is probably, could be...I'm more likely to listen to an album rather than a playlist – I wonder whether that's because of how I think about albums.

selection/curator

Playlist as curated thing, albums dying out due to Spotify...

How many musicians still think in albums as they like to curate...I don't want to say it's all musicians.

GFB

cards reacts as receptors?

Younger generation are more digitally focused...Think about the record player as a metaphor perhaps for interaction? IoT system that uses record player to connect to selecting music using the culture of records...

It's a thing. I think it would be in the living room. You might have music playing across the...you'd have the record player in the living room. The music might go beyond the living room but the object is situated there. I'm thinking in the same way that...I've got two shelves full of my CDs I pick one out and if I turn it to face it outwards rather than on the shelf, the systems going to play that. Think like you take the physical object, which could be the CD, tape, record - my physical object of the piece of the music and put it on a specific shelf, in the same way they have the frames you can put your vinyl in. You put that there and it will play it. It's playing from a digital recording anyway?

**A bit or cardboard with a QR code?**

Yeah, or it could be an actual CD. There was a project a while back to print physical things based on your kindle books. I think someone did a project...James Bridle. Print to make a physical think that represents all the books you've been reading, so you can show them on your shelf. Displaying what you've got because with eBooks they're all hidden away.

GFB - user experience is important to develop use - can this + my system need be combined?

**Got our CD or record, put on shelf, what's next stage? Starts playing, digital Spotify?**

So, it will start playing. You have a controller on the shelf? The equivalent of pressing the play button or putting the needle on and the thing will play according to how you have access to the digital file.

**Not necessarily Spotify?**

Some stuff on Spotify, other stuff on iTunes.

**Other elements of record player metaphor that could fit in to that the works in this idea? Not just the CD case on shelf, also remove media from storage? What benefit, what more does that mean?**

The annoying thing with that is you can't then read the notes, sit there and look at the record cos you've put it on the shelf to play it

**And as soon as you take it off it stops.**

You put it on the display you can't interact with the object?

**Skip track? How?**

On record player - lift needle. Not intentionally but an awkward thing.

**So this is too?**

A It's kind of taking away the freedoms of how the user can listen to the music. Not totally, but it was harder because you were listening to how the artists wanted their music to be listened to.

**Series of slots in the shelf? With records, move the thing forwards of backwards. Physical interaction but nicer that is more reminiscent of needle in groove or lifting and moving along groove. Maybe not square shelf or item?**

It's odd because the physical object the vinyl, cd and tape, they're going to die, and oh no they're not! They're resurgent. loads of cds around, vinyl is a bit, maybe with vinyl - it's so long since I've had to think, but I remember having to do it, it's been so long vs. a cd or even a tape. It feels such a distant time.

**Romantic metaphor, disconnected from reality of how music consumed. Moving away - person who spoke about record players says - music and quality and physical form.**

There's something about having some physical thing to do with the music, because I think there's a closer connection between you as the listener and the piece of music just through having an object for it. I've got a small selection of tapes I'm interested in exploring in this, but I don't have a tape player, so I'm listening to the mp3s on Bandcamp.

**Ooh moment - books and record, see how far through - interface in themselves. Can this translate to physical form?**

CD less so, vinyl...

**Tape and reel to reel...Car the represents track moves along to show the end of the record...? Skipping between tracks? Scrub along.**

Make it more playful, play around with it a bit.

**Back to records, DJ's mixing....**

*Physical  
interaction  
but*

You could have a really sci-fi interface. As soon as you put the physical bit into it, this black surface lights up cos it know the track and can give you the markers and you can line up as you move the thing across, put it here it'll play track four. That's a technically really...but you can imagine IoT being really star trek, but also slightly wrong because you have to move this thing which is...a piece of cardboard you have to put that in to make it all work. You could go I don't need that, I can call up my music on my...it becomes an object in the room just to access your music, IT can display it with a lush...because of the artwork with the CDs, the idea of the artwork being vibrant in a way, displayable as the music's playing, even though it's unnecessary. I remember listening to everything; the cd or record would be there so I was looking at it. Even if was having to do other things, the physical thing there was representative of music while I was doing a piece of homework or something around it. Just because it was very physical, it wasn't you've selected this and that and put it in the background.

**One of the things thinking about – started with premise of having collection of music. When talk about digi streaming that idea of having the physical album and having token doesn't work, as put in search term. Does this work with streaming or just a physical avatar?**

Because of my current take of the music streaming industry is how it's hurting musicians because the economics don't wont. I sat with Imogen in a workshops, she came in the next morning and said I was up last night working it out, I can no longer think about making a living just from streaming my music. That's Imogen heap, nit some u and coming young artist. Economics don't work.

**So you think this might be an alternative**

The whole thing with the tapes to get access to the Bandcamp. Has more of that potentially as things like mycelia are changing how...if there was more this track was played from this person and there was a fee paid or bought the CD or signifying,. They pay their bit of money, the artist has their X percentage of the thing which is potentially higher as there are less other costs sunk in and they can access it with no issues. I find Bandcamp really interesting as I can order a CD or a tape for it, but I immediately get the download, so I immediately listen to the music after previewing and a few days later I get the physical object.

*What's  
IoT?? in  
this idea?*

**Words and acts, IoT – intuitive system that selects system or all controlled by you, IoT element the signifier linking to digi library? Sensors, daytimes, space, intention of it, which it can't detect but infer from activities. Anything in there?**

Wondering if because Sunday afternoon, there is only, in a sense the control is with the person. If it was some other time it might be...

*Time constraints, lets change elements for more interest!*

Let's change the time...spring? Not Sunday, but springtime, any time of day, day of week? What mean? Too vague?

**Listening to music? Just play spring themed music, Primavera, rite of spring?**

Then in winter all you can listen to is Scandinavian death metal.

**Springtime, other ideas assoc. with spring, things that happen in the home, music? More like, in the spring dancing round the maypole, thinking of desperately? Easter?**

Summer there are festivals, spring is less...

*To summer  
festival  
passion...*

**The idea of summer? Summer idea of this maybe you have a summer pass you sell for festivals and put signifier in to listen to live festivals? Revenue stream, different stages. Can't be there but live direct feed.**

That would be kind of interesting. I think a music listening...it's not a resource management thing; it's to do with personal space, but also a shared space. You could have in there sensor to say its nine of clock and you live in a terraced house, lets knock the bass down before you wind the neighbours up. There are little things you could have in there. The kids are awake, don't play Eminem. Watersheds for music.

**Time control, after 10 it gets quieter, or kids in bed, as you said.**

Having those as would contextualise that in the environment.

### Not the music output but the music output.

Which I think is interesting. "I want the best music system, oh actually I want a nice music system, I want to listen to music and don't piss off the neighbours cos I like living in this area." The system reminds you,

### Prompts not adjusts?

Could do either, but in a sense it's actually, don't be a dick. The IoT of don't be a dick! "Making it easier to realise that certain activities could annoy the neighbours."

### Bass adjust & volume. Meta data could contain EQ?

A new music format that you have to get a new player for, but it's where the artist gets to set it as closely as the recording environments, how I've sculpted it to sound and it can go over streaming. So the technology of the artist to really control that is there, so it could be integrated into it

### Automatically adjust by genre and track...

And if it's late in the evening it can make it quieter, you can override it and say I've spoken to them and they're happy with the fact that we're going to be partying to half eleven cos we're old now! You can do that.

**Festival access note. Could do that with anything you're broadcasting from - Edinburgh fringe, church...A bit, backwards looking to have punch card libraries of music sources?**

Overly nostalgia, retro...

### Due to the fact of records players?

Because of record players and my context is to do with music collecting which does have vinyl and cds, if we're talking about music then it's heavily driven by the concept of an album or an artist's curating a selection of things that gets released like that, rather than a, "Oh I've got a song, oh another one." For the most part it's pulled together into a collection, which they've gone through, cos there's stuff that gets recorded and doesn't get released, or ends up released later as a B-side, which weren't existent until the physical era. We'll re-release that as a single. The industry side of music being the charts associated with singles...

### Skewed by streaming so Ed Sheeran. Which is depressing?

SO I think the idea of having a token where you have this transaction with the artists...still could be mediated through label etc...it could be a virtual token.

### Maybe a QR code?

I think the physical...maybe the thing is...I can buy the music on Bandcamp and it's just a digital thing, it sits on my iTunes, and I can access from my music shelf. But there are some things that I love the art, I just like the idea of physically having the thing and looking at the pictures they've put together and reading the words...I can read some print eh lyrics but others don't. One of the things Imogen was talking about is that it could sit in the sat around the song, if she wants to publish the lyrics she should be able publish the lyrics and they get reproduced in exactly the right way wherever they get used, rather than at the moment where they end up slightly different. So maybe the token actually should be a nicer thing, cos there's the extra bit of effort and cost with it, but it's something you want to display.

Maybe the token is a small thing, whole unit, shelf, coin slot? Screen still! A display of artwork, lyrics...What about if we assoc this with other acts supporting by listening to music...if a case of paying attention to music that's one thing which we've been talking about...what if

Returning it to value. Beggars the question is that something we do want to return to?

Sounds like the value of art, which is what music is, isn't considered to have that value when physical objects? Shift in industry, musicians, music I don't know. I have an idea but not evidence. In context of IoT system, concept what about the background use?

I stick on the Orb and go and do the washing up in the Summer time, doors open, little fluffy clouds. Plays through until it ends, and my washing up is slow and there's a lot of it, so music ends and I'm still there with rubber gloves on. That changes...or somebody else might go along and put something else on...what this is, is a singular, very much "We're putting on this piece of music..."

Background use +

"Singular"  
Music

A system with only one controller then? A bit tough when shelf full of tokens/signifiers. Just like any music system, people can leave it or change. In terms of IoT, react to activities, where doing? Terrible example of Sonos following you, shallow but neat.

Environment  
+  
use

I want to take in other environmental considerations, shifting the music as I've gone into the kitchen other than turning up the volume until the walls are vibrating is more polite and still a better quality of music as it follows you. Turning on the tap, having stuff running - the volume slightly increases due to ambient noise, but within context. The Hoover comes on and you can't hear both - Hoover on, music off. Probably makes sense, I've done that and thought why have I put the music on?

HR to self  
music?

What if start to do dusting, hovering, bath and doing quick movements and somehow it can detect temp, heartbeat, jawbone apple watch - then music self-select into different tempo? What happens in that situation?

You could do that, if...

Does that fit within the context of experience?

Experience  
→  
automation

I think there's a thing between - I want to have that curatorial control and when I want to change it I have to go and change that to something else. Versus I wouldn't mind it playing something more ambiently - still using the same speaker system and music source, it's just selecting. Maybe it starts with the Orb but because somehow I'm not listening to the music, I'm doing stuff, it kind of listens to the other sensors round the house.

Brings up when system or you choose and whether you want experience to be automated - cooking and lighting.

This is the thing that again, the IoT I think that the fact that there's usually more than one person in the home, they've probably not all doing exactly the same thing. They'll be doing different things.

Part of what I'm looking it is how to create communities of practice through tech, whereas at the moment tech can be distracting. Phones in the same room, but different worlds. So maybe that's a fine thing that it's trying to encourage that communal activity rather than fractured.

Idea of not being controlled by the phone, to have this place to go to in the house to take proper control of the music is a nice idea. Having it so it could be switched to a more ambient mode is probably useful, cos there are contexts that want that and having more music playing is not necessarily a bad thing. You could have the radio on.

In this instance trying to be curatorial, you have it like this and if automated it's like this - a hinge thing. Or a lid. Mode states.

The music's playing and again tech wise the beat matching in music, again Imogen has been speaking there's a lot of work about that, cos it's a revenue thing for artists.

But all driven by revenue...

They've bought into music as music. The only thing is that whole making it so it has more value attached to the actual music. Just Spotify by itself has broken.

Perceived value...Same with newspapers? Why but and respect it if not physical form. Happy with this? Keep going? Good core concept to work with...User experience map...So user touch point on experience map? Where start?

The setup.

Started with explaining what it was, some basic forms of interaction. What is it? An IoT music player? A physical device to access digital media.

Yep. That, it forces you to go to the device...

Situates the act, forces you to go to it. Forms of interaction - selecting, placing, object moving, album position and track position.

Didn't speak about how to control volume, we should think. Obviously, it might change it according to the room I'm in. If you're going between rooms, the idea that it follows you to a speaker that's already there.

Volume control/

Also the way to - music playing but you'd released control to the...

Switch between automatic and curated. Could be the lid being closed? Product idea – tokens to access musical streams – album, festival stage, church, school play, listening to bedtime stories, could be loads of different things, could be permission token to listen to streams. SO how first engage with it?

Hmmm. Get it home, plug it in, you need to connect it to sources of music.

Power, Wi-Fi, music, audio streams. Setup. Much like a new laptop or any IoT product really.

Like the Sonos speaker.

Positive negative neutral?

I expect it will be fairly positive?

Pairing button?

The worst it'll be with connecting to music you'll have to put in some...there has to be some way of authenticating, connecting to your library and stuff. There will be...I can't see how you can get around.

Screen based – setup through email controls physical. Problematic in some ways.

That's the thing, there will always...not always, but...Looks like initial set up is always, there's always a point of pain. Even if they say we've got our own bridge, all you've got to do is plug it into your router, you don't have to worry about that sort of thing. The Sonos one, there's still this bit of I have to go to the Sonos app, you have to press it and hold it...a little more fiddly than plug and play.

IST  
USE +  
SETUP  
ALWAYS  
A  
POINT OF  
PAIN?

So where?

It needs to be over here, it shouldn't be too hard. I don't expect it to be over here at all.

In the middle? Assume all set up, decide to listen to music, how go about that?

You will select your token from your shelf, or box, or however you...

Whatever looks like...

And you'd put it on...obviously you'd open it...

The second thing is you select the token. The third thing is you put the token on...Or open, turn switch – whatever that form of interaction is...Place token. Pleasurable or not...

To me this is like stopping to look at...it'll be annoying when you suddenly think, "Well where's that one?" Rather than type into a search box.

There will be problems with it...

Put it here, but the thing is you're scanning backwards and forth – "Ooh I'd forgotten about that." Which you never get, well you can stumble across thing...

I dislike playlists, self-selection – loss of serendipity. Library analogy.

The serendipity bit of you scanning the shelf. It might be something like the spine colour of that one. I think even though you might go "err" it would also be then "ooh!"

So balanced?

Yeah, in those terms. Overall, I think it's a positive experience, massively.

Next – opening, turning switch for curation mode, token. Pleasurable? Negative? Difficult things?

NEOSTALGIA HISTORY?

Give it to anyone who had a record player or cd player it would be lovely to have that connection back. TO anyone who didn't have that it would be "What are you doing this for?" sort of thing. But I don't know...

Isn't that the point – music back into valued resource?

It could be that there's the CD and you bring it in like the display underneath it and it lights up and take it away and it dulls. You can do these things that are fun. You can make that really delightful in a sense of self.

DESIGN  
OF  
PLEASURE

Object reacts to token presence in delightful way...

I think in a way it might have like a Star Trek control panel, OLED in black and colours - but again it only happens because you've stuck on a physically inert object. It feels anachronistic, but also fun and interesting.

**Positive, negative, neutral?**

I think it'll be - imagine it like a Braun or the Japanese tape decks where everything is so smooth - I think it'll be kind of a fairly...

**Not just the quality of the physical interaction, the act itself? Pos or neg?**

Actually, no. The act because it's going through this has got a very definite purpose. SO as well, you're getting all of this lovely mechanical and electronic feedback from it as well.

**Moving towards goal too.**

SO actually, I think this...

**Two marks - one for physical interaction, one for quality of act.**

In terms of doing the...it's a very definite thing. The playlist, you're putting it there. What you've done is it's playing this from beginning to end. You can then do your other iterations, the first thing you're doing is like that, a very definitive singular act.

**A good exp?**

Yep - I'd have it quite high at the top.

**Ok, so that's the goal focused element. What about physical interaction element - mark with black pen.**

Probably slightly down, but thinking about as an object it's more like - not a cheap tape deck, you're being a bit audiophile, it'll be a physically nice object. Maybe you tape it like that and it slowly comes down in the same way the tape deck does. That sort of "I can't wait!" The soft shut drawers - just playing with this door, watching it do that thing.

**Slightly lower than goal focused element?**

It's the thing that is slightly, because of the things you won't get bored of, but you might become slightly blasé. Initially to start with, but then when that happens there you're taking control of your music listening.

**Object reacts to token presence - delightful, terrible - what happens if dark evening, trying to relax and calm down and like show. Negative as well as positive?**

Thinking about it from that musical audiophile thing - all of this stuff is building up these bits of experience. Cos then I'm going to sit in my comfy chair and listen to it. All of that is going to be on the wall over there. In a sense maybe I'm not even going to look at it. The whole experience of putting it on feels all tactile, sensual. There's all this - the lights have come up - almost like you've gone to a concert, the lights go down. It is an experiential thing. It's all in anticipation, and once it starts playing, it touches down, after wards it would disappear. Then the keys things, like track number, volume - maybe they're still there. Maybe the volume slider only comes up when you put your finger...I think the idea of all of this stuff until it keeps playing is crescendo upon crescendo stuff.

**So?**

Same place.

**Got to this point - music will start playing - adjusting stuff.**

The closest thing that you've got to having dropped a needle on the record. Then you want to move a track, skip to a track.

**Do that by moving token? Positive/negative? We discussed marks on the track that show where each individual track sits so some frame of reference...**

How we're describing it, I can imagine that it might feel a bit fiddly, which might get a bit frustrating. If it didn't feel frustrating to slide it along to track three - it might be delightful the first couple of times, but then it might be, alright. I can imagine in some ways it's got that initial delight, but it could quite quickly get like - just play track four.

**Sounds like not purely positive.**

Wondering about that as an aspect of it. It might be the fact that physically having to move it - just some surface where you can touch the thing. That might work a bit better, rather than trying to

Experiential  
thing  
gaining



physically move it. Suddenly I'm imagining that you put a cd in, you slide it alone, dust catches slightly, it goes a bit funny.

**So, not purely positive. Where sit?**

When it works, it's fine. It could quite quickly get over here as well. All it takes is...it can fluctuate between. All it takes is you've got one album which has multiple funny track because of the ways it's encoded. "Why the hell is it like that?"

**So skipped track, volume changes automatically? Depending on time – 6, gets to 9pm. Volume automatically changes. Or kids in bed. Positive or negative? If using system taking control from you and negative, or intuitively doing what you'd have done anyway?**

Some pre-set thing, volume adjusts. I'd put it like this – when it works, that's good. Also, the couple of times you'd think – why's it gone, oh...it'll jar you out of the thing a bit.

It might remind you of the time through the act.

Or it might frustrate you because it happens just at that bit of music – oh what? Then you think, oh ok, but it won't make you hate it. It's more likely to be a smaller range. I think my thing about the IoT stuff is I think they're always going to be like that. It's totally context dependent and will change. One day or a whole month it will have done it and you won't notice, that one time it did it and you suddenly though – oh why's it done that? There's no other reason that it shouldn't have done that, but in your brain your thinking – stupid thing. And then you'll get down to there.

*Exp's  
IoT - tends to neutral but when it's noticed goes strongly negative*

*— SYSTEM CHANGES VOLUME + YOU REMEMBER TIME/MISS*

*Soul*  
*Claf*

**Positive qualities? Social?**

Through physical object, it's a bit more social because it's got your things on display, so there is a more positive social thing vs. all your music is hidden away and no one in the house has an idea what your music selection is. I would put it...I think it's one of...I'm nosey, I like looking at the bookshelf other people – a bit lower than the very top.

*SOCIAL + MEANING OF THINGS!*

What about social listening to festivals etc. – voyeuristic or relevant?

I don't think it's got increased social because of...I suppose if you are listening to a live stream and there are good routes to interact...people could be tweeting...it could be as well. A bit less, but it would be a fairly, increasing social...

**Assistive? Elements?**

Elements to do with the ambience, controls and sound, rules and stuff, so a little bit assistive. Not hugely.

**Automated? Positively? What?**

A little bit, digitally. It can automatically follow you around...

Delineation between automated and assistive...

I was imagining that you can close it and let it play away using whatever algorithms. Maybe you've got it connected to your fitbit and it plays music according to your activity, or you can take control.

Make life easier, easy process, easy object to use?

Fairly, as putting on a piece of music?

Easy as Spotify or record player?

Easier than record player, easier than Spotify? Yes, because it's your music collection versus you searching for music. Fairly high.

**Emotion? Encourages this?**

I think kits got a high emotional connection because again it's tying in with...the physical connection to it, because of the physical object its giving you a higher emotional connection with specific bits of music. The fact it can play other music where you don't have a token diminishes it a bit, so that's maybe...You just don't have that possible relationship that much, but it allows you to have a higher emotion...Quite high, up here.

**Intuitive?**

I'd say, there are some funny bits in there that are a bit odd. Set up is bit odd. In the middle. I think with a bit of thought it could be made pushed up that line.

*Focus THROUGH CHARACTER*

157102

### Exploitative? Data, manufacture?

It's a big techie IoT project, so certain aspects will be highly exploitative in terms of resource extraction. In terms of the data, yes because the amount that the music industries and how the number...exploiting the artists and also the listeners a lot at the moment. Not directly tied into this object, but the fact that it's to do with music or digital files, which are being linked to by the tokens. So I think it's quite high. We need to do the digital/physical thing. The physical is right at the top, the data is quite high.

### Security and data?

You'd be connecting it to accounts, so that would be fairly risky and there are potentially accounts where you have payment details attached to them, so...If the data leaked, music listening could show off the IoT activity, you could see stuff like that. I'm sure there's a researcher somewhere going I can work out emotional state by how listen to Spotify...

### Where on axis? 8 Loss of interaction social and physical? What do you think?

I think loss of interaction, in some ways you're devolving that interaction back to the musician. You can go up there and play one song after another, you're very much interaction with the system. I don't think there is much loss of interaction, in fact it's probably forcing a lot more interaction with objects and what you're doing, even when you're switching it to play randomly. Digital, less so – it's fairly neutral. Physical would be much more up here, you're really having to pick things up and move them around.

### Changing practices?

It'll change it positively in a sense into a more thoughtful way of listening to the music, which will...but, my caveat on that is am I thinking about how I know artists currently think about it, and if I think about it artists will think I'll realise stuff like this and I'd rather people listened to it on Spotify. In which case this is totally anachronistic and again IoT for the middle class. It could be a very generational thing.

### Middle aged and middle class?

Good thing.

### For all else – e.g. millennials, where fit for them?

I think there could be a...young artists who are still really excited about releasing their albums...I think it would be a bit more neutral.. I don't think it'll be seen...they don't really care so much about this sort of thing. Part of me, a lot of the things like the tape things are driven by the younger bands – there is a connection with things. So it might not be as anachronistic as I think there unless you pay up the record player a bit too much, rather than the connection with the artists, which I think the interesting bit is.

**How does the development of a user centred structure/mapping of the IoT change how it is designed for?**

The person is at the centre of a domestic setting, it is only domestic if at least one person is using it as a home, so all IoT for this setting should have that person or that possible dynamic of people (family, friends, visitors) as a central pillar in how and what is being designed. The mapping allows you to quickly see if your idea does map into that model or are you very quickly making the person do odd actions to achieve what before was simple (light switch)..



**How does the inclusion of user generated values (specifications, negative and positive qualities) change the development of products for the IoT?**

It is the inclusion of this which I see as very useful as it gives such a strong alternative lens onto the product design, which is often lost in the excitement of all the new ideas and thoughts around an idea.

**How does the use of elements of practice and inclusion of this in a practice in the model of the IoT shift the outputs of the IoT?**

At this stage in the design I can see how thinking about practice and inclusion were very focused in thinking about what the 'thing' would do. Data and other aspects of the IoT model were much less thought about.

I think this did highlight something in that complex environmental interactions could be made with objects and systems that would 'enhance' an environment without capturing lots of data. So for such objects then collating all this data would be nothing more than a get data to monetise it somehow move.



**Did the card set help to focus you on how people use their spaces in reality?**

Yes, I would use the location/space on the card and then playback in my head how I use that space and my family to think about the patterns.

**Does this toolkit help in designing products that are suitable for the domestic space?**

I can see it as being very useful in keeping the frame centred on the people in a domestic space, rather than technical / engineering exercises. Could a variant model focused around, say office/work spaces also help in design in those spaces, possibly, but for the domestic space I see this as very useful.



**Does this method shift to make the users acts the central element of the IoT and does it make the user's perspective explicit to the developers?**

I can see how it helped in making possible acts very explicit and central in what we were designing. From the wild idea of a candle stick though to how it might be moved through the room, why the user might place it on the table, including very quickly coming to a conclusion that its not an act that would be used that often. I think there would be more steps to go through before I would feel that developers were getting clear insight into users perspective. *BUILD MORE INTERACTUAL STEPS*



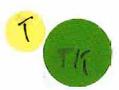
**Where is the boundary between qualitative and quantitative in IoT?**

How much and what data is actually useful. I think a new set of tools to examine data and flows, aggregations and the like is needed, we can design something that conveys something and that could impart feelings, emotions, thoughts, or just be 'useful' but what of the mechanisms and data that enabled that is actually qualitative in terms of being of use beyond having modified that light hue at that one point in



*GFB*

time? I'm not sure. Some deliberative prompt about the data would useful (and as data I mean that there has to be a thing there that measures something so that some action could take place, how often does it measure? what does it measure exactly? does it forget once the change has happened? etc.

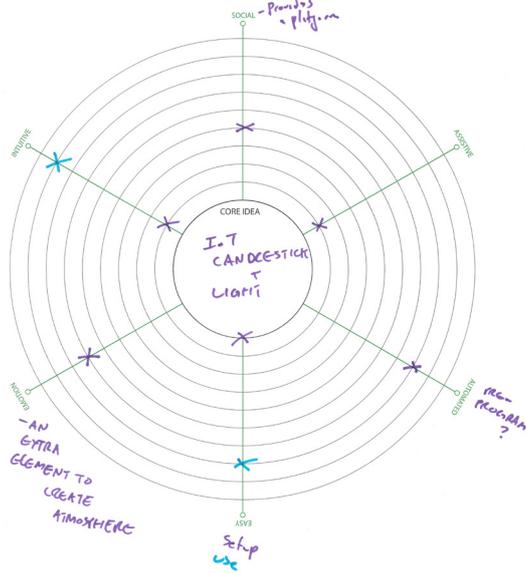


**Does this design method lead to physical products that make practices/routines in the home meaningful or reflect the meaning in these practices?**

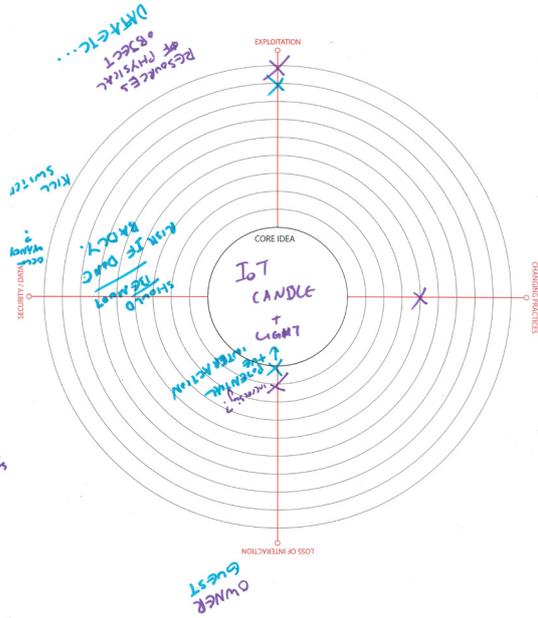
I see it as highlighting certain routines which, for whatever reason, have been internalised into the domestic space. Their meaning is hidden. I am not sure if the objects would so much reflect meaning as modify possible meaning or possibly modify the practice so that the meaning could be maintained. I could see how a group could construct specific, almost bespoke, IoT object/systems for specific personal / familial practices that could maintain meaning (and thus keep the practice going, maybe over more distributed families etc)



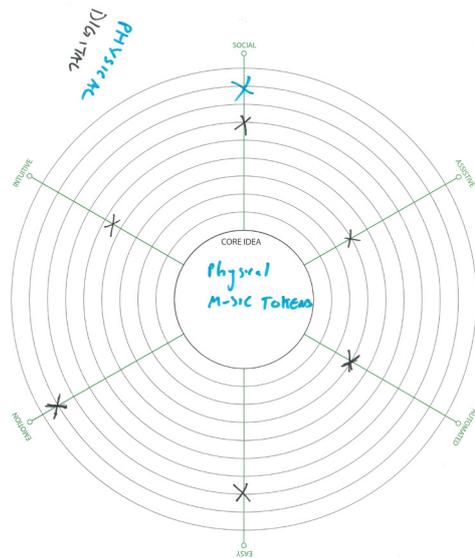
DESIRABLE IoT QUALITIES



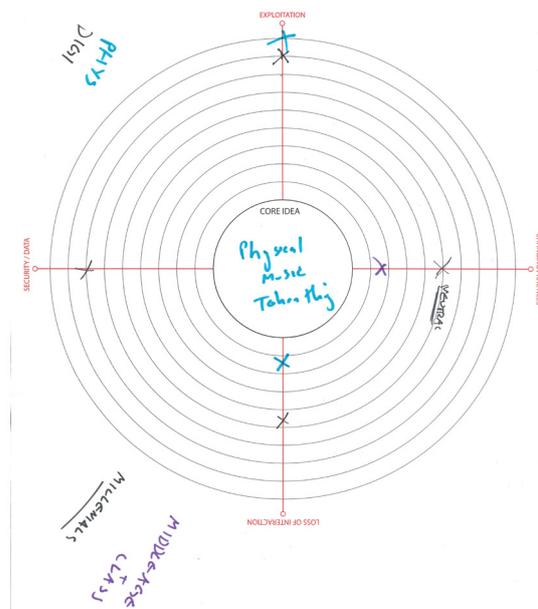
UNDESIRABLE IoT CHARACTERISTICS



DESIRABLE IoT QUALITIES



UNDESIRABLE IoT CHARACTERISTICS



## Participant D

Explanation of workshops development, background, know cards, etc..

Head of product at toy company – BBC Microbit & another product a HCD approach to called [Redacted] Won Fastco product design of the year, 2016. CO founder of company that intends to help seniors live in their homes for longer – customers 75-85 old. Just about the home.

Past workshops – writing of + and \_ and voting. Characteristic of IoT. Use them to evaluate content. Perhaps not suited for this project – group who came up with it are not the users. People

tend to be wary of IoT and human agency removed. Very blurred line between automate and assistive techs and difference between!

These pages are ... output of workshop/s with what kind of user? Engineers, end users?

Those interested in IoT gathered through arts and tech programme at space studio in hackney wick. Group of 10 mainly mid-20s to late forties. Design and tech. Here, three participants, much older group, late to mid-thirties, early forties, none designers, none background in tech, more end users. Interesting as this information was harder to get out of them, didn't have a clue about implications. Cigarette roller and insurance. End users tend to be more ignorant about IoT and data. Greens are perceived positive, reds are perceived negative. Specs are useful, but don't stick to too much.

I would call this attributes instead of specifications.

So, a bit of background and context. Will refer to it later and use to judge later. When started the IoT was in here in Gartner Hype Cycle.

Think of Alexa as IoT?

More voice assistant, IoT has an element of Thinginess. People focus on the Internet, not the Thinginess. Bring back to this through the workshop model. I don't count as IoT for this, to me a voice controlled computer. Making decisions based on use and detects in intuitive way.

Through machine learning or because they're an object in an existing....it's a chair but now it's a smart chair, you had a floor and now it's a smart floor. You had the floor before and you have the floor after.

Kind of. Hexagon couch. Not IoT, you control a malleable piece of furniture through phone.

It's the boundaries are getting more and more difficult, but ok.

It's a difficult subject area. Set Alexa and voice control hubs aside for the moment. Difficulty of defining IoT. Hype cycle continues. Models of IoT – architecture and mental models. Lack of people in a lot of them. Lots of these from engineering perspective. Forget about humanity. People are subjects, users, consumers. Not really embedded in the IoT model.

In this one, what is human?

The human and the digital entity combine to be a user. So your use of the object...

You aren't part of the system until you're paired with a digital entity. Which is weird because the IoT is assumed to be physical.

Different models, different confusing, don't include human in it a lot. One issue is mental models are really important in allowing people to understand how things work. With more complex things it gets confusing. Why is none including user in this. So ritual as way of hooking into peoples practises in the home. Came up with the idea of using them with parallels to that in IoT and acts as witness. Explanation of all the four elements.

Mowing lawn or taking garbage out, or TV?

Those things grew the overall – this whole things what words and acts, what time, what intentions, how positioned in world?

I took the garbage out this am, every other week I can take out my household waste or I can take out vegetable matter and cardboard. So taking rubbish to the corner is a ritual. But the aspects of the ritual are these things here?

It has been said by folk in anthropology that practice broken into these four areas.

POSITIONING  
IN  
WORLD  
D107

So, with the rubbish I notice that other people have the rubbish out too, so I'm part of the community. I'm thinking about who takes it back and who leaves it about and what that means about them. There's not a lot of...

**Keeping place clean**

Sacred and secular?

Taken out at particular time. Sacred thing could think about how past and future generation deal with rubbish? Words and acts – take it out, tie it up, put in bin,...

I have to wheel the bin from the garage to the corner, I have to open the door to get in to take it to the corner.

**Model & development.**

3rd

Can I share something with you? The council has released an Alexa skill so that when you ask Alexa what rubbish collection day it will tell you. It's the black bin this week, the green one this week. Of all the things to expect to receive from my council, an Alexa skill would never have been of the list.

FOLD

My problem with IoT as is based on resource management, factory. Work task analysis – Gilbreth, Taylorism, Managerialism models etc...IoT trying to embed rationalisation to home. Elements represent what the IOT is at the moment, resource management tool doesn't necessarily work in the home. If anything disagree, please tell me. Nest manages heat, doorbell manages access.

3rd

Don't know if symbiotic or it depends or they're related but you started by saying that the kinds of people creating IoT objects are solutions for problems, essentially engineers who are thrilled with this. And this resonates with me as I sat on a trip next to a guy and completely randomly he started talking about what it is he created in his home and he's been creating some scenes, light and audio settings. He's been doing it since 2000! And he now has all these...and he's super... This stuff is all super cognitive, if you give it to an engineer then what they want to do is optimise. If they have to code it, but it sits in that cognitive space. He did all of that but he did it for motional context. He did it cos he wants the lighting to be changed when he and the kids are in the hot tub.. You can set scenes and this automation to create an emotional environment. So he did all this cognitive stuff in order to be able to create a mod which lives on the total opposite end.

Engineers  
IoT  
D107  
cognitive  
emotional

That's a different situation, but I would argue that I have issues with that as its still something that might be tedious, i think the engagement and acting in the home is what makes it the space it.

1P

Me turning on my lights and setting them the way I want and lighting a candle is a ritual to establish an emotional setting, and if I can achieve that with automation I emotionally get the same outcome. Here's the challenge, for all the seniors that I've been talking to about home automation, those who cannot understand what it will do, who can't visualise or see themselves in that scenario simply respond "This is ridiculous, send me to the glue factory if I can't turn on my own lights." What I'm trying to understand is that you can achieve the emotional outcomes.

D107

**I understand. Let me run...**

This is all a high level, but I think the use of this has an emotional element.

Toolbox

GBF \*  
+ good explanation  
of IoT

Use of acts, reflecting on them, crystallised as static practice. Physicality and reflectiveness. Automation embeds ideas and stick in practice of doing things. Also leads back to craft, criticality of what doing, change it and do it, which is why design fits more that tech.

Lovely, get it.

D107

The whole Hue thing, and these scenes. The promise is that it can help you achieve these things, but in my experience of using them, I can't quite get the right colour, the app needs to be updated, I don't like the way it looks. The problem that the product says it's going to solve remains unsolved; I still have to do more. If I were to reflect back on the example I use of my friend, he says the family is little bit loud on that one, the setting needs changing, so he's still,... He doesn't configure it and that's how it works, he's constantly...and he's doing that with technology. He's the only one who has access to it, but he's not finished. So your point...

Recognise  
of IoT  
the problem  
remains  
unsolved

3rd

**It's not frozen,**

The way that I heard what you were saying, the physicality of doing things and lighting candles and changing them and that reinventing and finding new things to experience of may not be available in automation, he may be using automation as a way of doing the ritual. He's moved the ritual to a c prompt or Raspberry Pi. He's a maker, not a normal consumer.

The physical engagement with the objects of the IoT is really important, this idea of tool use and extended body and mind. Important to way engage with physical world. Object use to develop IoT outputs...

So in your view IoT requires a kind of interaction with it?

My IoT

In my understanding, the IoT – the idea that you extend yourself through your tools, shape tech and shapes us. Want to make tech sympathetic to way working as humans over years and engagement with physical world, then having physicality at centre of it is appropriate.

So going back to hue example, I have an app, I have a spinner, I do this, the colour and intensity in the room changes. That's a positive outcome; that would be in the spirit of the world...

A slight different quality of physical experience, just because that's where I come from – product and furniture design background

DIoT

The stuff that's totally ambient that doesn't offer an interface, when physically engaging with the interface which is the home.;

A different flavour of IoT, the Alexa at one end of scale and trying to work out the other side of the scale. Design and designers better placed to develop products for IoT, criticality, etc...

!

No small bias in that!

No none at all! Allows physical understanding and development of how to use objects and background to engage with users in research projects. Technologists do that, but bias and disciplinary understanding means post positivist approach to problems, a problem to be solved and done through tech and rationalisation.

WORKSHOP STARTS

So, IoT products – Nest, Dash and GNL.

GNL - Not IoT but Art? so is ~ IoT not

GNL – not IoT, I think it's an art piece, I think it lives on a really different conceptual level. I don't think it's what these are, these are...they feel the emotional space they live in incompletely different zones.

I argue if dash is IoT then GNL is.

IF use GNL, then when I turn this on it turns a message to a server that activates a device elsewhere in the world. So that's the reductive aspect of what that it.

Put it in there to show the scale of IoT to those not worked deeply across spectrum. Not neatly within it to illustrate. So practice with card sets, ask to select a product and try to develop an idea based on it, but with you cos got an idea of what trying to achieve more than others who want to explore method, maybe we ignore this and go into developing concepts based around the cards and set not using these and then once understand how the cards and model work together we can try to develop a specific ritual made up of those four elements that applies to the sector you're working with and then build concepts based on that. So.

tailored workshop/game variants

DASH GNL

Can I just, the...this is gadget, this is a gadget, this isn't really a gadget. This (Nest) is a larger service, so the intelligence of it learning what you behaviour is and predicting and anecdotally everyone hating how it actually works. And I asked my brother, he got one for Christmas and he's like "I hate it; I just want to set it on the thing!" But I have one in the house I rented; it's like a beige plastic with a little LED screen and some buttons. And I can schedule it to do many of the things that the Nest will do, but it's a terrible user interface. This is a lovely user interface. But this feels like something different, this feels like...I don't have any words for it. It feels like it does these two...I'm looking at your specs. It's does this, but it's a beautiful interaction model, it's sold on an emotional premise, it makes promises of a relationship that may or not be actually able to fulfil, it has a context over time, not a single use, but theoretically it should be getting better. I'll buy into the future that I'll have with nest. All this is that I don't want my nieces and nephews to forget me. Which is the reason I thought about buying it and then I realised the time-zone would be a pain, so I decided to stick to sending them messages.

DIoT



Interaction Emotion Time + relationship eternal

The nest has some elements of the home embedded in the way it works, fair pint. Also just about resource management, that's fine in some contexts of context of the home, but there are ways of

looking at the human elements in the IoT from this routine perspective to allow for the development of product that are less about managed and encapsulate home management.

GNL  
EMOTIONAL

I'd buy the Goodnight Lamp only because of emotional, not because of resource of automation or lowering cost or efficiencies. I'm doing it because it will keep me connected to somebody, which is a difficult thing to do and it does it in a delightful way. I think the appeal of it would wear off really quickly and the setup of it is a bit of ta pain in the ass, it won't deliver on any of its promises. The only reason id buy it is for emotional reasons. Looking at the Nest, I'd buy it for motional reasons, but my on-going investment in this thing comes from its benefits that it also create here on the rational, automation and all the rest of that stuff. So it nicely does both. This annoys me, these buttons make me insane, cos there is no emotional context to it, it's only about automation and if I'm too stupid that I can't remember to buy detergent...the idea that these are paid for by brands the condescension that "the consumer is too stupid to remember. Some woman somewhere can't do shopping and manage children and chew gum at the same time. She needs tech to solve her problem"...These Dashes make me insane, so I'd appreciate not doing this one. But I don't know here I'm getting at. If you're challenge to me was what we'd like to do is create a product that did something that wasn't about the resource management stuff, but instead prioritised the...I don't want to tell you what the product is, it's something that tells families that their parents aren't dead.

DIOT  
NEST  
-EMOTIONAL  
RATIONAL

DASH  
RATIONAL  
(ON THE MENDING)

The nest is filling both elements of that split, and that's possible why it's the most successful IoT. But still filling resource management.

Why wouldn't it free you up to spend more time on other rituals that are more important?

Automation  
greeting?  
No!

Evidence that automation and products supposed to free time make you spend more time busy.

NEST =  
MORE  
THOUGHT  
OF  
HEAT?  
AWARENESS  
FROM ROAD

Able to free up time and prioritise things due to the nest, but the reality is that have to think a lot more about heat in the home. From my perspective if I was going in the Nest direction is a product concept that would allow you to spend the time that you have doing other times and not worrying about this stuff. That one would be a deeply emotional, about social only, higher spiritual whatever. And I'm not talking about the dash.

A product  
to free-up time?

More stuff about model for workshop, etc...Cards, new pack from past participants. Explain card pack and selection...Four elements...Explained by area etc...

BREAK 2nd SESSION\* BREAK 2nd SESSION\* BREAK 2nd SESSION\* BREAK 2nd SESSION

GBF  
TR  
Riff through  
cards

You've got the cards? Small amount of examples as too many things to include. Choosing quite a lot of different ones?

TIME OF  
NATURAL  
EVENTS  
-changes  
every single  
day.

Yeah and I think I'm zeroing in on one thing...I don't quite know what the act is...I thought I had these all in sequence...The thing that I'm connected to and thinking about seniors is, and something I'm interested right now with the product I'm developing. The idea of the passage of time, I think there are things that happen every day but were not really sure...so here's what I'm super interested in, is sunrise and sunset. I'm really fascinated by the idea because it changes every single day. And I know one of the largest use cases by volume for Alexa is the weather. And I've yet to meet a senior in England who on some level isn't going to talk to me about weather. So there's this really interesting intersection of time, expectation, the ritual of the day, what's happening, what has happened and for some of them living alone, at a distance from their family and they're retired, what's the difference between a Tuesday and Thursday afternoon, unless there's an event. There's a lot of research about loneliness and isolation that older people feel because they're less mobile, because they don't get out, which makes it even worse. It thought there's something in helping...I think there's a ritual around the moment of sunrise, the moment of sunset. It's also a duration. A friend of mine had a ritual every day in his home. He lived in Florida and he had a view of the Ocean on the Texas side of the panhandle, and we would stop and when the sun touched the horizon until the sun was gone from the horizon we didn't do anything except from drink a martini and look at the sunset. What is fascinating to me reflecting n that experience on his home is that one ritual - it's a must it happens every day, but it doesn't happen at the same time every day. It's just a little bit different, which is what life is all about. There's something in this intersection of...I almost said opening the curtains, but the act is checking the weather...

Senior's  
- I'd  
- need to be  
involved?  
BCF

Looking out the window?

It is that where I went to is bringing the outside in, which is why I have the toilet and bathroom and kitchen and bedroom. These aren't always external...I have a window in my toilet, but it's...

DIOT

Frosted.

You don't wanted people to look in and at night with the lights on its brighter inside than it is

DIOT  
Domestic IoT  
- bringing outside  
in?

outside, so close the blinds so they can't see the shadow. My house faces a hedge, a wall of forest. There's nothing in front of me except for some trees and birds. But that's different to the built up environment that I had in London, where the toilet had no windows, it was inside or up high, **But then bring the outside in to be aware of what's going on in the outside world, to maybe create these little tick tock rituals with beginnings and end.**



Feels like you've got a grasp of the **idea mutability of ritual is important. Not a crystallised thing set by machine set but set but external things. IoT is interesting because of this rather than one rationalised process. So. That's your context? Try to narrow it down a little bit! Past one of each, two or more is fine if you think. Done in the past with tech folks, so struggle to grasp idea of qualitative side of it, quality of experience as important as output.**

REITERATE

I don't know what the act is...

Opening curtains – waking up, outside world, public to private – status updates, hidden to online equivalent... taking out bins, lighting a fire...

I'm going to stay in this area of sunlight and sunset.

And those three/4 different spaces?

I think so. I'll do sunrise.

So an IoT product to do with opening/closing curtains in the bedroom, kitchen and bathroom – makes sense. So some of the flavour quotes – **"LIGHT COMES IN AT THE BEGINNING OF MY DAY etc."** Delineating time, openness to world, engaging with world, just from opening curtains – weather, light?

REITERATE

GFB - from flavour quote

DIOT

It's a change of state as well for this person in that quote. It's the beginning of my day, so by inference it's the end of something else. It's the end of my night, rest privacy... That sort of drawing in...



BFF  
REMINDE  
OF  
PHYSICALITY  
ETC  
How do the  
is boarders?

Break this down – movements, gestures etc. of opening curtains – what acts, what do... drawstring, pulling the curtain? Made of quality of feeling? What does it mean to do that act? **Physical movement effect on quality or meaning of act?**

It's probably doing some sort of home automation of blocking light from outside – there's a streetlight that shines in from somewhere... but I think it's also it feels like its creating an even more private space. Maybe were turning to our home with windows into a cave – with that hibernation, safety. The other is that the windows become reflective, so initially they're passing light in, when it's darker outside than it is inside they're reflecting myself back and I'm more aware that I'm on show.



SO the act is to literally draw the curtain on a performance – I'm closing myself off from viewers.

Interesting – curtain, stage,

To be fair I lived in a flat in London and I'm speaking from experience. It was on the fourth floor, it had windows both sides and skylights. I never drew any of the curtains and the window in the kitchen, there were no walls it was open plan. I know the neighbours on the other side could see directly through and especially at night. But I could also see into theirs. I don't know whether we had some sort of agreement, but nobody drew their blinds and we could each look in each other's spaces. I know I was seen by "Lonely Lady" – there was a woman who had her light on a timer, so if she was home, the light would come on and she'd be sitting in her chair and watching TV and I'd think she's lonely. I made this assumption about her. She played bridge - she hosted a bridge night, so all the lights were on and the curtains were up and she's got all her company. I think I'm a curtain twitcher, but I knew what my neighbours were doing. The place I'm currently in, I can't see neighbours through the front or the back and I have huge glass windows. And I know no one can see in cos there are no windows, but I'm even more self-conscious now? I'm much more concerned about closing the curtain cos I don't know.

REFOCUS

Dutch aside. So, like idea of drawing curtain, private, turning space into cave. Sunset, so hibernation, winding down, or up when open. So, the act. Time... hibernation? Delineation time –

TIME FROM HIBERNATION

going from before day starting, how think about the idea of time involved in these things in terms of secular and sacred?

What goes through my head is there's a lot about how many hours of sleep we need to get each night. I know I have a bookmark in my head of what time I should get to bed, it doesn't change very much. I know I should probably be in bed by about ten, asleep by ten 30 and that doesn't change based on the year, if its more bright or more dark I'm still in bed at ten and I should still be trying to get 8 hours of sleep. So it doesn't feel like that's ??? In the same way that the amount of light that's available during the year is. And the fact that sunrise and sunset changes, I don't know what these

T.10

things are, and I'll admit to being curious about something that I don't have any control over. And what also went through my head around this is I know that my husband and I like waking up with light. We like waking up. Open a window, get fresh air. I don't mind it being cool in the room... That frames a good day for both of us. It's a weird shared value couple's thing.

What's great in that is you spoke about secular current, 8 hours sleep, bed at ten, also talking about long term eternal, sunset changing – but not taking into account? But also talking about shared values of that makes it more important that do these things. Exactly where trying to get to. Time – anything else think of?

Nothing else, not without you doing a lot more prompting.

BGF

Self and world → yellow or green. Selected bedroom bathroom kitchen.

So I'm the customer in this today. I'm making the assumption that some of this must be shared with others. In the sense that if there's a senior there probably still – my grandmother was like clockwork with sleep. I do know seniors who sleep less, who are awake during the night, they walk around, they'll go to the toilet more often. I'm making the assumption that they're a little lost in terms of the time or checking the time. My friends who don't sleep well are really area of how long they lay there. I put my head down, I'm gone and I'm back again. So the more you lay there the more you think about how long you've been laying there, which creates an anxiety about how long you've been laying there and now you're thinking you're not getting as much as you need and it cycles. In that sense I'm curious about there's one thing to know what the time is, maybe it's a sort of...

R.G.M. NO?

Maybe time, maybe intentionality and world. Or time and perception of it?

For somebody who's sleeping less during the night, what is time for them, what would be calming influence on them to get during the night instead of that really rigid LED light with the square edges and the red. Something blinking. Maybe there's something that projects a thing that gives you a sense – you kind of know that I don't have to be anxious. I've got that much of the activity at this point.

#### Qualitative INTERFACE?

Yeah. Kids will learn to tell the time – I think there's something lovely about teaching the kids the time when its relation based. You have the pie and 360 degrees and you're breaking that into smaller pieces you can sort of contextualise. You don't need to know what ten minutes is – it's this much and you get to feel what that id. When it's 1002 to 1012 the context and the what it is of something else is...

I think interesting, something that ties into other research...idea of quality of experience vs. detail of info – tension between engineering and mine.

Do you need to know it's 3.53 or do you need to know "you're ok!"

T.10

Yes! Fit bit and quantified self is dangerous in some ways – how much info need? Perception of time. Longer during insomnia. Self-reinforcing anxiety.

I've come back from SF on Monday. It's a short trip so I didn't do much jet lag adjustment. It means for the first few days I'm waking up at 2 or 3 in the morning, whereas I normally wake up naturally 10 minutes before my alarm goes off. I Don't know here I am in the sleep cycle – I don't know if I'm ten minutes from the alarm and should let myself come out of it or if I've got 5 hours and should hut up on go to bed. Then I go the bathroom and the nightlight goes on as I walk by and it messes me up a bit. I think I was linking it back to go it would be nice if I knew I was ok.

Some sort of assistance, reassurance.

I have a half bottle of wine – when the alcohol burns off biologically there's an adrenaline surge and you wake up when the alcohol burns off. Now I have to get water, I don't know what time it is. It would be nice if there was an "Its ok".

What I'd try to contextualise to social world and relations and bedroom/kitchen bathroom. Opening curtains or whatever act – act is interesting about private space and cave and its ok. Does that fit in with these three spaces?

I think most of what we've talked about is sleep so far. But if I separate sleep from a tick tock a morning evening, and if it's based on the sunrise and sunset, then you may be in any of these environments when those things happen. I really hate the idea that the curtains open. I think that says it's time to perform. I have one of those lights that's supposed to get bright ten minutes before the alarm turns on. In my experience that means that I'll wake up 5 minutes before that goes off!

Social positioning – the way that you're revealing or hiding self from wider world and retreating

the

DIGT

T.10

into private space? Me stating that. DO you agree?

I think it's about limiting the stimulation coming into a sleep cycle and allowing more stimulation as it relates to wake cycle. The process for me or closing the windows, shutting this down, doing the blue lights on my ipad – not watching TV past a certain point. That reducing stimulation is maybe the...

Detoxing the bedroom thing?

I don't have a TV.

Works with self and world Lowering stim when trying to sleep, rising when waking to engage with wider world. Lots of thing involved in morning rituals that are about engaging with wider world.

Meaning and intent – goal focused, process, closing curtain, the result, is it playful, change it, experiment with it? Purely about shutting off light? What is there to it?

In the context of sunset the amount of time it takes for the sun to go from the horizon to below may not be visible where you are, not visible through atmosphere if there are clouds – I'm also making the assumption that people like sunsets! I've yet...have you to meet anyone who dislikes sunsets?

No.

So, it's a rewarding emotional ritual that when you capture, grasping to find it; it's a nice moment. Maybe take the monitoring part out and make it about that. It's something that's going on in the world every day that you may or may not be able to see or be aware of as it changes. Make of it what you want – if you want to close the curtains, start partying, knock yourself out. Maybe the product doesn't have to mandate the process.

Peripheral to central not mandatory

Sunset – self and world., Connect to natural cycles and environments.

Definitely not happening in the house unless you have that view and you can see. My friend who could see the view bought the house for that so he could see the sunset.

Peru – friend of a friend has a practice of having a drink as the sunset over the ocean. People don't forget this. Is there a product in there? Do with curtain, light sensor? Physical movement of people? Where does it go, could be an affective emotionally.

Get away from these things, this sort of physicality of the curtains, or the blind. I think if it plays much and draws the curtains! Haha.

Told

Singing at curtains...

I mean if that's the ritual. I know a couple that were married almost 40 years. She's 70 something, he passed away 4 years ago from cancer. As a business they were involved in spas, they built up a chain. I remember them saying they had a morning ritual they performed to each other without any cloths on that included an embrace. Wow, that's a little too much info! But if that's works for you, ok. Signing to your curtains isn't that much weirder than embracing your spouse or life partner.

DIET

Singing to curtains by designer vs. coming from within. From designers, not user. Some of this automatic predetermined intentionality in IoT falls down imho. Design by a person/team who have a certain idea of how they do things and not necessarily fit with other people. These can also be metaphors. Curtain doesn't mean the actual curtain, the metaphor for what represent.

PCG

curtain of objects a metaphor

I think the object changes and becomes a light. I don't think it's about the curtain. I've got a friend of mine who's a designer, he has a product that he designed that he wanted to commercialise. It's a light that orients its self to magnetic north, regardless of where it is in the room. That's its thing! That's what it does. Pick it up, put it down and it will orient itself to magnetic north. It's got a motor and servo and connects up, gets coordinates, does a bunch of stuff. I'm probably not that far from that sort of thing. Some sort of light based object that responds to the quality of the sunset that is happening in that moment and then produces things that are around...and maybe even included, if you can parse it, what tomorrow is going to be like. Red sky at night...It'll do that kind of thing, so something about the light will bring the sunset into your home. It'll be a ritual that happens for as

long as the sun will take to go below the horizon from where you are physically standing. It somehow brings in a little bit of metadata which is about the qualitative predictions for tomorrow.

So that's the core idea now.

It is the exact amount of time from where you are standing. So your latitude, longitude, the suns travel time on the horizon. SO the secondary thing m what it also suggests is that it isn't the same in any two places.

Even next doors. His object isn't something to create that effect, but something that give the

space to reflect on those things and create whatever your own ritual is. So, second part is supposed to be showing the rest of the IoT map. So smart object, separate from input output. Intention isn't detected but impacts on the objects use. Actual ritual and characteristic that make it up.

STRATEGY TO REFLECT

The problem is I'm up here, already doing that - IoT connection and tech.

CORE IDEA + STRATEGY

Forget about that. We've looked at the practice, we want to look at the object. How does the physical use of in this case the curtains, how can we engage with it, detect what doing with it to start or modify, etc. this quality of light. What in object detects light, times, how and when used and same with self and world, how create idea of connecting or positioning in the world, room, place into the object or through the object itself.

FOCUS ON OBJECT

TOPICS

BUT ANSWER IS TECH

A slightly cheeky answer - my discipline, what I do is I do this (tech) I pay someone to do this and to do this. So this is where I would sit down with my friend and go "I need a light that goes etc..." He'd come up with concepts and sketches and I'd have enough info to guide a sense of what I want to achieve without a sense of implementation.

Talking about the physical use of the object - not technical. How use, engage with it? What's the interface, form, affordances?

REFOCUS ON OBJECT DESIGN

FOCUS

What I see in my mind's eye?

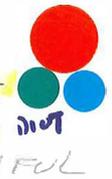


Split into this things to situate the object and the act - technical stuff happens too, but focusing on first.



Currently in terms of its physical entity, is that I'm really interested in a night light. I think it's really a wonderful thing that's underutilised. It has so much promise and potential. I bought fifteen night lights over the last three months, looking for different ways and functions to see which of them might meet the needs that I have. I think a night light can do these things. It think it can play a ritual, I think it can apply light to surface, which is the wall, I think it's not about a table light, some blinking and going orange and partying stuff - that's not what I want from he light. I like that it is something in my home that is down literally, and will do something delightful.

plays ritual



DELIGHTFUL

TO do that - would have a physical input, audio input to control them, or all automatic. You just plug in and automatically senses where it is, gets the data, etc...

It should be a nightlight, do what you expect a nightlight to do...

NO interaction between plugging in and sensing you walking by?



It's motion. Conditions are it works when it's dark, it is plugged into the mains and it's in a transit location. That might be part of your room, your hallway...

Because of recording of local time, detect when it should be on - the time these things are taking place, the time of day and seasons it can change those times.

What it does in its first instance - it's a nightlight it responds to motion it does that when its dark. Not a lot more than that. I don't expect more from a nightlight. I can go into weird requirements - don't want it to go off when the dog or cat go by. What the nightlight does is it plays a ritual that corresponds to the sunset and the sunrise.



In this instance, there is not so much physical engagement with the object...

REFOCUS

DESIGN



You don't invoke it, part of what it does is saying its night-time, tomorrows going to be red, blue. I can see it creating...where it is, the purpose of a night light it'll probably be a hallway or a transit location. It's not a living space, it's a transit space. Even if it's in a living space, it's objective is to be a transit point. If it's a hallway between the bedroom and bathroom it's going to be on a wall, it might be behind something. It has to be able to see. On top of that, it's going to set up a pretty light show. It's going to do the light show for as long as it takes the sun to set. And it's going to do another light show when the sun starts to rise as well, because that's what it does. When the suns up I'm not a night light anymore because I'm a night light. Before the night time ritual it's a night light, so it's not doing anything during the day, it's just plugged in.

OBJECTS physicality this conflict? can this be neg affect thing??

REFOCUS

Trying to look at each of these things with you to see how it works. Self and world - interesting in this idea of nightlight and self and world, bearing in minds what saying earlier of curtains, which is metaphor of this. Words and acts to social world.

SIGN POST OR SUPPOSE FULL OTHER



Less confident about that than relating something to comfort around the night. How long until sunrise? If it was signposting the amount of light consumed, I'm more interested in that than I am in it. Drawing and privacy and closing. I think you can stand other rituals on the moment. You already turn on your lights in your house, light a candle, run a bath - I think you're going to do that. I think the ritual you're working towards is to get yourself into a good state to be able to go to sleep. Those things that get you there - you read for 20 minutes, or...I think this is just a signpost.

DI-1

RITWKS

Could this information be used on a grander digital context, environment, systems – DND settings etc. Any value or cheesy?



Well, I think there's the practical and the brainstorm, I'm still staying in a practical cos that's where my brain is. On a brainstorm level sure – it sets your phone to DND, sets screens to remove blue light, puts a warning on the TV that you should be turning it off, it's a ping that reminds you make your coffee. Sure. I think I'm staying in my perceived purpose of the object rather than...



Adding multi functionality because you can.

I think the challenge is the stuff on the left side of the automation thing. I think that's the only domain that remains unanswered, I'm making the assumption that people can do that themselves.

Ok, so there's no connection between digi systems...

Not that there's not a connection, I just don't care!

No meaning connection...

I think you should turn your heat down! – Fuck off, its sunset that's all it is.



Social world – network of relations?

I think there's the opportunity – like Alex D-S and the GNL, it has this sort of patina of connectiveness, its very purpose is to signpost to someone that you've selected, chosen, curated with an imposition and assumption of what the nature of that is. I'm allowed to turn a light on in your home. NO matter how close we are physically it implies an emotional closeness. I think that this is the only domain that this could go to. A sense that it is connecting with someone else. Maybe there's a pixel for every member of your family. Maybe in the morning it's got motion, it tells you that the other device in your family, it brings the behaviours of each other into each other's home.



So brother living in Finland so get 24hr nightlights?



Wow, good example as Nightlight pretty shit in this environment! Maybe not, cos he'll be closing all of his curtains and nice to know that mums twinkling, sister's glowing...if there was something...that's a design challenge...

The only way you can see?



I thin kits the area of opportunity to say self and world. If it brings the outside in and the natural world into your environment, if its connecting you to the outside of your four walls then I think that's enough, The only other connection I would look for is the interpersonal one. What other areas of opportunity could there be in goodnight signals to each other,. Maybe that's the ritual – when I go to be I do a dance and it sends a sparkle to someone else's that then says mums fine.

As soon as connecting outside world – rainforests etc. playing through it – terrible!

Not averse to an audio clue related to sunset ritual.

Could be glasses clinking, G&T being made depending on practice. Maybe if it's having a cocktail every night with sunset, maybe then at that point cocktail area lights up. Perhaps you put it near where the practice you do is.

RGB LEDs on RGB?

Personalisation

I think I would follow that with the notion of personalisation. Making the assumption the ritual can have meaning projected onto it. So if that is then a cue to a larger ritual, a different related ritual for which this is just the cue, cool! But now we're into personalisation. And my experience with products is that there's almost never personalisation. There's an initial thing that people will do and then...you don't go back and reinvent it. I might just say that you get one of three things – plays BBC birdcall tweet of the day, hence the haha. You get that, or you get and object that nature brought into the world, or an object in the world brought into your home. We're not far from the rooster crowing in the morning at sunrise, that direct. It's a bit trope-y, I'm open to it, but...



OK, so smart object, technical worked out by someone smarter than us. IoT system has an output-automated assistive element. Ritual has output through smart object through use of it. That smart object detects how used and turned into the input for the IoT – data produced by it is then sent to cloud, analysed, EG nest can sense use, lights, movement or setting and data what to do over the phone. That in the way that I'm envisioning it is part of the cloud and the sensors detect all of that, whether that's the output of turning the nest on or off or moving past it. The data aggregates the information to make a decision through info processing and that actuates in some way, so smart object reacts to use in determined by all the info gathered and how interpreted. Make sense?

Tojo

Sure, if it's a hoover, or a nest. I think the assumption there is...the scope of the service that you're talking about. Whatever happens behind the digital curtain. the service. where I'm going to with the

BGF  
BUSINESS  
ASPECT IS  
MISSING

proper concept we've been talking about, I don't know identifiable information, I only need to know their specific location so I can calculate properly, I can anonymise it. I as an operator of the service...this is where it gets a little bit weird. The service can do all of these things, and they can have loads of information. The real question is...I think you're missing something, that there's someone operating the service. The point of operating the service is what people come to, which is usage retention, all that bullshit lingo. Because the people funding businesses like this want to know the commercialisation mode. From my perspective you use it, if you don't use it you unplug it and throw it away. If this is a subscription service which I'm charging, then I have an obligation to provide the services that I specify, for which I need information to ensure that my service layer is doing what it's supposed to do. Therefore I need information from the service which may include uniquely identifiable info. If I don't make a commitment to make much that smart, learning how your home works and your movement and when you're there so I can manage your heat. If I don't make that commitment then I don't need that crazy stuff we're talking about. I can anonymise stuff, I can aggregate things. Theoretically, my house, no5 and the house next door, no3 should be slightly different in terms of the ballet that these things do, but I'm going to put a circle around this area and say I don't need more than that.

DATA  
GRANULARITY  
FOR SERVICES  
NEEDED  
NIC

In that instance you don't need this element of it, it could be a self-contained object, geolocating, gps, time chip etc.

Exactly, and what it does is going to be result of the promises that the product is making and what the people operating the service are committed to doing. There's where the data slips and you get this messy area of who know what about me.

BGF  
Service  
Operational  
Data

Service at odds of what the customer wants to achieve. The mandate of the service operator is the area of risk, not the smart devices that do interesting things with lots of different information. That's not the problem the problem is what these people think they need to know in order to operate the service.

DL7

In this product, the info needed by an outside cloud is necessary? Can all be done by small processing on the side.

It could be. There are different technical architectural models that could be used. But in hardware design and electronics, the BOM and the more that's on board, the more certifications that are required, testing the processes you need, the BOM gets longer and your component supply and all

DL7

lot - interior/domestic  
exterior/public  
Dwelling cost

sorts of stuff in the middle. When you're moving logic to the object you're increasing the cost of the object. There will be a line somewhere in this where it has to happen in an aggregated cloud based way because its more effective to process it there than on board. What I would do is work through a process of defining this and then take this product and begin drafting BOMs against the design concepts to see where it is, how often it makes the call, what's it transmitting, how much memory is on board.

To10

Ok, let's leave that there. Let's go to analysis. Characteristics. Product -Sunset nightlight. Social? 0-10? All have a little description and info to help you understand what it means.

I might pass on the emotional ones. When I scan them, I don't see...I was looking for higher purpose. On the model you've got these wonderful big layers of scared and connected, its up on 30000 feet and emotion, you could remove it. It's easy - that's not an emotion. If I was to describe the emotion, ideally this is creating the ritual then I think it must have a really strong, cut through emotional dimension, like the GNL. It has a cut through, emotional - yes it's emotional to be...

Ritual/  
emotion

In that case scrap those, write your own definition on there. These are themes derived from quotes and past workshops with user language. Easy in the context of emotion is a good experience of using it - I should expand on this or explain it better. Some of the things we were talking about send emotion, send reassurance. Changes depending on environment. Tracks data use...

BGF

Another dimension of intuitive is that it doesn't have friction. It would surprise me if you were talking to a customer and they say it's intuitive, they mean that there's very little friction in using it, and that means that they're not challenged to answer something or learn a new concept. They would say that's intuitive, it's not it's just frictionless. The ease with which you can use it makes it appear intuitive, but the service design and user interaction process, when focused on removing friction may give it the appearance of being intuitive. And it's simple and lovely and quick, because that's where you lose people. If it's not intuitive, I don't use it. You couldn't get to the benefit, it never delivered on the promise. The nest is such a ball ache to set up, they don't remember 6 months in when its 6 months in. We can only hold high and low in our head. The high we can hold in out head is delight, we can hold happy or satisfied or smug. Even those moments of "Aaaahhh the

WFW  
X  
A  
REWARD

Handwritten notes: "I think it's about the return to the original state"

sunset." I rode home the other day and it was an absolutely beautiful sunset. I can kind of recall it but I put an artificial pin in it. I can recall the moment, that's group into this emotional domain of...And the real emotional moment I had in watching he sunset on the horizon is abstracted. And the purpose of the ritual is to return you to it. But the delight I felt in that moment is what I actually hl din my memory. I had a start-up and the object of it was to measure emotion. What we wanted to do was measure emotion service environment as we knew from research that the only thing that provided recall was delight, the technical definition of delight is an unstated need met in an unexpected manner. But it only happens once. (So, technically you can only be delighted by something once and after that you'll continue to go back and it'll reinforce but you only experience delight once.)

Handwritten notes: "RITUAL TO RETURN TO DELIGHT" with arrows pointing to the text.

The rest is referring to it?

Exactly – and the same is true of negatives, but that gets adrenaline going.

The delight thing is something I've spoken about.

Handwritten notes: "BGF DESIGN ITERATION POST THIS WORKSHOP LIMITATION OF METHOD"

It's a night light. It brings the outside in. The reason I put emotional not at the top, and this is probably a design and validation through iteration activity, is to keep looking for the delight. Design and deign and design the experience until you get that "ahal" moment and then its deeply emotional. Until then its "Meh."

Handwritten notes: "DIT" with a red circle and a green circle.

Based on execution, not he concept. Same thing for negative/undesirable characteristics. Data exploitation?

Yes, location, movement, because it tracks movement or react to movement. But if in terms of implementation if I didn't record movement, if it's a PIR, then it doesn't have to record the data. It just turns on the light. I'm going to say there's a potential for data exploitation.

Not developing patterns on moving around t night, times you might wake up etc.

Yeah, it lends itself to that.

That service could be implemented, but in this concept not going down that route?

For the purpose of the workshop I believe it should be on the right hand side, the green stuff. That's really my value, that's what I believe and thinking about aging people, that's the right thing to do. Commercially what gets added to it, there's challenges. Keep it under 30000 people and it doesn't need these things, but if it was about practical and commercialising and operating a service that when these things....

Handwritten notes: "AUTOMATION + AGGREGATED DATA"

High on changing practices.

Still interested, not as a negative, but perhaps changing people's sleep patterns. Has an influence of daily routines.

Idea of daily practices changes is outside influences could change for the worse. It's assisting you – don't have to put light on when going to toilet at night. Point of these isn't to come up with final grade, more to stimulate conversation about these elements.

The implementation...how you implement it and what the objective of that implementation is has a direct impact on its undesirable characteristics. Oh well just use open APIs and send it directly to their home and make the call from their IP address! What?! That's just implementation – we'll manage it...

User Experience map. Start at beginning of user exp. of the object.

Handwritten note: "Tool" with a green circle.

In my experience there's two, one which is first use, the second which is service use. First use, many of those use cases are different. You could really create a complex user expedience map if this was first use, this was configuration and change and this is daily use.

So, daily use – more interested anyway. In terms of daily practices. Is there even any need?

There may be, but in my mind it's close to a functional thing. There's sunset, reacting to movement, tripping the light, there's sunrise.

Positive, negative?

Not really negative.

Sunset leads to nightlight turning on, or process of sunset equal to light being on, quality of the light. How do you convey the next day weather? Where fit in user experience? Timescale of object? What's the difference in representing sunset, being night light and predicting weather through quality of light? (LONG PAUSE) I like the idea of lighting a path, with multiple objects lighting up in sequence.

Or the unit directs the light.

Neat.

BREAK 3<sup>RD</sup> SESSION\* BREAK 3<sup>RD</sup> SESSION\* BREAK 3<sup>RD</sup> SESSION\* BREAK 3<sup>RD</sup> SESSION\*

Second part I what we've done but using random cards - I've done that before to stop participant being overloaded. Idea is that this will become a more structured board game with 2 players - so need to work out an end goal/way of winning. Without me it can be misused as a workshop tool - methods being misused by other disciplines. HCI - oh we're doing design! Board game to give more structure, less misinterpretation. Time, act, space, object cards. Object is a dog lead. Space is in bedroom at sunset! Sunrise. Evening. Friday. Playing an instrument with a dog lead - does that work? Sometimes a mismatched method.

BGF  
CARDS  
TEXT  
IS USEFUL

Too!

Actually while in making coffee I'm on the piano - recently trying to do breakfast of miso soup and used piano to time the soup. So the amount of time that you're playing a particular piece on the piano indicates the amount of time for the miso soup...

REFLECT REMIND

Maybe something in there - not literally playing an instrument, a metaphor in some way or a jumping off point. Friday? Day after Thursday, end of week, depends on what culture, sacred for Muslims and Jews, everyone goes out Friday night.

Thursday was the new Friday, Wednesday is the new Thursday.

The bedroom, hmmm. A dog lead. Again, not sure it works. Absolutely fine to swap out.

I want to keep dog lead, cos I'm interested in that. I'll take it out of the bedroom.

Bathroom,

An inherent bias because ????

Issue we're having. The deck needs to be themed so there can be a huge amount of randomisation.

It also amazes me how well Cards Against Humanity holds up. The format is so...even when you get the same card again; it's how it's played. The company I was at TWS, it was before me but they

Perhaps not about the outcome but the learning?

invented what they called the inventors kit - a series of playing cards and they sold that kit as a concept and physical cards to teen tech, they worked out a game and the cards were components and circuits and kids could learn computational thinking and a little bit about...The objective of the game wasn't to create an outcome, it was to learn. It's different when it's about learning with pedagogy baked into it.

BGF

Maybe a better direction for this - to talk to tech people and tell them what's important in this. That's an education method more than an output led method

If your game took you through a process where you could more clearly highlight the reds and greens and people can make moral decisions, find common ground and values.

BGF

We're going to do instrument, Friday, hallway dog lead. Words and acts. Dog lead is the object, an IoT dog lead that's got to do with playing instrument in hallway on Friday.

Means it's connected to the internet

How connected dog lead work in the context of those other elements? Does it? DO we need to change some of them?

No I'm finding the picture of the hallway quite evocative. You use the dog lead to take the dog out, I'm assuming in the hall - it looks like that's the door to the outside. That's the door to the house. It says hallway but it's actually the entry way. If we interpret it that way then it's about you're going to take the dog for a walk. Dogs pee and poo on their own calendar and there's not much you can do about it. They anticipate the behaviour as well - if every day you're up at 6 and that's when you let them out then at 6 they get alarmed cos they need to go out! they train their biology around your patterns. I'm going to keep brainstorming. Imagine there's a Friday ritual, if all you dog has a memory of is peeing and pooing and going out, but you could create the higher...dogs react to the jingle of the dog lead. It's a kind of musicality. Imagine the dog could invoke your Friday ritual with a musical expression from worrying the lead.

CONTEXT

The hallway in this context is where the lead is kept or the action with this device happens? The hallway is an interesting public/private space, delineating going outside and zero space of the boundary.

The hallway in this context is where the lead is kept or the action with this device happens? The hallway is an interesting public/private space, delineating going outside and zero space of the boundary.

Do dogs remember the dog lead as there until you jingle it? Babies go through that phase where they throw things away – object recognition is a key phase babies go through. A dog knows what the sounds and look of a lead is and probably knows what you putting your shoes on is. Could you train it to a musical dog lead that reminds the dog the lead exists?

Good concept but neither of us have any idea about dog psychology. A bit more understanding of human psychology. What if dog lead with those elements but design to help the dog's master?

Here's what I'm getting at. Imagine in the same way that a dog has a Pavlovian response to the sound of the dog lead, imagine we could train he dog to have a certain type of reaction to the dog lead producing musical set of tones. The dog then knows to do things? Maybe there's a ritual around...I know, based on my proximity to my home on a Friday...the lead starts twinkling and jingling and generally announcing my arrival so that I have my fast and friendly furry friend fully

focused. Imagine how nice it would be to come home – dogs are always happy to see you, but this would be ready to go. It doesn't have to be just Friday. REFRAME

It doesn't, it's just a generic day of the week perhaps in this instance.

What if the challenge was to go beyond the Pavlovian response, the sound of the garage door being the cue that makes the dog freak out and know that you are the next things that happens in that sequence. I would if you could train a dog through it...

With musical cues. The lead is the thing that controls the dog.

CONTEXT Its reacting to proximity or calendar...The dog lead essentially determines what the journey is. The user journey with a dog lead is you put in on the dog and you take the dog out. IF you have a lead and there's no dog involved, then I don't know what you're doing.

Let's look at it in these four section maybe help to focus the mind. Words and acts – definition on sheet. The ritual is made up from series of acts and movements. Playing an instrument – in this it's somehow integrated into musical cue rather than playing instrument, or...

Or maybe you could use music or tones or notes to train the dog when you are out with the dog. I skipped over Friday, but in the same way you use food to reinforce behaviour and help train it. What if you could give the dog behaviour cues with the lead – musical behaviour cues?

If pulls too much...

Set the pace of a run? A doggy musical metronome, where they help set the pace. It might fall down at a traffic light...

Even reversing that – what if you use the dogs pace to determine what you're listening to on your....

IMPLEMENTATION AS CHANGE? I like that! Yes! Your playlist is dynamically generated based on the pace. Ok, I like it! That suggestion was the first one where I went to implementation, I'm like, ok there's the API, there's the private playlist on spotify. With the other ones...woooo! It feels practical.

The other things on the dog lead itself that are physical that you can use to determine elements of this. He more it's buckled up determines the size of the dog.

YEP, HE GETS IT If we go beyond the lead and make it the collar as well, maybe if the dog is not with me, it its outside of a certain proximity it plays the tone and has a light show and this helps me find them again helps someone to return them to me. That's the left leaning side of automation, functionality and return to base. What might the sympathetic feedback loop be where I get benefits and the dog gets benefits and we get better together.

Thinking about collar size determine size of dog, which then means something? The pitch of the instrument is created by this, an accompaniment the dog, the size, the way it runs, the start and stop, maybe musical piece written by the run?

You can start to tune into a general doggy symphony – you can bring it all together and if I'm a mad dog owner and I miss it during the day and I'm one of those who has a camera on the food bowl, then I want to hear the doggy symphony.

Maybe, ok. This is bonkers. The hallway – this thing lives in the hallway. I think that dog leads do live near the outdoor space.

Ok, so it lives in the hallway,

PERSON IS STILL INVOLVED + CENTRAL

It's part of that transitional... maybe it invokes, reminds you, or acts as a prompt for the person as well as the dog. A two way - it connects the person and the dog and helps to build that relationship between the owner and the dog when they're apart.

Your heartbeat - you'd be able to sense the dog's bpm, and you could match that with your fitbit knowing your heart rate and that stuff.

Yeah, BPM...fitbit. The dog's even got a BPM.

Because you're connected to the dog maybe you can sense the heart rate.

Dog product - Tagg. This is much more interesting. As we've got this from words and acts, what about time?

If we went to the corner of the bullshit map, this would be kind of - maybe we could get dog psychologists involved and begin to give the dog, not a literal voice, but...we think that sort of thing where you project emotions on an animal...anthropomorphisation. Maybe this lives in that space and it's a better indicator of their happiness. Maybe it can indicate when they've got to poo...might it give your dog a kind of voice? I don't know what I mean by that, but I think that's the words and acts bit. If there's a language, if you're sharing it, if its improving, then all these dogs and their behaviours with their owners are creating a better vocabulary for certain things, perhaps this is that connectedness, a social element.

DI-07

How work with time - length of walk, or the time of day of walk, or not a walk, what about idea of dog ownership into the past and future.

What's limiting me is this sense of Friday. The reason it's a limitation...I'm assuming that there's already rituals, because biology, so there's already rituals with dogs. This sort of challenge needs to think about a ritual that its other than those ones, and that s...its interesting for that to go well what is Friday? Is that your 5k or 10k run? Is that your walk through the sunset, is that take your family to the park? It feels like the challenge is to use Friday as a reason to do something that you wouldn't normally do. If we do the doggy symphony heart rate stuff, it can happen any day of the week.

LIMITATIONS OF CARDS?

What makes it different on Friday? Yeah? Well, if Ned of week and been away from dog all week, it's the beginning of spending more time with the animal at the weekend? Maybe? Seems a bit flimsy.

DI-TX

It needs a dashboard, maybe you get a week's summary on the Friday. It consolidates, somehow condenses and brings it all together into a happy or unhappy song. Have you run them enough; have you taken them out often enough, have you spend enough time in terms of the emotional needs of

X

your dog with your dog? And maybe it gives you a moment where you pan forward on what you can do next week. Friday might be nice as you can make up lost time on the weekend. If I said I'm going to spend 10 hours with my dog walking it each week and I haven't achieved that on Friday, then I can make that difference and do more of it at the weekend. I can rely less on what I can do during the week.

What about the idea of the Friday and the length of time of walks, what about past and future, any relation to this? Dog ownership in the future or dogs in the past?

Maybe again if I stay with the dashboard concept, your back to the quantified self, and that's data over time, so you can reflect on...

When thinking of this and sacred time and dogs - one of the few species that we've completely adapted. Idea that eternal time a dog would be a wolf. Don't know how fits into what talking about, or if does.

Well, cats are independent. Dogs have more dependence, emotionally.

I think the reasons of that is arrested dev. of puppies for life - wolf pups in fully grown dog body. Not relevant! So, self and world - positioning in social world in acts and networks of relations. Does it do that, can it, how? Position yourself as a dog owner?

This is again really QS stuff - if we stay with the dashboard view, you have leader boards, you can gamify the amount of time spent walking your dog of a certain size vs. how other people are doing it.

That's where my brain went too.

So, you can gamify it. I have serious doubts about that as a utilitarian function, but yes it's possible to connect.

238 Thoughts are QS

X

One thing realised issue in design for home, but actually for outside of home, so designing something based around domestic ritual...maybe the ritual is not he walk, but putting the collar and lead on the dog before going out and the information in the hallway

REFocus  
TO  
DOMESTIC

It would need to recharge – if the object had power then when it's in the recharging stage it can do thing. What I mean is that information could be there when you get there. \you don't have to turn it on and poll and sync with the internet.

**Connect with the wider world. Can't think of many things worse than a lead singing to me when I'm outside about my dog. Full crazy person. A whole collection of owners!**

Here's the thing – if this was for singles! The one thing a guy's guaranteed to get is girls talking to him when he walks the dog in a park. So maybe its...Lynx its chemical composition is designed to appeal to me. Women don't like the smell of it, men do. So what if this was a reverse Lynx – you do have to like what it sounds like, but it's a siren song for women!

DI-1

OK? I'm going to write that down in a different colour...

Do you know how many you would sell if you said – this dog lead, with your dog, in any park – all she needs to do is to bump her phone next to it and you've got contact? It's plugged into your tinder!

**The intent of the act is involved in some way? How does that impact upon this object development?**

INTENTION  
ALITY  
+  
TIME!

Don't know if answering question, but intentionality of allowing to arrest your dog long enough to do this feels like a ritual. This is something that someone will do with their dog 3-5 times a day for the entire life of that dog. It's a lovely opportunity for connection and reconnection. You know when you take the lead the reaction eh dog has to it – how nice would it be to reinforce that and make it even more delightful.

DI-1

**Through this idea of musicality, as a way of attracting people in the park. In the home it's a different musicality? How to encourage opportunity or connecting and reconnecting through this? Maybe links back to time – certain time for walks? Predicts or pre-empts and starts to play song...**

What if it does something for the dog, but it does it on your phone? Your phone is anticipating you getting close to home and the anticipation your dog is having and that's reflected in a playlist or musical cue? My home chimes when me weather app, which is different from the notification of a whatsapp of imessage sound. Everyone has their own jingle, maybes there's that kind of...a little bit of anticipation, cos we'd have a little response to those things too.

DI-1

**Dopamine from Facebook notification.**

That rush would anticipate you arriving or a walk. Physiologically it would be good to have dopamine reaction Even if you're drunk; it knows your blood alcohol level!

**Adult owners of dogs, get annoyed with having to take the dog, but children? A good way of encouraging them to take it out?**

If the kid takes the dog for a walk and doesn't pick up the poo, then its "waah waahhh waah" it plays a jangly, dissonant...you're training the kid! You get home and it plays a certain tone when it goes back on its charger thing, you know whether its cookies or grounded.

DI-1

**Ok, happy? Next bit. Practice is dog lead. All 4 elements. Smart object – the lead itself, the docking station, some sort of dog avatar thing? How detect all these elements? Will it?**

You're going to get a bias from me - I spent so many years creating digital products that I don't have a lot of patience for things that aren't physical. All I can see in my imagination is a kind of dog lead, dog collar, charging hook, light something. It is a designed object in the home that you can put on the wall and it does things. It's kind of bejewelled with little lights on it. The same as the lead. Maybe in the handle of it there's – I didn't get to this. Maybe in the HR thing, maybe by holding the handle it'll get your HR and the dogs HR on the collar. There's a status light or indicator which gives you a challenge you need to achieve – red amber green or blue orange purple for intensity levels based on what the dog needs to do this week.

FOCUS ON  
FORM +  
PHYSICAL  
TO (ROUND)  
IDEAS  
DI-1

This is still quite instrumental – a neat thing, and subtle but tech perspective.

So, I'll share with you what I think the QS stuff is all about. You know the JOHARI window? 2 Psychologists, one called Jo, one called Harry. It's what public, and private to me and private to others. This is what I know about myself but others don't. This is what we both agree is not about me. This is what others know about me that I don't know about myself. The purpose of this is to say

DI-1

DOMESTIC

TR

that when the private me is shared with what other people know of me and becomes public it grows and my self-awareness grows. For me, this model I apply to the IoT stuff, because I don't know certain things about me and I'm beginning to learn my fitness level of my heart rate, not necessary other people, but I can share that, so that's what the gamification does. It takes the things that are private to me and starts sharing it with other people so that they know that about me as well and it becomes public. Where it falls down is where people don't want to share these things. But there's a limit to what your HR will ever tell you about yourself. There's this early interest into what it means and then it lulls off into a new normal where you become conscious of deltas, but it isn't wholly new territory, it's not like my HR is a black box - part of my brain might know but I know nothing about it. It rises up into the conscious layer and with it in this layer I now have the capability to share with others, change my behaviour, all of that stuff, instead of it being guilty emotional stuff.



There's a balance and limit to it.

NOVELTY  
EMOTIONAL  
LONGTERM  
DEVELOPMENT

In that it establishes a new normal. This is telling you a HR and the dogs HR; it'll be interesting for a while. Then after a while it'll become know - it needs to become something else to stay invested in emotionally. I'd be interested in trying to set challenges or standards, trying to take information that you know that you didn't before and trying to get you to change your behaviour.



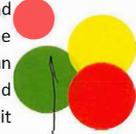
This change that quality of the experience as well? Through a quantitative method of measuring what's going on. OK?

We didn't get into anything like location, mapping the routes or any of that stuff.

MODEL  
GETS  
TRUCK  
AGAIN  
AGAIN

I think that's quite good cos one of the big products I find is that they never manage to do one thing well - this HR monitor and making musical instrument/cue form it as one core concept is neat and original. Shall we evaluate them? Or more to go through? Actually one last thing - this is the first run through and then feedback - how think act would be changed by information, change in quality and experience? Second time through o thing differently? Or nth time -different way of doing it?

Struggling a little bit with your question. The model that's widely adopted by technologists and increasingly adopted in IoT development is the idea of iteration. So what I would do in my discipline - I would take this, I would call it as a version, test it knowing what the assumptions are (in this an emotional relationship with dog, info about the two things creates a better life and experience e and get you hooked somehow to an addictive feedback loop so I can make money) prototype, test it etc.



That question wasn't clear enough - not about product iteration, but the repeated use of the same product and how using it over time would change the engagement. First use is the delight, the rest of the time to try to recall it - does this feedback loop, where you are in some way made aware of past experiences make you aware of past change you future- reflective practice and feedback? Make it clearer?

Still stuck between a process flow and the product flow.

This is a purely experience of the product. Do it once and then learn how to do it - do it more refine how do it and the feedback from object or lights, dog, changes how you do that.

OK,  
SOLUTION  
AVOID?

I'm pretty sure the product that we just defined is a bit of a fad gadget that won't be used in the long term. You take advantage of the emotional needs of the dog owners; you target the crazy end of it or the singles who will do anything for connection. I think that that's ok.



Over time could it improve relationship with dog, experience of walking it?



In this model, you'd get a new normal, you'd have more data that you didn't have before and you'd simply absorb that and learn. You'd retain the learning but not necessarily reflect ton the knowledge itself.

Cloud you do user experience map please? Doggy symphony? Siren song? Train child to pick up poo?

BGF  
TR

This is the point - we produced a result of the brainstorm a series of options but we don't have in the game that we're playing a trap for prioritisation. We haven't done feasibility or the attributes of this. What should the product do - if it's the stuff on the right instead on the left then it'll take us to somewhere where one of these things is more important than the other.

Quality of experience and the idea on the right of that - identity, security, belonging, control, etc...Don't know if it's about rationalisation, automation - doesn't fit in with dog ownership.

This is HR stuff – over here. Its super cognitive and there's not a lot of emotional payoff in knowing my HR 135 and the dogs is 220 – is that good or bad? I don't know – that's the problem with the QS stuff – there's really any context and it requires this. This stuff, meeting, dating, training your kids 0 it's kind of gross and I don't have any signs that suggest that this is an achievable outcome. So I'd probably prioritise staying on this side of it a delightful, ritual of garbing, connecting, the ritual of putting the lead on, which I'll do 1000 times in eh dog's life and turning it into something special. A way of meeting. I was in SF< I took a walk, I took the wrong park and there was a dog playground, The dogs were playing and the owners were talking to each other. I think dog owners know the dogs and the owners but not he people. The relationship isn't connected – its oh you're Fido's owners, how's he doing? You have a social space that you can communicate in that isn't about you and me being friends or coming for dinner. What if on this side it pushed through some social boundary and assisted the rituals of people already getting to know each other, meeting a girl...

DI.7

The siren song, but with less of a creepy, sexual overtones!

What if we were able to mutually agree that when I'm walking my dog and your walking your dog, that that's an ok social convention to do. I don't need to know where you live or your name. But if Fido and Mutt want to play, then give me a little tingle, tone on the lead that Fido is out.

**You pair then through the leads?**

Dos become friends, the leads rub off on each other and you get little sparkles and tinkles to let you know.

**It's still anonymous..**

It's not about people, it's about the dogs!

**Let's go in that direction then. User experience map of that and desirable and undesirable qualities and then wrap.**

To loop back, the purpose of this dog lead is to tell you an indication of how good the amount of time is the dog's been walking – functional stuff. It sits in your hallway and recharges. It'll give you a little bit of status so you know where you are by the end of the week compared against the goals you've set. It has this magical bit where it will sparkle, shimmer and shine when your dog's friends are also out walking.

**Sounds great. 1<sup>st</sup> thing is pick up collar? From docking station?**

POSITIVES  
+  
NEGATIVE

For me I'm unlikely to define anything on the negative side, because the customer will tell me all the negatives! So I'm not at this moment I only have to live in the positive, I should be cognisant of the negative, but I will define the ideal.

TK

**Sure, but I can think of a few negatives. What if the dog's friends goes out a 12 at night and the thing downstairs starts playing the song of the dog. A few things like that but mitigate for it.**

Edge cases and then write requirements and logic to accommodate that. (PAUSE) Who's the actor when I write these.

**I suppose the person, not the dog.**



Or the product – on the other one the product is the actor.

TK

OK, on this one it's the person, seeing as it's about human centred IoT products. PAUSE I suppose after time if you and the other dog owner get to know each other you could give more information. A neat idea! Undesirables – some follow up questions but will email them over to you about what you felt about the process?

**Exploitative in anyway do you think – data, manufacturing, relationship between you and animal, other people?**

Yes, but again its about implementation..It has the potential.

**Very highly! In an ideal world, it wouldn't be.**

Or in the deeper design activity I would be mitigating – so recognise knowing someone else's dog is out for a walk is kind of creepy, so how do I take it from an edge case and anticipate those troubles, Or I'd spend time with customers talking about that – what would you like to know, what wouldn't you?

**This evaluation is for identify areas that might be problematic rather than a final evaluation.**

Security – it'll probably be secure. Loss of interaction, what does that mean?

CLARIFY

**Loss of social and physical interaction.**

No, you'd meet other people and take your dog out – it encourages social interaction. Changing practices.

**Changes the way you do things**

But it's doing that by design, so I don't think it's a negative. It's telling you need to walk your dog and it needs to poo.

If your lazy it'll make you walk it. Which is a good thing!

You bought it because it's changing your practices. (PAUSE) You have to set standards and apply setting and apply permissions

It does automate the time...hmmm. it doesn't really automate. Well, is it only half automating, automatically detecting things and making the song out of it. Kind of.

It's automatically doing things, I don't think it'll be that intuitive. I don't think I'll know why these lights are doing what they do. I'll read the manual, if I read it and then I'll forget it.

Again that intuitive nature could be mitigate in design stage – instead of lights, the collar falls on the floor – could design around that, but in the current concept, ok.

I don't think it;; be that emotional. I think it's helping you to walk your dog, get outside,

Have a chat with people maybe,

That's the left side – its automating your social stuff! I'd on think your like – "This product - aaaahhhh!" You'd be – "ok – it's blinking. I'll take the dog out." I don't think it'll be easy to use. Well, no - I think it's a dog lead so it'll be dead simple, but I don't think understanding it is going to be easy.

Ok, one last thing for the emotion – it's low. What about emotion for the dog, are we thinking about that, or the emotional connecting between you and the dog.

I said the 10000 time ritual...maybe it makes that better?

Marginally or a lot?

I don't know, you've got to do it anyway. You can use a rope, you know what I mean. It does not make it that much better that it would index higher. I suspect not.

How does the development of a user centred structure/mapping of the IoT change how it is designed for?

I am super sorry - but I don't remember which tool this was. If this is a general question (an overall view) then I suspect you won't be surprised by my belief that starting with users is the only way to solve a meaningful problem. Tech is just a solution looking for a problem, and the likely 1:1 mapping of this to a customer problem is, in my experience, almost impossible.

How does the inclusion of user generated values (specifications, negative and positive qualities) change the development of products for the IoT?

I appreciated the context they started to set, but the terms felt like the output of a workshop - and my this I mean the terms would be more meaningful for the participants because they would 'explode' a given term or phrase into a larger meaning, but to someone coming at it cold I am not sure my interpretation of the term aligned with the intent from the workshop. Overall it was helpful, but not hugely impactful. I have almost no recall of any of the terms.

How does the use of elements of practices and inclusion of this in a practice in the model of the IoT shift the outputs of the IoT?

This is the only part of the time we spent together that I wrote down. Practice is a term for something I have been feeling my way towards in the user testing and research. So, a personal opinion only, but to me this is the BANG POW KABLOOM the best part of what you shared in our time together.

Did the card set help to focus you on how people use their spaces in reality?

Yes! I enjoyed it. I enjoyed being in a free brainstorm place without worrying the feasibility. The card helped this.

Does this toolkit help in designing products that are suitable for the domestic space?

In its current form, not likely. It required Michael to "teach" a lot before we were on the same page. So if facilitated then possibly. It is likely best applied to engineers who may not be as close to customers or the ways customers live in their homes. I don't think it would be as effective for a product manager or product designer audience. <sup>-VE</sup> 

Does this method shift to make the users acts the central element of the IoT and does it make the user's perspective explicit to the developers?

I don't think it develops relatable personas for someone to "look through a users eye" so I don't think it does what the question asks. I think it puts makes the developer the user, and I think this is dangerous in the IoT space as I suspect they do this already. <sup>-VE</sup> 

Where is the boundary between qualitative and quantitative in IoT?



Qual would surface the emotive and cultural outcomes sought. Quant would surface the usage and behaviours of the system. 

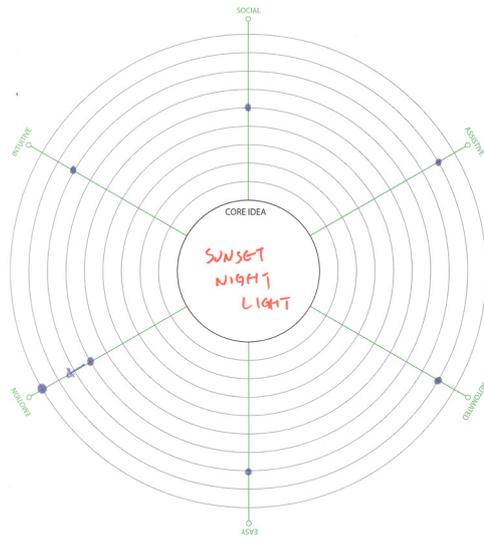
Does this design method lead to physical products that make practices/routines in the home meaningful or reflect the meaning in these practices?



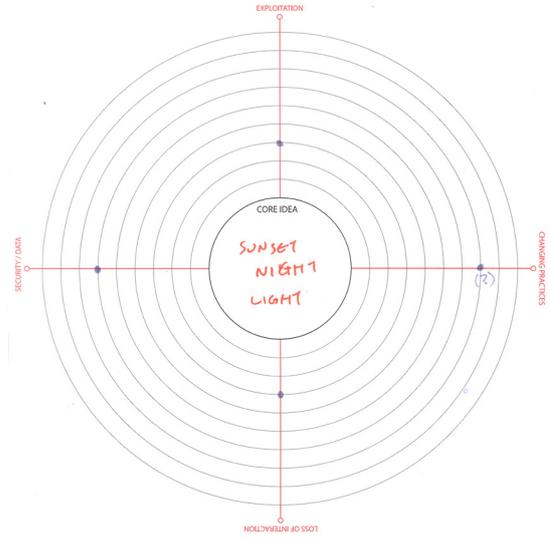
In my situation and in my workshop, I would say yes. I suspect this is an outcome shared between Michael's facilitation and participation, my bias and background, and the framework the cards and game brought to structuring our brainstorm. 



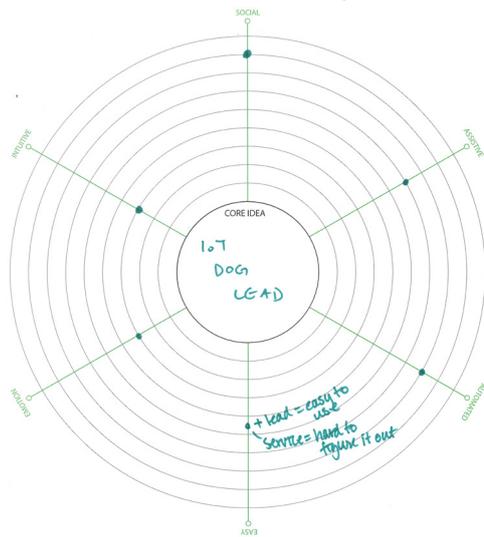
DESIRABLE IoT QUALITIES



UNDESIRABLE IoT CHARACTERISTICS

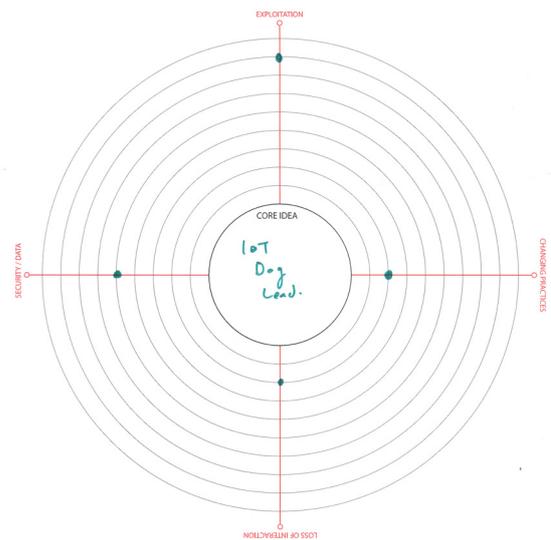


DESIRABLE IoT QUALITIES



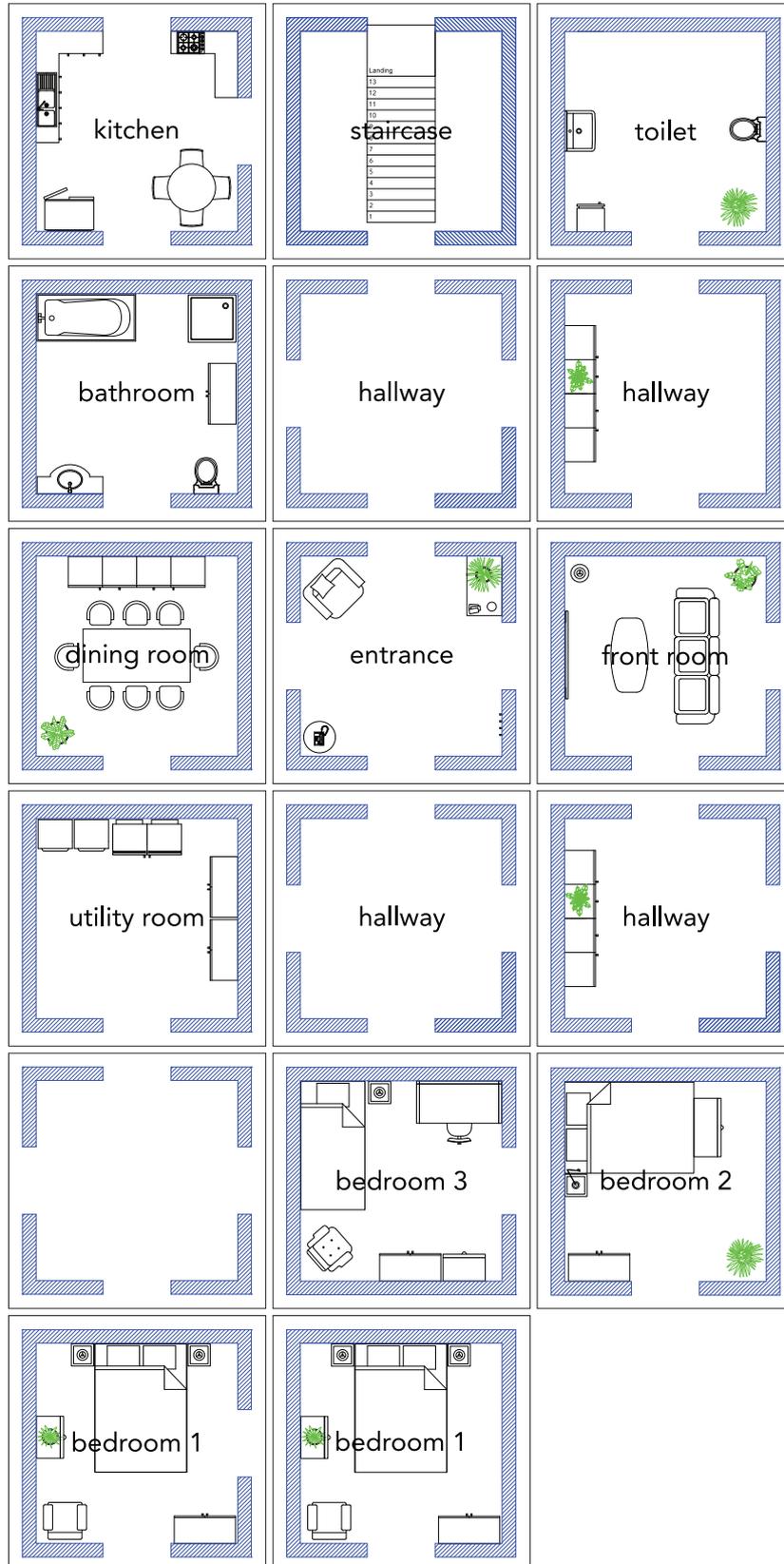
UNDESIRABLE IoT CHARACTERISTICS

(potential)



## Appendix O - 5.4: Final Professional Design Practice Toolkit

Feedback informed the redevelopment of tools to suit the intended audience. These included Domestic Tiles; DV, People and DPUGV cards; tokens and blank cards detailing DP aspects; cards representing positive, negative and desired IoTUGV and blank cards detailing IoT-Practice aspects.



<p style="text-align: center;">people</p> <p style="text-align: center;"><b>Dennis, 60</b></p>  <p style="text-align: center;">heating engineer</p> <p style="text-align: center;">traits: helpful, reliable, stingy interests: hiking, fishkeeping, singing</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">extrovert</td> <td style="width: 20%; text-align: center;">○●○○○○</td> <td style="width: 30%;">introvert</td> </tr> <tr> <td>sensing</td> <td style="text-align: center;">●○○○○○</td> <td>intuition</td> </tr> <tr> <td>thinking</td> <td style="text-align: center;">○○○○●○</td> <td>feeling</td> </tr> <tr> <td>judging</td> <td style="text-align: center;">●○○○○○</td> <td>perceiving</td> </tr> </table>	extrovert	○●○○○○	introvert	sensing	●○○○○○	intuition	thinking	○○○○●○	feeling	judging	●○○○○○	perceiving	<p style="text-align: center;">people</p> <p style="text-align: center;"><b>Charlie, 44</b></p>  <p style="text-align: center;">bus driver</p> <p style="text-align: center;">traits: dependable, observant, picky interests: body building, martial arts, NFL</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">extrovert</td> <td style="width: 20%; text-align: center;">○●○○○○</td> <td style="width: 30%;">introvert</td> </tr> <tr> <td>sensing</td> <td style="text-align: center;">●○○○○○</td> <td>intuition</td> </tr> <tr> <td>thinking</td> <td style="text-align: center;">○○○○●○</td> <td>feeling</td> </tr> <tr> <td>judging</td> <td style="text-align: center;">●○○○○○</td> <td>perceiving</td> </tr> </table>	extrovert	○●○○○○	introvert	sensing	●○○○○○	intuition	thinking	○○○○●○	feeling	judging	●○○○○○	perceiving	<p style="text-align: center;">people</p> <p style="text-align: center;"><b>Moses, 32</b></p>  <p style="text-align: center;">librarian</p> <p style="text-align: center;">traits: bossy, cultured, meticulous interests: gardening, reading, yoga</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">extrovert</td> <td style="width: 20%; text-align: center;">○●○○○○</td> <td style="width: 30%;">introvert</td> </tr> <tr> <td>sensing</td> <td style="text-align: center;">○○○○●○</td> <td>intuition</td> </tr> <tr> <td>thinking</td> <td style="text-align: center;">●○○○○○</td> <td>feeling</td> </tr> <tr> <td>judging</td> <td style="text-align: center;">○○○○●○</td> <td>perceiving</td> </tr> </table>	extrovert	○●○○○○	introvert	sensing	○○○○●○	intuition	thinking	●○○○○○	feeling	judging	○○○○●○	perceiving
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<p style="text-align: center;">people</p> <p style="text-align: center;"><b>Raph, 15</b></p>  <p style="text-align: center;">secondary school</p> <p style="text-align: center;">traits: arrogant, fearless, persistent interests: mountain biking, piano, squash</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">extrovert</td> <td style="width: 20%; text-align: center;">○●○○○○</td> <td style="width: 30%;">introvert</td> </tr> <tr> <td>sensing</td> <td style="text-align: center;">○○○○●○</td> <td>intuition</td> </tr> <tr> <td>thinking</td> <td style="text-align: center;">●○○○○○</td> <td>feeling</td> </tr> <tr> <td>judging</td> <td style="text-align: center;">○●○○○○</td> <td>perceiving</td> </tr> </table>	extrovert	○●○○○○	introvert	sensing	○○○○●○	intuition	thinking	●○○○○○	feeling	judging	○●○○○○	perceiving	<p style="text-align: center;">people</p> <p style="text-align: center;"><b>Albert, 74</b></p>  <p style="text-align: center;">retired</p> <p style="text-align: center;">traits: concientious, independent, pompous interests: gold, stamp collecting, woodwork</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">extrovert</td> <td style="width: 20%; text-align: center;">○●○○○○</td> <td style="width: 30%;">introvert</td> </tr> <tr> <td>sensing</td> <td style="text-align: center;">○○○○●○</td> <td>intuition</td> </tr> <tr> <td>thinking</td> <td style="text-align: center;">●○○○○○</td> <td>feeling</td> </tr> <tr> <td>judging</td> <td style="text-align: center;">○●○○○○</td> <td>perceiving</td> </tr> </table>	extrovert	○●○○○○	introvert	sensing	○○○○●○	intuition	thinking	●○○○○○	feeling	judging	○●○○○○	perceiving	<p style="text-align: center;">people</p> <p style="text-align: center;"><b>Hugo, 4</b></p>  <p style="text-align: center;">primary school</p> <p style="text-align: center;">traits: adventurous, bossy, gregarious interests: exploring, dinosaurs, insects</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">extrovert</td> <td style="width: 20%; text-align: center;">●○○○○○</td> <td style="width: 30%;">introvert</td> </tr> <tr> <td>sensing</td> <td style="text-align: center;">○●○○○○</td> <td>intuition</td> </tr> <tr> <td>thinking</td> <td style="text-align: center;">○○○○●○</td> <td>feeling</td> </tr> <tr> <td>judging</td> <td style="text-align: center;">○○○○●○</td> <td>perceiving</td> </tr> </table>	extrovert	●○○○○○	introvert	sensing	○●○○○○	intuition	thinking	○○○○●○	feeling	judging	○○○○●○	perceiving
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<p style="text-align: center;">people</p> <p style="text-align: center;"><b>Steve, 24</b></p>  <p style="text-align: center;">tradesman</p> <p style="text-align: center;">traits: charming, conscientious, vulgar interests: football, socialising, videogames</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">extrovert</td> <td style="width: 20%; text-align: center;">○○○○●○</td> <td style="width: 30%;">introvert</td> </tr> <tr> <td>sensing</td> <td style="text-align: center;">○●○○○○</td> <td>intuition</td> </tr> <tr> <td>thinking</td> <td style="text-align: center;">○○○○●○</td> <td>feeling</td> </tr> <tr> <td>judging</td> <td style="text-align: center;">○●○○○○</td> <td>perceiving</td> </tr> </table>	extrovert	○○○○●○	introvert	sensing	○●○○○○	intuition	thinking	○○○○●○	feeling	judging	○●○○○○	perceiving	<p style="text-align: center;">people</p> <p style="text-align: center;"><b>Robbie, 19</b></p>  <p style="text-align: center;">student</p> <p style="text-align: center;">traits: imaginative, impulsive, keen interests: climbing, photography, poker</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">extrovert</td> <td style="width: 20%; text-align: center;">●○○○○○</td> <td style="width: 30%;">introvert</td> </tr> <tr> <td>sensing</td> <td style="text-align: center;">○●○○○○</td> <td>intuition</td> </tr> <tr> <td>thinking</td> <td style="text-align: center;">○○○○●○</td> <td>feeling</td> </tr> <tr> <td>judging</td> <td style="text-align: center;">○○○○●○</td> <td>perceiving</td> </tr> </table>	extrovert	●○○○○○	introvert	sensing	○●○○○○	intuition	thinking	○○○○●○	feeling	judging	○○○○●○	perceiving	<p style="text-align: center;">people</p> <div style="border: 1px dashed black; width: 150px; height: 100px; margin: 0 auto;"></div> <p style="text-align: center;">traits:</p> <p style="text-align: center;">interests:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">extrovert</td> <td style="width: 20%; text-align: center;">○○○○○○</td> <td style="width: 30%;">introvert</td> </tr> <tr> <td>sensing</td> <td style="text-align: center;">○○○○○○</td> <td>intuition</td> </tr> <tr> <td>thinking</td> <td style="text-align: center;">○○○○○○</td> <td>feeling</td> </tr> <tr> <td>judging</td> <td style="text-align: center;">○○○○○○</td> <td>perceiving</td> </tr> </table>	extrovert	○○○○○○	introvert	sensing	○○○○○○	intuition	thinking	○○○○○○	feeling	judging	○○○○○○	perceiving
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people

**Penny, 74**



retired

traits: encouraging, fair, impulsive  
interests: childcare, jigsaws, volunteering

extrovert	●○○○○○	introvert	○○○○○●
sensing	○○○●○○	intuition	○○○○○●
thinking	○○○○○●	feeling	○○○○○●
judging	○○○○○●	perceiving	○○○○○●

people

**Grace, 58**



councillor

traits: capable, humble, quarrelsome  
interests: crosswords, gardening, pottery

extrovert	●○○○○○	introvert	○○○○○●
sensing	○○○●○○	intuition	○○○○○●
thinking	○○○○○●	feeling	○○○○○●
judging	○○○○○●	perceiving	○○○○○●

people

**Yasmin, 44**



police officer

traits: dutiful, sarcastic, valiant  
interests: mountain biking, running, comedy

extrovert	○○○○○●	introvert	○○○○○●
sensing	○○○●○○	intuition	○○○○○●
thinking	○○○○○●	feeling	○○○○○●
judging	○○○○○●	perceiving	○○○○○●

people

**Sasha, 19**



bank clerk

traits: fair, finicky, optimistic  
interests: cooking, dancing, socialising

extrovert	●○○○○○	introvert	○○○○○●
sensing	○○○●○○	intuition	○○○○○●
thinking	○○○○○●	feeling	○○○○○●
judging	○○○○○●	perceiving	○○○○○●

people

**Katie, 26**



IT consultant

traits: imaginative, meticulous, unfocused  
interests: meditation, painting, knitting

extrovert	○○○○○●	introvert	○○○○○●
sensing	○○○●○○	intuition	○○○○○●
thinking	○○○○○●	feeling	○○○○○●
judging	○○○○○●	perceiving	○○○○○●

people

**Julia, 35**



dentist

traits: charming, precise, self-centered  
interests: online classes, reading, swimming,

extrovert	○○○○○●	introvert	○○○○○●
sensing	○○○●○○	intuition	○○○○○●
thinking	○○○○○●	feeling	○○○○○●
judging	○○○○○●	perceiving	○○○○○●

people

**Beth, 14**



secondary school

traits: affable, discreet, keen  
interests: animals, basketball, coding

extrovert	○○○○○●	introvert	○○○○○●
sensing	○○○○○●	intuition	○○○○○●
thinking	○○○○○●	feeling	○○○○○●
judging	○○○○○●	perceiving	○○○○○●

people

**Maisie, 4**



pre-school

traits: exuberant, fearless, stubborn  
interests: baking, ballet, singing

extrovert	●○○○○○	introvert	○○○○○●
sensing	○○○●○○	intuition	○○○○○●
thinking	○○○○○●	feeling	○○○○○●
judging	○○○○○●	perceiving	○○○○○●

people

traits:  
interests:

extrovert	○○○○○●	introvert	○○○○○●
sensing	○○○○○●	intuition	○○○○○●
thinking	○○○○○●	feeling	○○○○○●
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<p>domestic</p> <p><b>Happiness</b></p> <p>The experience of happy events and general feelings of happiness are an integral part of home</p> <p>1</p>	<p>domestic</p> <p><b>Belonging</b></p> <p>Comfort, relaxation and familiarity contribute to a sense of belonging to home (cf. Tuan, 1975)</p> <p>2</p>
<p>domestic</p> <p><b>Responsibility</b></p> <p>Stability arising from ownership and responsibility for the home (Haddon, 1973)</p> <p>3</p>	<p>domestic</p> <p><b>Self-Expression</b></p> <p>Behaviour in and manipulation of the place are closely tied to ideas of home. At home you can do what you want, and personalisation (cf. Becker, 1977) allows expression of self identity</p> <p>4</p>
<p>domestic</p> <p><b>Critical Experiences</b></p> <p>Learning to be independent, formative experiences, living through a stressful period are formative of deep associations (cf. Proshansky et al., 1979) with home</p> <p>5</p>	<p>domestic</p> <p><b>Permanence</b></p> <p>The continuity of home (cf. Rakoff, 1977)</p> <p>6</p>
<p>domestic</p> <p><b>Time Perspective</b></p> <p>Places exist as home whether in the past, present or future (cf. Bachelard, 1969; Hayward, 1977)</p> <p>8</p>	<p>domestic</p> <p><b>Privacy</b></p> <p>Privacy here refers to Altman's (1975) model of microinterpersonal boundary regulation</p> <p>7</p>
<p>domestic</p> <p><b>Meaningful Places</b></p> <p>Because of specific, but not necessarily critical events taking place there</p> <p>9</p>	<p>domestic</p> <p><b>Knowledge</b></p> <p>Tied to familiarity, this aspect of home emphasises physical and social knowledge</p> <p>10</p>

<p>domestic</p> <p><b>Preference to Return</b></p> <p>I.e. in terms of a locus in space (Gelwicks, 1970; Tuan 1975)</p> <p>11</p>	<p>domestic</p> <p><b>Type of Relationship</b></p> <p>Type of relationship and personal choice over being with particular people is the essential focus of this category (Hayward, 1977)</p> <p>12</p>
<p>domestic</p> <p><b>Quality of Relationships</b></p> <p>The quality of relationships</p> <p>13</p>	<p>domestic</p> <p><b>Friends and Entertainment</b></p> <p>People visiting the home who form the core of social entertainment in the home</p> <p>14</p>
<p>domestic</p> <p><b>Emotional Environment</b></p> <p>A place where there is love often signifies a home</p> <p>15</p>	<p>domestic</p> <p><b>Physical Structures</b></p> <p>Enduring physical characteristics</p> <p>16</p>
<p>domestic</p> <p><b>Extent of Services</b></p> <p>Lighting, heating, household equipment, garden, telecommunications etc. (cf. Canter, 1984) are sometimes seen as a necessary part of home</p> <p>17</p>	<p>domestic</p> <p><b>Architectural Style</b></p> <p>Some homes are meaningful because of their architectural style</p> <p>18</p>
<p>domestic</p> <p><b>Work Environment</b></p> <p>Working at home is sometimes a defining aspect of home, e.g. students often have no division between work places and living places. Work is part of home because this is the only quiet place available to them</p> <p>19</p>	<p>domestic</p> <p><b>Spatiality</b></p> <p>Spatial properties and the activities that those spaces allow, as well as their location, are an important aspect of home for some people</p> <p>20</p>

examples

### Putting keys away



Placing keys somewhere safe when arriving home / work

examples

### Adjusting lighting



Altering the brightness of a space to suit a number of conditions, including environment, time, activity and people

examples

### Opening the curtains



Usually in the morning when waking up, but can be opened or closed at other times for a range of reasons

examples

### Leaving / returning home



"I might go out for a walk... if I'm working from home I have to leave the house at least once or twice."

examples

### Looking at bookshelf



"If I go into someone's room I look at their bookcase. If I have a second I go over and stare at it."

examples

### Watering plants



"I water plants to grow vegetables, and going and watering them, which is something that you do three of four times a day is something...when I wake up I go and do that."

examples

### Playing an instrument



"Actually, while I'm making coffee I'm on the piano. Very recently I've been trying to do breakfast, and that's miso soup and I actually use the piano to time the soup."

examples

### Taking out the bins



"Taking bins out on Wednesday, pretty straightforward."

examples

### Adjusting TV volume



"They go to bed around nine and around that time we'll turn the TV down. But when she isn't there the TV stays on loud extra late, almost like we're overcompensating for it."

examples

### Cooking for guests



Preparing, cooking and sharing food with friends over the course of a meal

examples

### Listening to music



Listening to music across a variety of conditions, including together or alone, through speakers or headphones, for background music or centre of attention

examples

### Doing housework



Keeping the domestic space clean and tidy through dusting, hoovering, mopping, washing etc.

examples

### Going through photos



"...we sit there and flick through photos; that feels oddly meaningful, looking back over the last couple of years and two kids have arrived."

examples

### Having a family meal



"...to do with the relatives and everyone where every Sunday we all meet and have lunch. And my granddad who I never met set that up..."

examples

### Leaving a note



Leaving a short message for someone that they will see later

examples

### Meditating



"I used to meditate, but I stopped doing that. If I could, I'd meditate but I never do. I'm too flighty."

examples

### Putting children to bed



"Putting my child to bed is the thing that I do the most. He usually likes me to lie down next to him and read him a story in his bed and fall asleep with him while he twiddles my hair."

examples

### Calling relatives



"My mum will call every Friday evening, even though I almost never answer cos I'm out doing whatever. 7, 8 o'clock on a Friday night, she'll call, leave me a voicemail and then I'll call her back over the weekend."

examples

### Shaving



"I go and brush my teeth and sometimes have a shower and shave, get dressed, have a cup of tea. I'm always late so I do it all super-fast."

examples

### Listening to the radio/records



"I'll always listen to the radio, I guess. I do have one routine that I've developed recently which is listening to records in the evening."

examples

### Washing up



"Well washing up I do constantly, and I mean constantly. I hate the idea of coming home to a massive pile of washing up."

examples

### Lighting a fire



"I light the fire now and then, and then I'll cook something."

examples

### Reading a book / e-reader



"The reading a book thing is a cultural thing – I find myself with spare time and think that would be a good thing to do."

examples

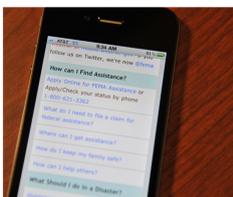
### Looking in the fridge



"...come back in open the fridge, close the fridge..."

examples

### Checking emails on mobile



"...and if I've got emails and admin stuff to do I do that then, the most sober time of the day [morning], when you're going through stuff and reviewing what you have to do."

examples

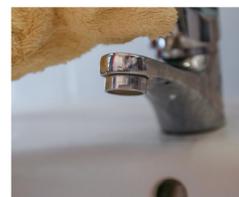
### Making a hot drink



"Of the three people in my house who drink coffee in the morning I'm the first in the kitchen and I will make coffee."

examples

### Washing



"So, brushing my teeth with my electric toothbrush, washing my hair and my body, generally in that order."

examples	examples
<p style="text-align: center;"><b>Dressing</b></p>  <p style="text-align: center;">"I go and brush my teeth and sometimes have a shower and shave, get dressed, have a cup of tea. I'm always late so I do it all super-fast."</p>	<p style="text-align: center;"><b>Brushing Teeth</b></p>  <p style="text-align: center;">"I go and brush my teeth and sometimes have a shower and shave, get dressed, have a cup of tea. I'm always late so I do it all super-fast."</p>

<p style="text-align: center;">positive</p> <p style="text-align: center;"><b>Easy</b></p> <p style="text-align: center;">Quicker to do "X" than "Y"</p> <p style="text-align: center;">Convenient</p> <p style="text-align: center;">Easy</p>	<p style="text-align: center;">positive</p> <p style="text-align: center;"><b>Social</b></p> <p style="text-align: center;">Could provide a greater scientific understanding of the human aspect of the IoT</p> <p style="text-align: center;">Can bring people closer together and send emotions</p> <p style="text-align: center;">Provides more choices and information into lifestyles and routines</p> <p style="text-align: center;">Shared across mobile devices</p>
<p style="text-align: center;">positive</p> <p style="text-align: center;"><b>Emotion</b></p> <p style="text-align: center;">Can be removed if user doesn't like it or the object/system doesn't learn properly</p> <p style="text-align: center;">Uses monitoring to understand emotions and change "X" to suit it</p> <p style="text-align: center;">Can bring people closer together and send emotions</p> <p style="text-align: center;">Easy</p>	<p style="text-align: center;">negative</p> <p style="text-align: center;"><b>Dependence</b></p> <p style="text-align: center;">Users might start to believe the IoT intervention more than themselves</p> <p style="text-align: center;">Analysis of human interaction could be to remove it!</p> <p style="text-align: center;">A sense of loss if device is forgotten or lost</p> <p style="text-align: center;">If the system does things in a way decided by others</p> <p style="text-align: center;">Has an influence on your daily routines</p> <p style="text-align: center;">User could become dependent on it</p> <p style="text-align: center;">Objects may fail</p>
<p style="text-align: center;">positive</p> <p style="text-align: center;"><b>Assistive</b></p> <p style="text-align: center;">Collects info without needing to communicate explicitly</p> <p style="text-align: center;">Can bring people closer together and send emotions</p> <p style="text-align: center;">Provides more information and choices into lifestyles and routines</p> <p style="text-align: center;">Uses monitoring to understand emotions and change "X" to suit it</p> <p style="text-align: center;">It can analyse the products that people use and give feedback</p> <p style="text-align: center;">Suggests changes to your routine to increase your health</p> <p style="text-align: center;">Recommends specific products</p> <p style="text-align: center;">Reminds you to "X"</p>	<p style="text-align: center;">negative</p> <p style="text-align: center;"><b>Security &amp; Data Ownership</b></p> <p style="text-align: center;">IoT products/systems have control over types and volume of data gathered</p> <p style="text-align: center;">Data collected is for the company and might provide inaccurate information</p> <p style="text-align: center;">Data gathered may be used to develop unnecessary new products</p> <p style="text-align: center;">Data can be sold for personalised advertising</p> <p style="text-align: center;">Data breaches</p>

<p style="text-align: center;">positive</p> <p style="text-align: center;"><b>Automated</b></p> <p>Collects info without the need to communicate explicitly</p> <p>Automatically sets to the appropriate sound/light/etc levels</p> <p>Uses monitor to understand emotions and change "X" to suit it</p> <p>Changes "X" depending on environment/activity (working out, walking, working)</p> <p>Warns if there are unwanted elements in IoT product/service</p> <p>Can wake you up</p> <p>Tracks your data</p>	<p style="text-align: center;">negative</p> <p style="text-align: center;"><b>Changing Practices</b></p> <p>Automation when the system thinks is correct would be bad - users want control</p> <p>Minimises physical engagement with important interactions</p> <p>Analysis of human interaction could be to remove it</p> <p>If the system does things in a way decided by others</p> <p>Users would have to be organised to use it and could become dependent on it</p> <p>Influences daily routines</p>
<p style="text-align: center;">positive</p> <p style="text-align: center;"><b>Intuitive</b></p> <p>Changes "X" depending on environment (working out, walking, working)</p> <p>Monitors to understand emotions and changes "X" to suit it</p> <p>Tracks your data</p>	<p style="text-align: center;">negative</p> <p style="text-align: center;"><b>Loss of Social &amp; Physical Interaction</b></p> <p>Minimises physical engagement with important interactions</p> <p>Individualistic focus doesn't encourage social interaction</p> <p>Users might start to believe the IoT intervention more than themselves</p> <p>Capable of modifying habits</p> <p>Influences daily routines</p>
<p style="text-align: center;">negative</p> <p style="text-align: center;"><b>Exploitation</b></p> <p>Analysis of human interaction could be to remove it</p> <p>Data can be sold for personalised advertising</p> <p>Data collected is for the company and might give falsified information</p> <p>Products may be made unsustainably to lower production costs</p> <p>If the system does things in a way decided by others</p> <p>Data gathered may be used to develop unnecessary new products</p> <p>The system has control over what kinds of data is produced</p> <p>Drives societal stratification by limiting access to select consumers</p> <p>Users locked into manufacturer's ecosystem</p>	<p style="text-align: center;">attributes</p> <p style="text-align: center;"><b>...save more time than they consume</b></p> <p style="text-align: center;">1/10</p>
<p style="text-align: center;">attributes</p> <p style="text-align: center;"><b>...have no failure states</b></p> <p style="text-align: center;">1/10</p>	<p style="text-align: center;">attributes</p> <p style="text-align: center;"><b>...have no subscriptions or continuing payments</b></p> <p style="text-align: center;">1/10</p>
<p style="text-align: center;">attributes</p> <p style="text-align: center;"><b>...have minimal impact on environment/resources</b></p> <p style="text-align: center;">1/10</p>	<p style="text-align: center;">attributes</p> <p style="text-align: center;"><b>...are accessible and can be controlled</b></p> <p style="text-align: center;">3/10</p>

attributes	attributes
<p><b>...save time</b></p> <p>3/10</p>	<p><b>...advance science and knowledge through data collection</b></p> <p>4/10</p>
attributes	attributes
<p><b>...have automation</b></p> <p>4/10</p>	<p><b>...are convenient</b></p> <p>4/10</p>
attributes	attributes
<p><b>...increase access to technology, leading greater equality</b></p> <p>4/10</p>	<p><b>...increase human interactions</b></p> <p>7/10</p>

values	
_____	<input type="radio"/>
_____	<input type="radio"/>
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### Participant Project Information & Consent Form

(One signed copy of this form should be retained by the Participant and one copy by the Project Researcher)

*The Internet of Things in the Domestic Space*

For further information  
Supervisor:  
*Prof. Ashley Hall*  
*Ashley.hall@rca.ac.uk*

DATE:.....

Dear Potential Participant,

I am Michael Kann, a student in the Innovation Design Engineering programme at the Royal College of Art. As part of my studies, I am conducting a research project entitled What Furniture Wants: The Internet of Things in the Domestic Space. You are invited to take part in this research project which explores the development and implementation of the Internet of Things (IoT) in the domestic space. This system and the accompanying products and services have developed from a technical, industrially focused position, however this approach explores the application of the IoT to the home from a cultural perspective, taking into account the Importance of practices in of the domestic to people's ownership and engagement with this space.

If you consent to participate, this will involve:

Taking part in a participatory design workshop with four main stages and ideation occurring throughout. This is a game like process, with participants generating floor plans from map tiles, using card sets to inspire concept development, playing pieces to show user placement and journeys within the home and evaluating concepts by scoring against Domestic Values, User Generated Values, the design teams prior knowledge and understanding of the sector. There will

**Research Office** Royal College of Art, Kensington Gore, London SW7 2EU  
t +44 (0)20 7590 4126 f +44 (0)20 7590 4542 research@rca.ac.uk www.rca.ac.uk/research

also be a short feedback session to evaluate how this has impacted on the design teams thinking around the IoT in the domestic space.

The first aspect focuses on the domestic setting, the values associated with the home and how the domestic acts as a stage for practices. The second focuses on these practices, breaking them down into constituent elements through two understandings of practice from past researchers. The third looks at how the IoT can interface with practices through the elements discussed above and the impact the IoT could have on people's practices and so their engagement with the home. Finally, the concepts developed will be evaluated to see if they are more suited to the domestic space through the understandings developed in the workshop.

Participation is entirely voluntary. You can withdraw at any time up to the point of publication and there will be no disadvantage if you decide not to complete the study. All information collected will be confidential. All information gathered will be stored securely and once the information has been analysed all individual information will be destroyed.

***Please delete as appropriate:***

- (a) At no time will any individual be identified in any reports resulting from this study.
- (b) Images or quotes, which may allow you to be identified will only be used with your express permission.

If you have any concerns or would like to know the outcome of this project, please contact my supervisor Prof Ashley Hall at the above address.

Thank you for your interest.

I (*please print*) ..... have read the information above and all queries have been answered to my satisfaction. I agree to voluntarily participate in this research and give my consent freely. I understand that I can withdraw my participation from the project up to the point of publication, without penalty, and do not have to give any reason for withdrawing.

I understand that all information gathered will be stored securely, and my opinions will be accurately represented. Any data in which I can be clearly identified will be used in the public domain only with my consent.

Participant Signature.....

Researcher Signature.....

Date: .....

**Complaints Procedure:**

This project follows the guidelines laid out by the Royal College of Art Research Ethics Policy.

If you have any questions, please speak with the researcher. If you have any concerns or a complaint about the manner in which this research is conducted, please contact the RCA Research Ethics Committee by emailing [ethics@rca.ac.uk](mailto:ethics@rca.ac.uk) or by sending a letter addressed to:

The Research Ethics Committee  
Royal College of Art  
Kensington Gore  
London  
SW7 2EU

## Appendix P - 5.4.1: Final PDP Transcripts & Outcomes

### Participant A

#### Concept Summaries and Processes

##### **PARTICIPANT A**

##### **Ideation Stage 1**

I have been looking at the bookshelf and I was like completely stumped initially but I started thinking about--

##### CONCEPT 1

Well I was thinking about Penny actually. **So I was thinking Penny, I don't know if she likes cooking but she can like cooking for this example.** She has got a lot of old recipe books. Maybe actually all the family want to use them so she's got all **these old recipe books.** You can't actually get them anymore because they're that vintage. They've got quite **a lot of old family recipes** in there so I thought instead of having to re-buy them on Kindle, which you can't actually do anymore, you **should be able to scan the book bar codes and there should be system where you can access these books now.**

If you already bought the book you can have it in a digital version automatically without having to re-buy on Kindle. **From there I was writing a few other ideas and i thought actually maybe she prefers cooking out of a recipe book.** Maybe she doesn't want to be necessarily following on a phone. There's a particular recipe she loves that she wants to make, call it shepherd's pie, she knows she has it in one of her books but she doesn't know what book she has it in. **So she can ask Alexa or something, I want to make that shepherd's pie recipe, I know it's in one of my recipe books, can you find it for me or let me know what the book's called and the author.** So she can go through the books and find it and get the book out and read it from there. Like your own personal recipe database.

**That was from the bookshelf point of view.**

##### CONCEPT 2

My other one was **making a hot drink and** I thought about **Moses and Maisie** for this one. **Moses is doing his yoga. I can imagine he is probably an early riser** it's quite a simple idea but his alarm goes off, **it sets him off the machine goes off at the same time as the alarms or thing or 10 minutes later, makes him a green tea** or whatever he wants to. Maybe we'd like warm milk but she could only have her warm milk if her parents go to the kitchen and pour the milk and get it ready for her. **Maybe there could be a system whereby she knows there's a special button that she's allowed to press on this machine that will dispense it into a special cup that set up for her so she can like access it herself, to get to that little bit of independence** so she doesn't have to go out.

Yes, it's not too warm and it's non-spill, so it filters through like a lid or something.

Yes, so just like **so she's got that little bit more freedom, her parents can do what they need to do.**

##### CONCEPT

Using Penny as the user for the concept and the bookshelf as the practice, Participant A developed a first initial concept that transitions between physical and digital realms. This uses barcode scanning to identify and supply existing recipe books available via e-readers, or alternatively, recognising that the user may prefer using a physical book, uses digital assistants to remind users which books specific recipes are in, creating a personal recipe database.

The second initial concept was framed by the practice of making a hot drink and the users of Moses and Maisie. Essentially a teasmade, with a similar conceit to **PETER**, this device would prepare green tea while Moses undertook other activities, such as yoga. However, this then developed into a system that provided warm milk to Maisie into a 'special cup,' providing her with a little independence and freedom, allowing her parents to do what they need to do.

##### **DOMESTIC VALUES**

The domestic values explored before selection were *friends and entertainment, quality of relationships, self-expression, responsibility, architectural style and permanence* with the participant selecting *quality of relationships and responsibility*. This related to concept 1 by considering the

continuity of home and *permanence* by integrating personal recipes into a database system to keep old traditions alive. *Quality of relationships* impacted upon the participants concept by contradicting their initial idea, leading to the participant considering the implications of Maisie pressing a button to get warm milk and how this might supplant parental responsibility by replacing the important interaction between a young child and parent.

----

#### **Domestic Values**

Friends and entertainment, self-expression, responsibility, architectural style, and permanence.

Actually, I got a couple for the reverse, that contradict my idea. I've got permanence, as well, the continuity at homes, building on the idea of, you can keep these if we do integrate personal recipes into that database system. You're keeping the permanence. There's old traditions, you're keeping alive through that. Then, on the reverse, picked out a couple like quality relationships. Obviously, that's something really important, but what does it mean for Maisie when her mum and dad aren't interested in getting her milk for her at four years old and she's to press the button on her own. That interaction between parent and child that's probably very important at such a young age. I thought that was a little bit contradictory and the same falls with responsibility. Is it a parent's responsibility to execute that or is it not? Does it bring into question some areas there?

#### **DOMESTIC VALUES**

The domestic values explored before selection were *friends and entertainment, quality of relationships, self-expression, responsibility, architectural style and permanence* with the participant selecting *quality of relationships* and *responsibility*. This related to concept 1 by considering the continuity of home and *permanence* by integrating personal recipes into a database system to keep old traditions alive. *Quality of relationships* impacted upon the participants concept by contradicting their initial idea, leading to the participant considering the implications of Maisie pressing a button to get warm milk and how this might supplant parental responsibility by replacing the important interaction between a young child and parent.

#### **MMC & Practice Aspects**

Okay, so what space, objects, time, intentionality, experiences of the world...

#### **REFER TO PHOTOS**

#### **UGV**

#### **REFER TO PHOTOS**

#### **Final discussion**

So, milk for Masie. Kind of this concept of allowing a child perhaps to have a little bit more like responsibility in the home for like to getting themselves a drink if that's something that they want instead of always having to like to- to their parents and having to ask. So, I kind of like personally went through a bit of roller coaster with this one because first I thought it was a good idea, then I thought actually maybe this is kind of a negative thing like it's actually limiting like those social interactions that are probably really important for a child.

So I'll run through it with a little bit of structure, so time, I guess it's always running in the daytime so it runs from 6 am to 6 pm and it will only dispense the milk twice a day in a limited quantity. That kind of plays into objects. As it's an IoT device, it'll be accessible via an app so a parent will be able to look at information such as they could probably limit that time further. If they wanted it between 8 and 3 they could adjust those time frames, those parameters, they could put in different things like

the quantity of milk they want it to dispense and a few other...I've got loads of notes but I feel like they've all moved. Anyway, that sort of thing.

And then in terms of space, so the appliance will remain in a communal space, kind of in the kitchen area. I mean the kitchen is becoming increasingly open plan, part of the home so it's not like she's going to be in there on her own but I mean it could be a possibility and it would be kind of worked around so that from a technical point of view there wouldn't be any harm to her. With the space thing I thought also, and again with objects you'd need to have an understanding of how and when perhaps the appliance is running out of milk, so you could have it then speaking to B's fridge and understanding is there any milk left in the fridge or is it something we need to order in and that could be a notification through some sort of merged system or whatever, however that would work.

So the intentionality around here, I think from a positive side it would like kind of to teach Masie a little bit about responsibility, so the fact that she only has provision to get it twice a day, does she have the ability to wait or is she like drinking one at 8:30 and another at 8:45 because she's like, "I love it so much I want it right now." But then she realises, well that's it, I'm done so is that actually having a positive impact on her and teaching her from a younger age "okay I've been given two but if I eat it all now that's it for the rest of the day." So is that encouraging decision making there?

Again I did counteract myself a little bit here. I don't know if this was potentially like a negative thing here. Was it removal of responsibility for a parent and did that mean that the relationship could become more about a parent's interaction with the appliance and the child's reaction with the appliance than the child to parent relationship? Because you're kind of like a giving person and a child respects that but what does that mean long term for that child if they're always expecting kind of those results from an appliance and not necessarily from a human? But I didn't know actually I was kind of thinking perhaps on a really long-term level maybe a little bit too deeply but actually what would be the implication for someone if that was an introduction to how they were being given something?

And then to words and actions I thought that it fundamentally removes that action of asking permission, so as a child you have to ask your mum and dad for everything like that's just how it works and I didn't know whether that was a good thing or a bad thing, that kind of automation? So did it result in kind of loss social and physical interaction for that child? I kind of think that actually...and also kind of negatives, like what impact does it have for future activities? Does it limit creativity?

For example, if you're boiling milk on a hob then you kind of have that interaction with the hob and that becomes part of a wider eco-system of cooking things, whereas if you only always pressing a button like what does that mean for the way you like to eat and how you'd like to access food and how you'd like to cook for the future? Does that mean like the microwave's the one to go to because it's one click? Or ordering food online is the only you kind of know how to do, so I didn't know-

No I don't think so. I think there was certain elements where interaction was actually required for example, say there's this special cup that you slotted in, that would have to be found, washed, there would have to be some priority of interaction there. There were elements of it not being entirely automated.

I did write that the app can locate the mug. It can locate the mug over the app

## **FINAL DISCUSSION**

The final concept followed a similar direction, allowing the child a little more responsibility for getting a drink. Practice aspects helped to focus considerations on times of availability, initially described as 6am to 6pm, although the participant mentioned that this could be altered via an app. Space considered both the location of the dispensing device and the ability to locate the cup, with the kitchen seen as the most suitable place for the dispenser and the ability to track the cup through the app mentioned.

Object focus directed the participant to consider the supply of beverages to the dispenser, the cup that would be used and the locating of this through an app. Further to this, the participant considered the wider eco-system of objects involved in heating milk, for example when using a hob, and how pressing a button on a device might have implications for cooking in future. (COMPETENCY)

This relates to words and acts, with the participant stating that this removes the action of asking parents for permission, however the participant wasn't sure whether this level of automation was a good or bad thing, as it may result in a loss of social and physical interaction, raising the question of what impact this would have on future activities, such as limiting creativity.

In terms of intentionality, there were positives in that it would teach Maisie about responsibility by limiting the amount of times she could get milk to twice a day, teaching her from a young age about decision making. However, the participant also considered that this was potentially negative as it could remove parental responsibility, leading to the interaction through the object meaning that the relationship was more about the parents interaction with the appliance and the child's reaction to this, rather than a direct child to parent relationship. They raised the question of the impact of this introduction to interaction in the long term on the child.

While the participant initially felt that this was a good idea, through taking part in the process they also considered that it may be negative due to limiting social interaction.

### ***Scoring***

I think it's low for quality of relationships, but that being said I think there's a good argument for cognitive learning. There was a study that showed that children who couldn't wait for things, who knew the whole marshmallow test, those who could do that scored better in their tests and all that sort of stuff.

**MK:** In terms of quality of relationships it's middling, low?

**Participant D:** I would say low.

**Participant C:** If that's the case I'll probably give it like a 5. (Neutral)

**C:** Say if we're still talking in the context of milk and not anything else like just nutrition, it depends on the individual, but if Maisie's asking for milk a lot, if it's an essential part of her diet as a child then it's very convenient.

**MK:** How do you feel about this with the theme of loss of social and physical interaction?

**Participant C:** It's definitely less.

**Participant D:** I don't think I agree with Participant B here because it's knowing what I want and if my mum and dad cannot give it to me anyway I need to, even if I ask my mum and dad and they need to go to this milk dispenser to get the milk for me. The milk dispenser is just an enabler to give a cup of milk. If I wanted I would go into the fridge and take it. It's more of...as long as it's within that context, I don't see really a big social interaction is missing because once I learn the behavior of, "If I need an ice-cream I need to go to the freezer to take it, if I need milk I go to the dispenser to get the milk."

Maisie loves warm milk - a product which allows this to be created + served without Adult intervention.

- Cup Accessorie which is non-spill / non warm to touch.

Had making 4 lattes individually with a coffee machine! Option for multi-servings to save time + get on with the morning or hosting.

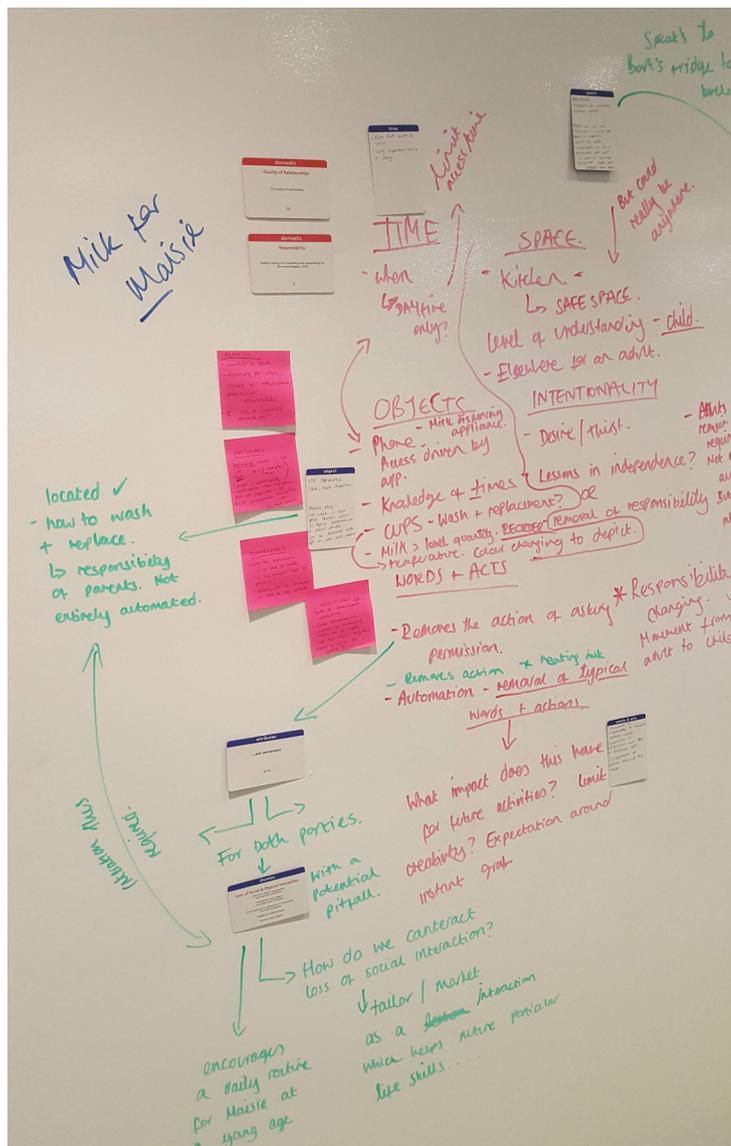
Scan all book barcodes to have access them online rather than needing to rebuy as a knock version

Looking for a recipe in a codebook you already have on your shelf. No paper coding from a book.

ASK Alexa - where is recipe XYZ. Store of recipes - scan old books which not digital! Personal recipe database.

DOES IT LEAD TO

- lack of knowledge elsewhere.
- Does Automation mean so bubbling milk on a note.
- Will this instill doginess
- Where a position for cooking?



MEANING

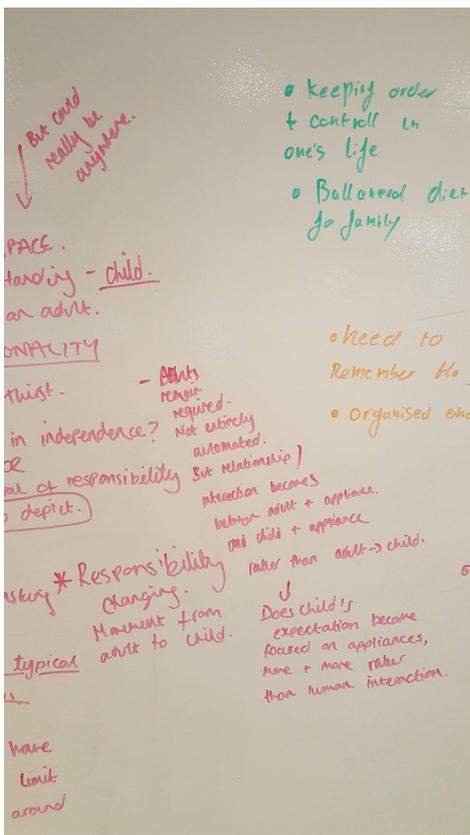
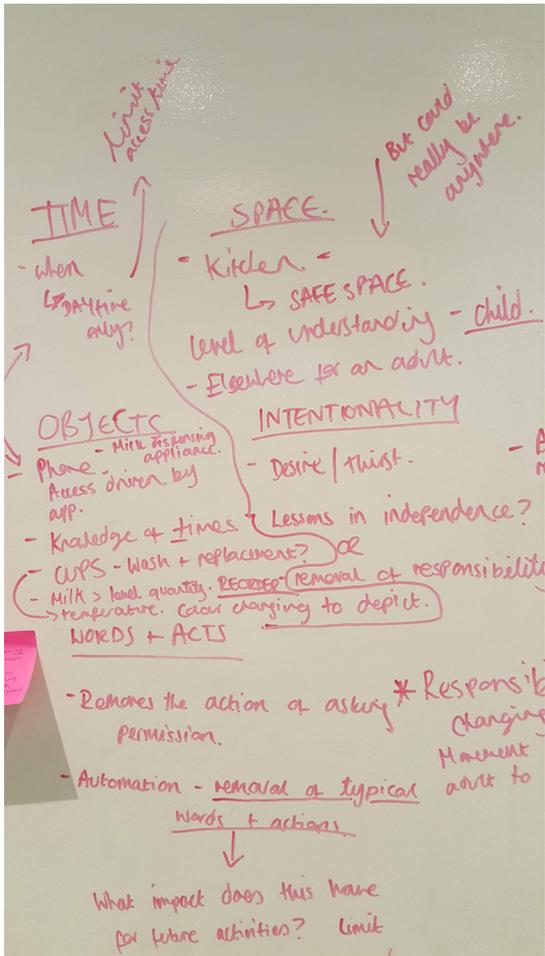
- Wanting a drink
- Providing for ones.
- Lessens in independence, gratification, responsibility
- OR - Lack of interest / parental care?

MATERIALS

- Appliance which is set up
- Cup. # is it remote? tablet?
- Wall + electricity
- Notification when appliance set up requires running low.
- Adult intervention
- milk drinks

COMPETENCY

- Using the appliance
- Is it full or milk
- is the correct cup in place?
- reliant still on parents for some of the above.



## Participant B

### IDEATION STAGE

#### *Practice Examples*

Putting the children to bed, dressing, washing, leaving a note

I've got doing housework.

Yes, I've only got one so far, which is the looking in the fridge.

#### **CONCEPT**

Yes, it was Moses and it was the practice of repeatedly walking up to the fridge out of boredom or hunger or whatever to look for something to eat and it was encouraging his experimental cooking side. He really enjoys cooking either for guests or maybe it's for himself. I saw a scenario where the weekly shop would be the list of ingredients would be imported to his freezer through some mechanism, that could be directly talking to the store or scanning a receipt or something. Then, instead of walking over to his fridge/freezer, he can open an app and the app will tell his fridge either give him suggestions on pairings or complete recipes or dishes or things that he could make with what's available in his fridge without having to go and check. Because, sometimes you have look for things that are just ready to eat rather than ingredients. I guess it's encouraging his desire to want to maybe cook more.

There's some work on that on the fridge that maybe did that but I didn't think there was an element of it suggesting what to cook, what items are going off.

Maybe in a system like this, maybe it can educate as well? Maybe it can suggest to check that's something's off?

#### **DOMESTIC VALUES**

The emotional environment is interesting, making sure that however, your products talk to you, if they are intelligent, it's emotive and not like, just logical.

I've chosen self-expression and then emotional environment. Self-expression. I guess, the people that are interested in cooking and are devoted to it and have it as a passion or a hobby. I'm going with the fact that Moses', our persona is like that. That self-expression is a big part of it. Any system that encourages or enables him to cook more should be about emphasizing self-expression rather than giving him the straight up. "You have this. This is the most logical solution." Being more holistic than that and saying, "you have this and these are some good pairings." Let him make the decision to make it about his thought process. Then I think, that ties quite closely to emotional environment. It's more emotive experience as well as enabling someone to cook, especially in a family setting. Then it allows you, or enables you, to be able to cook for the other people around you more frequently or more often. It would say, well, "you've got everything for a cake and you've got a bit of time in your schedule. Do you want to make a cake with family?" I think, encouraging the love behind the cooking. Not saying that these people don't have that love already. It just makes it easier for people to grow and create.

#### **MMC & PRACTICE ASPECTS**

Yes, the time as well. It was encompassed all times because you're either shopping, you're subconsciously planning meals or consciously planning meals. You're physically in the kitchen cooking, but that could be at any time of the day other than maybe the middle of the night. ,

So like, say objects or food something that can detect the utensils or equipment you may have. Intentionality is shopping habits, cooking methods, preference on cooking methods, words and acts like lists, when you're physically making shopping lists?

As an act you can record. Is that along the right lines?

#### **UGV**

The idea is to counter the issue of dependency.

Yes. The provocation is that, ultimately, if you're just relying on suggested recipes, then you might

not develop...you might outsource your creativity.

I'm not worried about the removing human interaction because it's not cooking for you. Its suggesting-- if it was good it would be suggesting ideas that were very feasible. So, I guess it's just the worry that you'd become dependent on just scrolling through and finding something you wanted to cook, but not actually using your own creativity in certain things, and that's so imagine a world where absolutely, hypothetically everyone used this, that no new dishes would be created.

So, I've got counter dependence by offering ways of creating new dishes?

Yes, that's true. Or you could use some kind of machine learning. A lot of people cook with sweet potato and this ingredient. It goes well with-

(to themselves) Minimal impact on the environment and resources...

### **FINAL DISCUSSION**

The last stage in the summaries we made were in the purple but don't even try and attempt to read my writing. It was just thinking really about these being the inputs and these the considerations and what. I was just trying to summarize exactly what the system would and wouldn't do or what it would take and what it would turn it into. The two things that emerged from it as important at the end is, maintaining your creativity as someone that wants to explore cooking as well as reducing food waste. These are two that I picked up on as I was working through this and more obvious ones as well. Encouraging more frequent cooking and using up what's going off, not just in the sense of food waste, but just that principle of having spent money on food and wanting to use it, and there could also be health benefits as well included. It's really looking at taking information like your shopping lists, your cooking habits, maybe inspiration that you've seen online or that you've discussed with other people. Or inspiration that could be offered by supermarkets, like you said if it's being paired up with Ocado or Waitrose or whatever.

I've got for words and acts things like making, making lists and the cooking and the prepping. Intentionality, your shopping habits, your cooking methods. For objects, type of food and the utensils that you need and what cooking utensils may influence the recipes that you get to use as well. For time, the times that you cook if you're at having to cook dinner early for Maisie and know that and offer different suggestions and different times. What I've written down is that the system should challenge your preferences. I was thinking in most cases, in a lot of apps and IoT systems, it's about learning what you like and offering more of what you like, whereas I think it's important to not do that. Obviously learn what maybe ingredients you buy more often, but suggesting recipes that you may not have tried or particularly like or something that's not along the same theme as what you're already cooking.

If this is replacing the process of, "Shit, what am I going to cook tonight?" then it needs to challenge that because it could be so much more efficient and it's working with a library. Even if it's just giving you BBC Good Food, which has a limited library of recipes, then it's going to be able to offer more than you could come up with yourself. They're all pre-made so I think it should be a system that doesn't just learn what you like but it challenges what you like.

It was this process, it was dependence on coming up with your own ideas, so if this is doing it all for you then you could just get into the habit of, "I know that if I buy tomatoes, courgettes, aubergines, eggs, it's going to offer me quite a large number of recipes and I can just choose from that." You don't then alter your cooking behaviours. I suppose instead of just offering recipes of what you have in the fridge, but maybe saying, "If you bought this, you could try this new dish." As well as including community recipes that people could submit and just build an environment.

That's the thing is once you get away from the idea that a recipe is a good way of eating those ingredients, it's just one of a billion combinations that you can have, an infinite number of combinations you could have with those few ingredients. There's no right or wrong in cooking. I think trying to just not get rid of that independence.

Yes. It's not going and finding a recipe, it's assisting you to be creative with what you have.

### **EVALUATION**

**MK:** There were the four things. Self-expression, emotional content, I think it was? Emotional environments, the idea of dependency being a negative thing and minimal environmental impact being an attribute you want to try and meet. So how much do you think this helps meet self-expression?

**Participant C:** I think it's good, but it's all down to the implementation of it. Because in its raw form, it's basically "I've got the recipe, I'll do that." There's no self-expression. The sort of stuff you were talking about towards the end, if that could be incorporated in a usable way, that encouraged it, it's got to be better than neutral.

**Participant A:** It's down to the user as well and how much they want to do that.

**Participant C:** It's recommendation.

**Participant D:** I feel the self-expression or the expression will be on the lower side because you've already pre-empted their...already given them the template to start with, the level of self-expression because you might be ending up in a situation and if I change this, then I'm not sure what it's going to be. So, more often you tend to follow what's being given rather than the...I'm not saying everyone, but it's a natural tendency to end up doing what's there to get the best appreciation for yourself that you've done the right thing. This is just my feeling, though.

**Participant B:** I think for someone who may already be explorative with their cooking, then it could nurture that, but for someone that was really still just very curious it maybe could dampen it but I suppose it would work well for the people that just cook the same thing every day.

**Participant B:** Yes. I think I said it totally depends on the person.

**MK:** What about the emotional environment then? A place where love often signifies a home. Maybe love is a very strong word to use in this particular one, but maybe love through food.

**Participant D:** Since because still you are doing it, so it's like you know what you are making. Being part of what you're eating is really... Rather than buying prepared food, compared to that, it's a bit more of an emotionally charged thing. Whether if I have put all my effort to make this. Because still bear in mind, even if it's a very simple recipe, still, I have to do this whole exercise, so I have to be emotionally involved to make that recipe even if I'm following step by step. You know what I mean? Sometimes you may end up doing two hours of this cooking and you don't want it to be that time looked wasted.

**MK:** Dependency being seen as a negative thing.

**Participant A:** I think you'd become quite dependent on it actually.

**Participant C:** I think if you want to. If you want to be dependent.

**Participant A:** It's so helpful. Why wouldn't you become dependent on it? I feel like it's a cool thing. I'd use it. It's hard work having to look through recipes, especially trying new things.

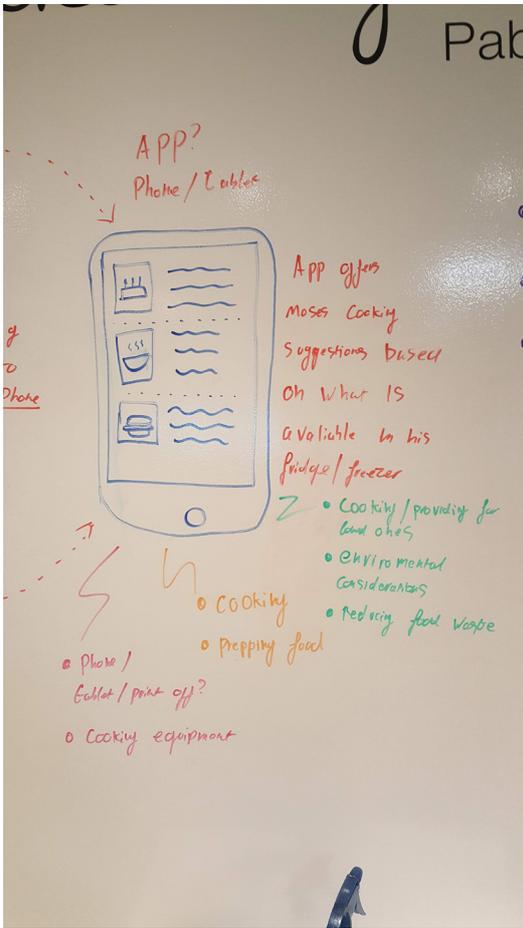
**Participant B:** That's the thing, is that's what you do anyway, right? You go online and you Google cheap recipes, cheap healthy recipes, you go on the top 50 list on BBC Good Food you power scroll through it then you choose one at random and then you decide you hate it.

**MK:** Environmental impact?

**Participant A:** I think it could have a positive impact there. I like it. Best by dates. I think it's quite a positive thing.

**MK:** In terms of food waste?

**Participant A:** Yes



intentionality	object	space
<p>Intentionally Shopping / planning / Preparing + cooking for family. Visiting friends could be conscious or <u>unconscious</u></p>	<p>Technologies that record + remember what you purchase have been as well as a knowledge of food, cooking and it's uses</p>	<p><u>Kitchen</u> mainly social space being <u>intended over</u> vs <u>not</u> This fills the space of hoodly to know in advance</p>

time	words & acts
<p>Meal times (Evening)</p> <p>or any time</p> <p>reading/die to</p> <p>Shopping list +</p> <p>Planning</p>	<ul style="list-style-type: none"> <li>• Reading lists (cognitive + physical)</li> <li>• Shopping/visiting fridge apps to get info</li> <li>• Cooking + prepping food in the home</li> </ul>

space	time	words & acts
<p>APPLIANCE</p> <p>- Remains in communal kitchen space.</p> <p>Additional info on appliances - such as time of dispense, levels of milk, temperature of milk accessible via app.</p> <p>↳ look to extend ecosystem - milk gets ordered when low</p>	<ul style="list-style-type: none"> <li>- Runs from dawn to dawn</li> <li>- Only dispenses twice a day</li> </ul>	<p>Movement of responsibility of decision making within limitations or restrictions set by a parental app.</p> <p>Development of routine specified by child.</p>

intentionality	object
<p>Teach Maisie about responsibility.</p> <p>Permission to access only twice - teach ability to wait?</p> <p>Understand limited access.</p> <p>↳ encourage decision making / delayed gratification</p>	<p>IoT Appliance.</p> <p>Coffee / Milk dispenser.</p> <p>Maisie Mug -</p> <p>Cup which is non spill. Changes colour to depict temperature of liquid inside.</p> <p>Can be located with App in case left elsewhere</p>

## CONCEPT SUMMARIES AND PROCESSES - PARTICIPANT C

### IDEATION STAGE

#### **Participant C**

#### **Practice Examples**

Listen to music.

Checking emails on mobile.

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#### **Ideation Stage 1**

Cool. So I was looking at listening to music and I was thinking about, I was really thinking about the couple. They probably still want to have dinner parties or maybe just the two of them. The idea would be you'd pick a recipe you wanted to do and it would say this is the sort of music you want to listen to. So it creates the ambience around the evening so it's really more for special occasions just to set the ambience, suggest a playlist. It could suggest other things. What film you want to watch to go with the area of the food or vice versa. You might have a movie planned and it's oh yeah do this because they eat this kind of food in the film or something. You might have Pulp Fiction, let's get McDonalds. So that's one idea so it sets the ambience and the so it could talk to your devices, your Alexa or Echo Dot or whatever or maybe the lighting as well? All that sort of stuff so actually you could create a whole kind of environment. So now the eating food becomes more of a kind of theatrical thing. The other one was just guided audio, tell you what to think and when to do it. That was the idea, create this environment.

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#### **Domestic Values**

For critical experiences, I have knowledge, privacy and work environment.

I've got meaningful places, because it's going to help generate an environment where people can have specific, but not necessarily critical events. [laughs] Friends and entertainment just because it's going to help with that and architectural style. I was thinking about this and saying, "Well, what does this do?" Depending on how lighting and music affects it you're actually effectively changing that environment which is something we're looking at.

#### **MMC & Practice Aspects**

**Participant C:** Material wise, like having a tablet or something. Obviously connecting to the environment, maybe a light or projector...

**Participant C:** Space, it's like the physical space...

Yeah, on objects. So words and acts, words and acts. I still don't know!

#### **UGV**

Have no subscriptions or continued payments?

From a business point of view, how do we deal with that? Do we say, "There's revenues streaming in the subscription." So does it assist actual physical product selling. Something like that you might buy the Italian food pack?

#### **Final Discussion**

We're talking about this creation. So basically the meaning is creation of environment to enhance food and create a deeper, deeper experiences. That's the aim and also looking at shared the experiences. You probably wouldn't do this for yourself on your own. We're looking at not just setting the scene, but also how the scene can change between courses. So, you've got various inputs that can be used for that place, table setting on there, when plates come off the table. You know that you're getting on to the next course, so cueing whatever your next experience is.

Basically being able to monitor and recognize difference between courses, change the environment and looking at time, primarily evening. Shorten that down to be honest, most likely to be weekends, bigish occasions. I'm also thinking, maybe it could also in the morning for breakfast, so when you wake up maybe it sets an ambience which gets you ready for your day, that sort of thing.

Also it could tie in with calendar, so looking at setting dates, looking having an event time with that,

so it could collect available times. Also maybe as the evening goes on, the lights could even get dimmer or brighter if you want people to leave.

So, we were looking at the attributes, increase human interactions and assistive. Thinking about collecting info without needing to communicate explicitly, you can bring people closer together, and send emotions. Which I think...that's quite key.

**Scoring:**

idea of friends and entertainment being an important part of the home??

**Participant A:** Yeah, 10 out of 10.

**MK:** Then the architectural style of the home being important.

**Participant A:** There's quite a lot of different elements that would have to come into play if your table was going to recognize when your plates are being taken off, and music was all going to be incorporated.

**Participant B:** Placement of the smart lights as well.

**Participant A:** There's definitely a lot of talking.

**Participant B:** There's need to be quite a dedicated host to setup a system that works, optimally.

**Participant A:** An IT guru. "No, this isn't working. The internet's gone down. Ahh!"

**Participant B:** Normal dinner party, crap music.

**MK:** How meaningful do you think this is?

**Participant D:** Managing other people's preferences in terms of the music and tastes and things because when you have groups of people that if you don't get....friends' place, how different settings would....

**MK:** How about the meaningful nature of it, then?

**Participant A:** No. I think it's become less meaningful, personally. Only because I just think there'll be so much focus on the technology. There wouldn't be any focus on social interaction in the same way.

**Participant C:** Would it spark conversation? Because that's what I was thinking about. It'd be quite-

**Participant A:** Yeah, but only between, I mean this is very stereotypical, actually I'm not going to say it. I was going to say only between men cos we'd be like, god there off off again, and then we'll talk about...

**Participant C:** Also thinking about, say if you for an Italian, "Ah, remember when we went to Italy" and blah blah blah. You should go to Italy, because blah blah blah."

**Participant A:** Yeah, that'd be cool. I think it can swing both ways, couldn't it?

**Participant C:** Is it meaningful to that or is it just kind of like a-

**Participant A:** A gimmick?

**Participant D:** It depends on what's your overall objective. Is it about bringing people to together for that day, for an event. Similar to that one, whether it's likely in a much more ... technical technological...If it is purely about me coming there to listen to music and changing of lights, that is a gimmick, but if I'm getting to know people and talk about it This is a means for me to come out of my everyday routine and do this one that looks slightly different.

**Participant A:** It's almost that none of this stuff should be mentioned. There shouldn't really be any conversation about it, because it should just be...It should be **invisible**

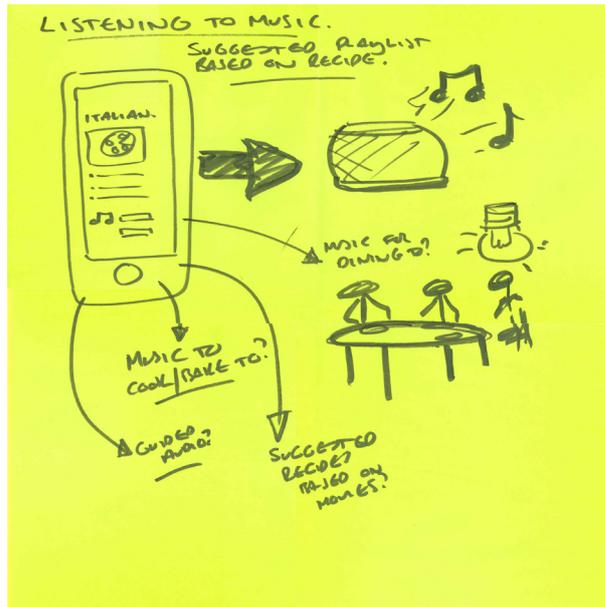
**Participant B:** [inaudible] I see it as a sliding scale on where at one end it will never lose its novelty, because it's just dimming the lights, setting some nice music. Generally just offering some classy recipes, all of which you already do now. Just you have to put more effort in. Or it could be a fully experiential thing, which would obviously lose its novelty, but you wouldn't do it all the time.

**Participant C:** It was theatrical, wasn't it? There's two ends, isn't there? It's like clowns on stage, like big bright lights...although there's something a bit more classy in mind. Subtle..

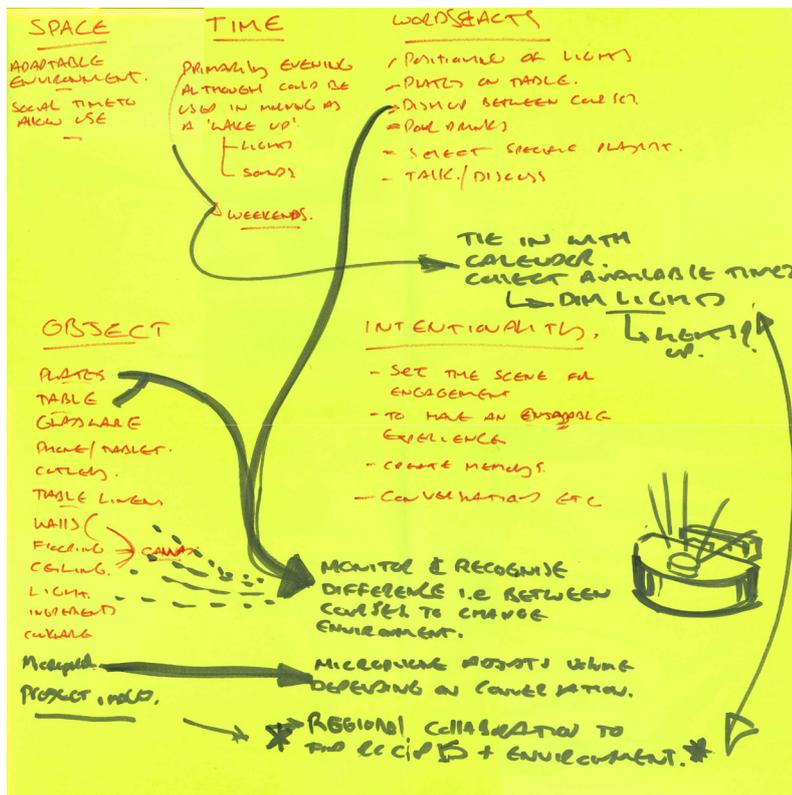
**Participant C:** It's to spark conversation

**Participant B:** But it can record conversation, then target advertising to all of the people that were there.

Participant C



COMPETENCIES	MATERIALIZED	MEANING.
KNOWLEDGE OF ENVIRONMENT ↑ USE OF EQUIPMENT. DESIRE TO ENGAGE ↑ PERSONAL AND SET UP. ↑	<b>TABLET.</b> - CONNECTED - AUDIO - LIGHT - PROJECTION? - TV? - CURTAIN CROCKERY - TEMPERATURE	"CREATION OF AN ENVIRONMENT TO ENHANCE FOOD AND CREATE DEEPER EXPERIENCES!" "SHARED EXPERIENCE"



## Participant D

### Practice Examples

Having a family meal, cooking for guests.

This has become relevant as well, washing up after you cooked for your guests.

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### Ideation Stage 1

I just want to focus on one thing, which is having a family meal. I chose the granddad because it gave us an—I just want to write it down. It's basically having a family meal to do with relatives and everyone where every Sunday we all meet and have a lunch, and my granddad, who I never met, set that up. Granddad was a 74 years old person and definitely did not grow up with the technology where we are today. There is an interesting research that shows that they are the most likely people to use Facebook, to look at the Facebook marketplace and things. Today they have collectibles and they want to sell it. They are constantly on Facebook, social media, more than anyone else. There is a research that proves that people over 60 years have been using Facebook a lot. That gives me insight, okay fine, but again, they are not technologically savvy and also they don't understand the whole app experience. As soon as they let's say receive a spam email they don't know what to do next. Those kind of things.

I was thinking earlier how Internet of Things can play a role in—this has been a tradition? I don't want to take tradition away, but how I can engage my grandchildren and my children who are currently living in this digital world to be more part of it with the technology around them. The IoT is not physical product but this whole idea of it being an ecosystem and an experience where the granddad is driving this whole experience at home, but he's using the technological means to drive this. It's basically to start with the family meal planner, so you have a family WhatsApp group anyway so you plan the activities and all those kinds of things. Then scheduling for the week. Each week, there is a theme that you set. The grandfather's looking into Facebook, Instagram and gets lots of inspiration from what kind of themes for the week should be. He's already published a nice little profile picture on WhatsApp to say this is the theme for this week. The whole family is actually waiting to get to the day because it's going to be a fun and great event. Under recommendations from the influencer, coming from the granddad speaking up, what is going to be interesting is we have this AI algorithm that enables you to manage your family now to know what's the dietary requirements are, which has been really a difficult one. Because planning a family meal is okay, but I need to remember if my grandchildren are lactose intolerant or allergic, gluten-free and all those things. Once we have a personal profile, profiling things in the app the granddad doesn't have to think about all this. The system already knows who are my family members and it knows all the allergy information. Once I get the personal recommendation it links to the thing and also giving out replacement ingredients if you wanted to, if I'm allergic, to use the same recipe.

Preparing this whole family meal but becoming more inclusive for everyone in the family because you don't want to exclude, say that that person's is vegan so I didn't cook it, something like that, so we want to bring in that kind of atmosphere. Once you've done that, then the next step is I don't need to remember what I need to order. Based on the recipes I chose the online ordering is automatically done because it's all linked and it's being delivered to you. Every week on a weekly delivery because it's a weekly tradition, it's automatically on a Friday evening you get it delivered on time and all these recipes come through. All these hidden barriers and all these things have been removed because all you're doing is choosing what the theme for that particular week is. The system is automatically generating and these things are being shared within the family.

Kind of like a technological means to satisfy what he doesn't need to think about. At the same time families are more comfortable to learn what has been happening because they are all constantly on the phone, so that's the idea.

Like Google Lens right, it's really cool. Even food pairing can be done, like you know if you have wine because lots of wine manufacturers are today just constantly, even in the restaurants, you could actually, they could give you your menu and you can actually get the app to recommend what wine you want to go along with it as a food pairing. It's becoming a big business based on the base flavour.

If you have ten people coming through and six or seven of them have no issues and three of them have a specific requirement, one thing is you don't want to let them be odd there because we have the inclusive ideas, the inclusiveness. At the same time you don't want to, you don't know how much to spend and how much you wanted to cook because lots of times when you cook for multiple people you can't—definitely the people who are allergic they won't take the other dishes but the

other people might.

Just kind of balancing out how much of a meal servings I need to prepare and doing all of this calculation is really helpful like okay fine if I take a couple of things and just putting this, which is very difficult to work it out.

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### **Domestic Values**

The first one is happiness. This is a family meal, the experience of happy events and general feeling of happiness are integral parts of home. That's the whole point of the objective of that particular idea itself. It's going to stay. Then preference to return, being it's a tradition that's been followed for a long, long, long time. In terms of locus in space, and you're constantly bringing back the attention of people coming back, and even when the grandparent is not there, still, it's been followed as a family tradition. Once again, it goes on really along with the whole thing. Then again, time perspective, which is similar to preference to return. Places exist as home, whether it's in the past, present, or in the future. That's the whole point of the combining these three things together to work with that particular concept of going along with it.

### **MMC & Practice Aspects**

Intentionality - Bonding, happiness.

The main intentionality is basically, leading the family together and build happy kind of that's the main intentionality.

Do objects become the material part of it?

### **UGV**

These three attributes seem to go really well with-- it's really a must things for those things because one thing is about. No-no, well, okay, if you want me to choose any one of them based on the meaning that's being offered and everything, I would choose personal [unintelligible 01:43:37] as one of the key things because this is under the assumption these people are already there. So, maybe that's the case. If I want to choose only one, it may be an old person and I don't want to fail and if the family...but otherwise, these attributes are a must to make it work because I want the information because I can—I'm trying to learn the family, know about their interests and everything I need to have an... under the assumption that these things are already cooperating. In terms of the themes it a social, emotion go hand in hand, changing practices, ok it changes the practice but you're already learning the WhatsApp...I think I'll go with social...

This makes sense, in terms of say this is every week Sunday lunch. In terms of the time further detailing down, say deliver your ingredient on time, knowing what's in the fridge, getting meal time, informing appliances such as preheating the oven, switch on the dishwashers.

**MK:** That's the outputs and it's reading these things into making decisions based on that. Bearing in mind that it's trying to be social and have no failure states.

Causing happiness.

Because for me the intentionality (of the IoT) would be have no failures.

### **Final Discussion**

Still talking about the family meal planning, the primary user being the grandfather. With that in mind I think the key IoT attributes would be...We'll start with the meaning part. It's about tradition and being social and bringing the family together and bonding and creating this happiness. It's basically continuing this tradition even when the grandfather is no more. It's about making sure the family is always living together and having this family fun time. That's the whole idea.

With that in mind, considering the older person who will not be into the technological area, the key attribute, key point of this whole success of this concept is about have no failure states for two reasons. One thing is I'm not confident if something fails, I cannot go and fix it. The second thing is I don't want to ruin the family dinner because it's a really important thing that's happening every week and that's the time everybody get together. You don't want to come there and talk about the food not being good. That's the reason that this becomes really a valuable attribute so I want IoT to provide it.

From the idea of the key areas of that time, in terms of time, it's about making sure to deliver ingredients on time, making sure everybody's reminded when the dinner is happening, that making sure aspect of it. Also, one of the important thing is knowing what's the personal preferences are

and the likes and the dislikes and taste, and how intuitively I can gather this information. It's not anymore an app asking lots of hundreds of questions to know about you. I need to know an interesting way, an interactive way for the grandfather to actually use this device to know people's preferences and elements and how people can share this information together. About the spaces, the key thing is about the physical space, the dining table and all those kind of things because you want to make sure it's all set up in a right form and the right way so that people can get the chance to speak. One of the most important thing also is simply how to think, because it's a weekly time, people might be living in different parts of the city and they might be coming in. So you need to think about where the event is happening. Of course, it's going to be in the same place more or less, but even if you do not have a parking you need to sort out the parking. All this kind of, then once you expand this in the Internet of Things and all that, you can enable like recent technology of knowing where the parking space is and if you're living in a space where there's not enough parking space, how do you allocate bringing people together? It is any point of time making sure how we can bring everybody to that spot always without having any issue as much as possible. That's the whole idea about it. Then also about monitoring available ingredients. If I'm looking at the fridge and what I'm purchasing it and how much I've consumed previously and ordering those ingredients.

One of the other things I was looking into is going beyond the dinner, you are not going to just walk in there and have your lunch and walk away, right? You need to have an after meal spending time and what kind of activities you can organize it accordingly to do that. Intentionality is more about bringing the intuitiveness, reliability and confidence. This is the three key intentionality that I want the IoT to be offering it, because eventually you want to be a very clear and a very more seamless user experience for them to follow through. Because bear in mind, this is not the once in a while event, it's going to happen every week. It means I'm going to continuously using this system and I want to do this as seamless as possible.

The objects wise, definitely in a social messaging chat group like WhatsApp that is already, even though it's not physically present, but virtually go talking to each other and getting to know each other and knowing what's happening, really. Features that manages technology that can aid technology that manages people's preferences and recommendations and trying to combine with the parts, elements of what's in the fridge and trying to bring in these together.

The other ones could be the orchestrating the cooking process as well. Generally, when you have a family dinner you're not going to just make main meal, you're going to make a starters and a dessert as well, but sometimes you need to start at a certain point first. Before we go in to the starting point, how can you do the actions rather than thinking about a particular meal or a main or a dessert, a starter, thinking about the whole event as a thing. What activity needs to be done and orchestrating each of the steps one by one.

Then the words and acts mainly planning, ordering and also talking to, you know, once you're finishing up with the meals and stuff, dishwashing and how do I say that when the event is done, what things goes there.

### Scoring

MK The key things were that it has no failure states

**Participant B:** I think if it's considering everything, then the app itself, theoretically, if it's considering everything like parking spaces and public transport, and the availability, then the app may not fail, but in reality people may still fail.

**Participant B:** So the app might be fail-safe, but life is always...there's no such thing as fail-safe.

**MK:** Yes and sociality...

**Participant A:** Yes. I think it is.

**Participant C:** Yes.

**MK:** Then also happiness, which is one of domestic values, this

**Participant B:** Very happiness oriented.

**MK:** Then preference to return,

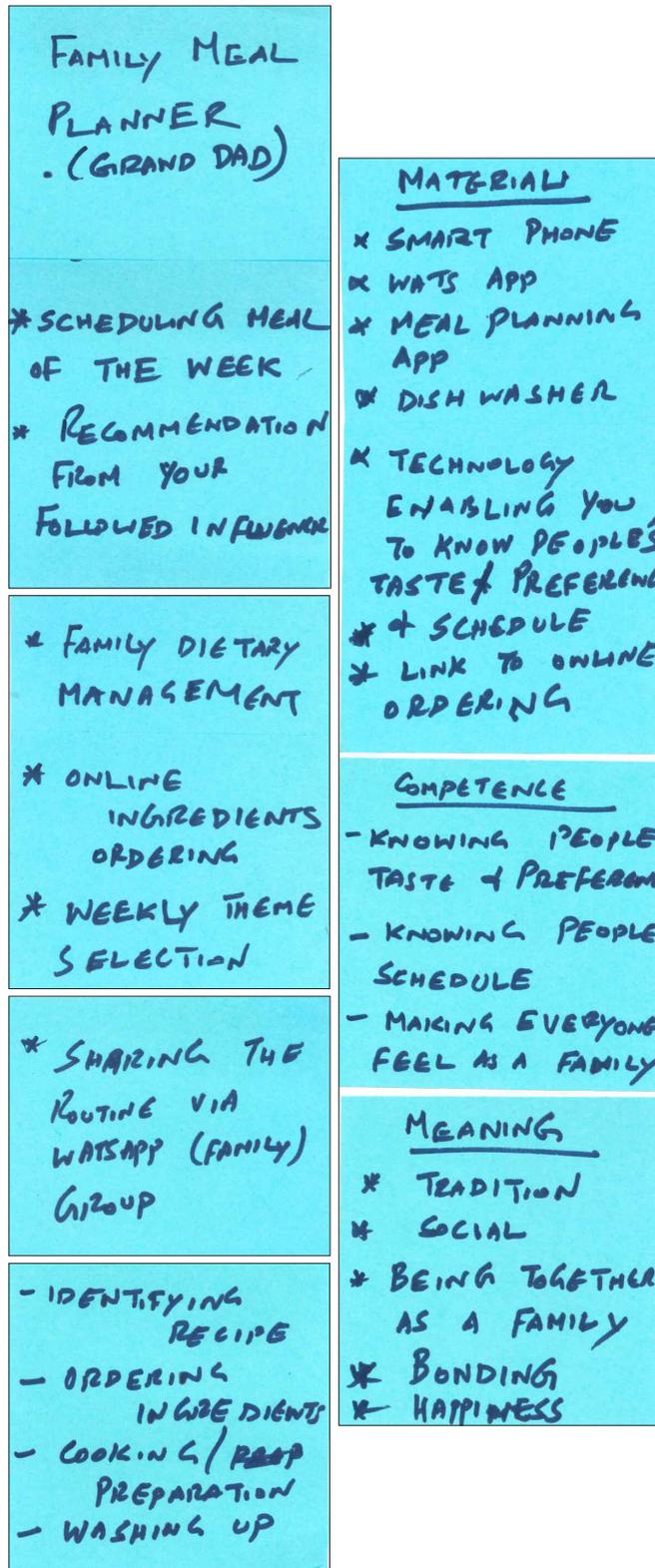
**MK:** Works towards it. Okay. Does it have time perspective?

**Participant A:** It definitely has this kind of thinking about the future, whether it has any focus on what's already been done, or what people have already enjoyed from a food perspective, you know what I mean, like ok, it kind of brings back the thoughts of there's a particular recipe in the library that, I don't know...but I think it's definitely more future oriented than perhaps learning from the

past or the present. That's probably something that could be incorporated in with a little bit more thought and development.

**Participant D:** My intention with talking about the past, present and future was it's about maintaining the legacy within the family dinner. So to going through that, okay, my grandfather used to do, and I'll be doing it. I'm not sure whether if that was the intention.

## Participant D



examples

Having a family meal



"...to do with the relatives and everyone where every Sunday we all meet and have lunch. And my granddad who I never met set that up..."

domestic

Happiness

The experience of happy events and general feelings of happiness are an integral part of home

1

domestic

Preference to Return

I.e. in terms of a locus in space (Gelwicks, 1970; Tuan 1975)

11

domestic

Time Perspective

Places exist as home whether in the past, present or future (cf. Bachelard, 1969; Hayward, 1977)

8

time

EVERY WEEK SUNDAY "LUNCH"

space

- \* KITCHEN
- \* DINING
- \* VIRTUAL / DIGITAL SPACE

intentionality

- \* CONTINUING THE FAMILY TRADITION
- \* BRINGING FAMILY TOGETHER
- \* FAMILY HAPPINESS & WELL BEING

object

- \* WHATSAPP
- \* MEAL PLANNING APP
- \* SMART PHONE
- \* FEATURES THAT MANAGES PEOPLE'S PREFERENCES, LIKE, DU LING

words & acts

- \* PLANNING
- \* ORDERING
- \* CO-ORDINATING
- \* PREPARATION
- \* COOKING
- \* WASHING UP

intentionality

LEARNING MORE ABOUT FAMILY MEMBER INTERESTS LIKE, DISLIKES PREFERENCES

object

- \* FEATURE THAT ENABLE YOU TO ORDER INGREDIENT
- \* FEATURE THAT ENABLE TO ORCHESTRATE COOKING PROLES

intentionality

- \* MAKING BEST MEAL FOR FAMILY
- \* CREATING A BONDING ENVIRONMENT

words & acts	intentionality	object
<ul style="list-style-type: none"> <li>* PLANNING</li> <li>* ORDERING</li> <li>* CO-ORDINATING</li> <li>* PREPARATION</li> <li>* COOKING</li> <li>* WASHING UP</li> </ul>	<ul style="list-style-type: none"> <li>* MAKING BEST MEAL FOR FAMILY</li> <li>* CREATING A BONDING ENVIRONMENT</li> </ul>	<ul style="list-style-type: none"> <li>* FEATURE THAT ENABLE YOU TO ORDER INGREDIENT</li> <li>* FEATURE THAT ENABLE TO ORCHESTRATE COOKING PROCESS</li> </ul>

space	intentionality	object
<ul style="list-style-type: none"> <li>* KITCHEN</li> <li>* DINING</li> <li>* VIRTUAL / DIGITAL SPACE</li> </ul>	<ul style="list-style-type: none"> <li>* MAKING BEST MEAL FOR FAMILY</li> <li>* CREATING A BONDING ENVIRONMENT</li> </ul>	<ul style="list-style-type: none"> <li>* WHATSAPP</li> <li>* MEAL PLANNING APP</li> <li>* SMART PHONE</li> <li>* FEATURES THAT MANAGES PEOPLE'S PREFERENCES, LIKE, DISLIKE</li> </ul>

intentionality	time
<p>LEARNING MORE ABOUT FAMILY MEMBER INTEREST LIKE, DISLIKES PREFERENCES</p>	<p>EVERY WEEK SUNDAY</p> <p>" " LUNCH</p>

words & acts	intentionality	object
<p>SAME AS ABOVE</p>	<ul style="list-style-type: none"> <li>* RELIABILITY</li> <li>* SOCIALNESS</li> <li>* INTUITIVE</li> <li>* CONFIDENCE</li> <li>* CONVENIENCE</li> </ul>	<p>SAME AS <del>ABOVE</del> ABOVE</p>
space	space	time
<ul style="list-style-type: none"> <li>* PARKING SPACE FOR FAMILY MEMBER</li> <li>* SPACE FOR AFTER MEAL ACTIVITY</li> <li>* WHATS APP <del>to</del> GROUP (SPACE FOR MESSAGING)</li> </ul>	<ul style="list-style-type: none"> <li>* DINING TABLE IS ALL SET</li> <li>* INTUITIVE MEAL PLANNING APP</li> <li>* EASY WAY TO CAPTURE FAMILY MEMBERS LIKE &amp; DISLIKES, PREFERENCES</li> <li>* MONITORING OF AVAILABLE INGREDIENTS &amp; ORDERING ONE THAT IS NOT AVAILABLE</li> </ul>	<ul style="list-style-type: none"> <li>* DELIVERY OF INGREDIENTS ON TIME</li> <li>* KNOWING WHAT'S IN THE FRIDGE</li> <li>* SCHEDULED MEAL TIME</li> <li>* INFORMING APPLIANCES AS &amp; WHEN REQUIRED (E.g. PREHEAT OVEN * SWITCH ON DISH WASHER)</li> <li>* REMINDER TO FAMILY MEMBER ON DAY+TIME</li> </ul>

## Appendix Q - 5.4.2: Final PDP Analysis & Reflection

### Reflective Writing

#### Participants

Participant A: Project manager, focusing on cookers which are the only connected product range.

Participant B: Innovation Team member, focusing on incremental innovations and application of new technologies to the core products of kitchen machines. Also exploration of wider tech advance and research focusing on innovations and insight identification in the food space.

Participant C: Team leader for new product design development, focusing on engineering systems such as mechanical elements and system architecture. Little prior involvement in the detail of the IoT, instead ensuring products deliver through testing and proving principles.

Participant D: Lead of IoT for the \_\_\_\_\_ group, focusing on building competence within the company and driving consumer user experience; within \_\_\_\_\_ this would focus on kitchen machines but across the company this also encompasses home control, radiators, humidifiers etc.

A good range of expertise and knowledge of the IoT in this participant group, with some participants having little experience of this sector (A&C), with further understanding and experience from participant C and high level of experience and knowledge from participants D. Product development seems to be driven by applying new technologies to existing products through incremental innovation and developing insights into user experience through design and trend identification. There is also a range of creatively focused design practitioners and engineering and feasibility approaches between participants – is this reflected in the outcomes produced?

Across all participants there is clear focus on the kitchen as the main area of interests, probably due to the company profile. This is a particularly suitable company to work with, as this concern fits into the previously identified themes of food and drink preparation and sharing the rituals... what will the outcomes reflect from this?

#### Current approaches to IoT Dev

Marketing and product managers tend to **deliver specs or ideas around different things we hear**.

Innovation team can understand what we are looking at, competitors, understand what they're doing in the market around perhaps a **user experience or IoT technology** and then from there we would work across the categories to demand what we want from our product.

**I think a lot of it will be driven around time**. There's this focus on **time saving and multi-tasking** so a lot of our consumers tend to be-- people are increasingly more and more busy and they don't want to spend time necessarily, or don't have the time to spend in the kitchen cooking something but they **still have a focus on being very healthy**, so they want to make food from scratch. **What we try to facilitate with the connected products is that a consumer can kind of throw it all in and press go on their phone and then wander off and do something else**. It's about kind of like this **parallel living** so they can look after their kids if that's what they're doing or watch TV or go and do the gardening but they can also just know that their food's being prepared for them in the kitchen at the same time.

So there's that element of focus, but **also around assisting people with becoming better cooks**. The app that we have at the moment really focuses on step by step so it really is like "add this, add this, add this" **very very simplistic for the consumer so if it's not something you're very confident in it guides you through that process**.

It's not something I've personally been involved with a colossal amount but my involvement would be finding out people **that are doing connected products and having a look at what they're doing and what kind of benefit they can find to the consumer** and then just understanding if there's this a **real consumer desire**, consumer need around that as well, just gathering and researching.

I think in our team especially, we've been taking on **the more food and consumer-centric approach** trying to understand **whether the finished product and the experience would be beneficial if it was that connected product as opposed to a non-connected product**. a lot of the benefit and joy of baking we've seen **this experiential in this, it's using the products and it's being hands-on and it's understanding whether the Internet of Things can fit into that space or whether you're possibly detracting from that experience**.

From an engineering point of view, currently **it follows our standard the stage-gate process**. It comes

from ideation, proof of principle, prototypes and all that sort of stuff. It also ties in to some of the IoT stuff but from a project point of view, it's not really treated that differently from another connected project. We find extra bits bolted on and a lot of the app development things tend to happen quite later on in the project because we need a base product to work around. I think most of us are from a design background and we understand that you don't just bolt things on if there's no user benefit. There's going to be a user benefit to it.

Product development can start from marketing delivering specifications or early ideas through competitor analysis, using either IoT technologies or user experiences to frame this. This is also informed by looking at current user's activities with connected products, the benefits they can identify between connected and non-connected products and understanding if there is a genuine consumer desire, particularly from a food preparation perspective. Detailed product development follows a standard design process, with app development developed later on rather than concurrently with the understanding that this development has to benefit users.

User benefits are important – this is seen as time driven, to save time or allow multi-tasking in parallel living to allow users to put it all in the machine and do something else while checking on the phone. There is also the understanding these product could assist users to become better cooks, with apps that teach users step by step in a very simplistic manner to guide them through the process. There is some sensitivity to experiential elements, as using the kitchen products and being hands on were identified as important aspects, with understanding that IoT products had the potential to detract from this engagement and experience.

#### Evidence of Process on Thinking

**MK: Has this process helped you see that the home is a different space to the sort of other IoT contexts? Because you tend to work in the home anyway as this company?**

**So has this changed your understanding of what the home is?**

**How people consider it and the things that people think are important to it? How has it changed that?**

#### **Participant A**

Yes, I would say so when we're talking about the values of the home, and talking about relationships, et cetera et cetera. I wouldn't say there's something necessarily would perhaps considered if you were talking about using your app to try and find a car parking space. So there's home values that we all discuss, we've all ranked them and said, "Actually, you know the relationships is really important, et cetera, et cetera". So I would say I wouldn't have thought of those things before, but actually thinking of them now. They're probably more important than we necessarily give them credit for.

#### **Participant C**

I think the interrelation between things. This has helped me think about a lot more, which I guess is what about the Internet for Things is. [laughs] So it's definitely helped with that.

**MK : So if you were thinking about the home is a different space, to say the office, you know, and you were designing a product for the home as opposed to the office, what kinds of things would you think about having been through this?**

#### **Participant B**

I think more the emotional aspects of things like highlighting...I mean some of these cards highlighted how a home is like a very emotional place for us and like a very safe space for people. I think in most cases, and that's very true. Sometimes it's easy to slip into the habit of thinking of the home as like a sterile kitchen, which you would just plonk your machine in. Your mindset when you're home is totally different to when you're anywhere else. I think it brought that to my attention a bit more.

#### **Participant D**

Who would look into the procedures, very important point of bringing technology into the home. It's about how even when the failure state, because once you start depending on something to do something and if it fails for whatsoever reason. Then you don't know how to then react or inform yourself to what you should do next. It's basically just affecting the confidence of yourself. That's something a problem which means I need to now consider things which I may or may not have considered previously, like creating this intuitiveness and seamless integrations between these things.

Do things, because if I'm relying on myself, I know my ability, what I can do it and so I will stop or do things. Once you become totally relying on technological things to actually enable you to do you and do a normal task. Then it becomes a barrier if something goes wrong, because you don't know, "I need to wait until somebody comes and fix it for me", or these kind of things because there's not enough knowledge or the knowhow within the consumer side to accomplish that.

**MK: how has the inclusion of user practice helped form your concepts? Because from what you've said, removing the ability to do something. The competence of doing something is a barrier to then continuing that practice. So has including practice as a concept in this helped you think about how those elements affect further concept developments, and the problems inherent in some concepts that are very automated?**

**Participant A**

I think with my one, because she was a child and you were comparing the competencies of an adult. There were certain things that she couldn't do such as refill it with milk for example. You have to then pull in that competent being to be part of that. Actually it did make me...I was just like, "Oh yeah, I'm sure. Do you press the button and you get the milk? Fine". I was like, "Hang on a minute who's going wash her cup up? Who's going to fill the milk up?" There was all these things that perhaps, if you're just thinking you would, "They're competent, they'll be able to do it", but as soon as you start thinking about them being a child and therefore not having that competency. It did open up a few more avenues of, actually, well that's kind of almost-- Is it a negative thing that those things are all automated now? If the whole process isn't automated, so?

**Participant B**

You assume that everyone's capable of everything. It's a reminder that you do need these set of competencies in order to utilise the system.

**Participant C**

I mean the interrelation of all of the factors that create a practice is something new to me. I can't tell you exactly which ones it is, but obviously it's a combination of all these things. That's quite interesting.

Yes. Potentially that's where the product if you were selling it, would fall down. You could end up focusing on, "Oh yes. It does this." I've still got to do this, and this, and this.

**Participant D**

Yeah, definitely. Yeah, definitely.

That's where the opportunity for you to find, because the new innovation to come through. If you see lots of technology that's there or even the new designs. It's been an evolution of improvements, reaching the point of being matured and being more appreciated by the people. So by introducing IoT in lots of areas, yes, it solves the problem, but it doesn't...it solves the problem in a particular context, it doesn't really take into account the other external factors that creates a new problem which we are not aware of it. Which is slowly...and it involves education of the users as well as a technological improvement at the same time to go hand in hand. It needs to work together...

**MK: So one thing I'll be looking at through the whole process is this idea of the qualitative of what we do, the experience of the home. The quantitative of the IoT is very driven by data detection, analysis, and then making something happen. Do you think there's a boundary or split between the experience and the quality of things? As conducting them yourself and the quantitative nature of the IoT being quite automated and doing them for you? Has that come through this workshop? Has that made you reform how you think about what the Internet of Things is for people?**

**Participant A**

: Following on is the business about time saving, but it's also what I said at the beginning. Is it a chore for you? Because if it's a chore then automating it is fine. If it's not a chore, it's something you enjoy, then automating it probably isn't something that you want.

**Participant B**

Yes. Obviously, it varies from person to person massively. For me, having a cake at the end of baking is the least important bit for me, that's all. It's, well actually the least important bit is buying the ingredients because no one likes doing that. It really is about--

**Participant C**

: To an extent. I think it has, but with our particular products, like cooking. It's quite a human thing, and I think we're all fairly aware that what we're doing is taking away that touchy-feely aspect to it. So there are some things that, yes sure you want to automate it because they're - -They're the mundane things. It's like, "Yes, I could chop all of these carrots by hand but I've got something that does it." That's fine but when it comes to kneading dough and things like that. Some people actually quite enjoy the process of kneading the dough.

Well the thing is, if it's not cheaper, then it's got to enhance something. It's like cake mix, it's like, "Well you know I can add water, but I still got to bake it. So why don't I just buy a cake?"

**Participant D**

I think there is a really clear distinguishing, like what IoT can bring because of cooking itself. Maybe I put it this way alright. As a user there is a level that you cannot do it, you rely on technology to do it. For instance, I cannot heat right? Similarly, I can mix it only to a certain level. So that's fine when you're relying on a technology to do it, like our appliances. Where if I wanted to chop one cabbage, slice one carrot, I would use a chopping board and knife. Because the time I take to take a food processor, chop it and slice it and washing it back again, drying it up, putting it into the cupboard. Generally, it's shelved off enough people never use it. But if I say we have a guest coming up, I need to use three kilos of carrots, then I have to use the technology to do it. So these are physical activities that where technology similarly...it's a similar logic applies for IoT as well when the technology we use. I see more value for IoT outside the food preparation itself. The cross integration when I go to the shop, this is what I look for. Where does the product come from, or or the provenance come from? Is it being factory or is it being organic? All of these things. If this information can be collated and give it in a format where it talks with each other, okay, my decision is much quicker. An as a user generally, we want to make a decision quicker because it keeps you happy when you make a decision quicker. For me, that's where the real value IoT is adding if I enable to make decisions quicker, then still let me do what I need to do. Then that creates a beautiful experience for me.

**MK:Has this made you rethink how the system of the Internet of Things shaped the products you use, the way you engage with it, and the practice you do? I think we've kind of covered that slightly already. Is there anything else you want to add to that?**

**Participant A**

**Participant B**

**Participant C**

: It probably dependent on what stage you're looking at it as well. If you're looking at it with our products in mind, but if you're looking at it from a complete new idea, then it's that things like the fridge, but that's different.

**Participant D**

Well, because I've been very closely involved with this IoT side of it. I still feel that it's not shaping the actual physical product itself so much. Other than the fact that you are actually enabling the machine to talk. Nothing more than that, right? Because it's not...the fundamental intention of this machine is not to be an IoT product it's to bake or mix a cake batter, right?

So that's the intention that's not change, which means the form and the shape and the user interaction has not changed and we do not have screens on these machines as well. So the only thing that has changed is the thing that sits outside the machine itself. So still I'm not convinced yet the fact that it has changed the product what we are designing it to it's fullest extent. It depends on

the definition of what the product is. Take a purely physical product, I would say no, not changed much. It stays as it is.

**MK: Do you think that the IoT can help conduct or conduct completely independently meaningful acts? In terms of maybe the meaning of a practice? Do you think the IoT can help change the meaning of a practice or develop the meaning of a practice?**

**Participant A**

Finding a car parking space. They're always a really good answer.

I don't really like IoT or technology. I like it, it's helpful, but I think we rely way too much on it nowadays. I actually don't think it's very healthy to have in the home. There's only things...you see some people replacing certain elements of their lives with it. You can sit and scroll for hours on Facebook or Instagram and people don't read books anymore. I come in to work sometimes and say what you've done this weekend, "I baked a cake and I did this", and people are like, "You're really weird". People think I'm weird because I do things that aren't necessarily focused entirely on technology and that's weird for a millennial. I just think that relationships are better for-- I don't text my friends or message my friends on Messenger or WhatsApp very often. I actually call people quite a lot because I hate using Messenger because it's constant and I don't want to be pestered by it all the time. I feel like there's going to be a bit of a backlash. I feel like people are probably going backwards and the fact that there's all these like, detox camps that people are trying to attend. This focus around limiting the amount of time you're on your phone for, you can set limits on your phone now, I don't know.

Just there because it can be. Because the technology exists, let's just do it.

**Participant B**

I was just going to say I think IoT just leading on from this is. It can provide meaning in some context, but it just needs to be thoughtful, responsible and not try and cover too much. Just provide just a small amount of very helpful information that you might otherwise have to go quite far out of your way to get, that helps you achieve something not just meaningless. It helps in terms to...

**Participant C**

**Participant D**

I think it's quite a lot of meaningful-- it depends on the context, of course, but definitely there is lots of meaningful value that it can add to the projects.

I would say it might bring in a new dimension to the practice itself. Whether we like it or not, maybe it becomes a new routine on your own. So for instance, 10 years before, when we had this first smartphone coming through to the...iPhone coming through with the touch screens, and the swiping thing doesn't exist at the app... doesn't exist and things were more, with the Nokia phones with icons and things. It's not changed your whole behavior of planning or activities or anything still didn't stop people taking notes and writing people and also typing it in. Today the overall the kinesthetic aspect in the schools things are people expecting to learn computers and iPads today. For me the object intention, it's not changed but the way we are the...that's given the new dimension of achieving the same thing in a different way. Whether it's good or bad it's for discussion.

**MK: This is interesting, because that leads me into a question about this overall method is, do you think that what we've done today has helped to make the user central to the process of developing ideas rather than that technology? MK: How has that happened? What parts really helps you get into their head, and understand how to design around the user and the experience rather than the technology side of it?**

**Participant A**

They're hard as well. Looking at a bookshelf? And then when you ask us to do our thing, I was like, "I'm going to change my cards out". It's not so easy, is it? Especially when there are things that are around the fridge-freezer thing, you heard of in the background. I was like, "Bookshelf, oh my God, what am I going to do?" **I would definitely say that when you're thinking of people's habits a little bit more or you're looking at their activities. How can you improve those? It does make them a lot**

more...

: It wasn't really about...even though we chose the people first they weren't the main driver. We read what they did, we read that they like cooking, but that didn't really mean anything. It was only where, like you say, where we had these, like you're practice examples. You were just like, "Okay, now I've got to try and think of something that's going to benefit this person".

: I would say from a marketing perspective what's made me realize that we have a lot of these personas of people in our segmentation, who don't necessarily have many of these motivations when we're developing. I would say we're lacking motivation.

I think this has been great. I want some of the cards! I want to do it again. Everyone should have to do it.

#### Participant B

Definitely. It's been really good.

I think just starting from house, person, action, it's like, every time because it's so difficult to think of things outside of a context. When you're trying to come up with an idea for like a system or a product or anything in really any context. Unless you have this really well-defined set of actions and persona and environment, which we had here, which we established at the very beginning. It's very difficult to explore any detail because you get caught up in the first stage just thinking "I can do this or this or this". Instead of following a route from "I have this precise scenario" and then you can develop the idea further. I think that's what I liked about it.

That's also a much greater challenge to consider every single stage; in this we only had one stage. We had one action that we did. I can imagine it's a lot harder to stick to when you've got so much to consider. Maybe when we do this, again, we have real-life examples of what you've identified as key motivations. The top 10 key motivations when our average 39 year-old consumer decides she wants to bake a cake for any...

I really enjoyed it.

#### Participant C

I think the practices. That was pretty, pretty key, because it's these are the things that people do.

Yes, pretty useful.

#### Participant D

I think you start with the user as a starting point it's completely. It's not even a user actually it's you start with the motivation. What's the real motivation you want to start with, and then you end up defining the user to it to associate a user. You start linking these two things, the personality and the motivation together and start building your story behind you.

That's never going to change whether you are with an IoT or a blockchain tomorrow, or not. That's not going to change. Maybe the way I would read a book and I'll go and select a book on a bookshelf would change and stop going to a physical bookstore. I may be going into a Kindle and searching for it, but that might change. Really, the intention is not changing and that's driving experience.

**MK: Interesting. Just two, three more quick ones. How did you find the domestic values? The user-generated values, these attributes and themes? Were they useful for framing the development of your concepts?**

#### Participant A

: Yes, I went the other way. As I was going through my idea, I actually decided I didn't really like it. I thought this isn't very nice. I don't think it's a good idea like a turnaround. I was like, "This is rubbish. I don't want this poor child to have to be pressing a button all the time." I thought it wasn't very good for relationships, so I picked one that was quite negative, like what does actually this do for relationships like a contradictory one. I won't want to-

#### Participant B

Yes, it's brilliant, I found so far that it's incredibly thought provoking.

In my field which is just exactly that, it can be a real challenge sometimes to rephrase, rethink about problems.

: I found the red ones, the negative IoT themes ones to be more interesting. I think, not necessarily, more interesting, more helpful because I realize for the first one, What were the red ones again?

I only chose positive ones and now going back and I wish I'd done more negative because when I chose this one...it just helped me sculpt the idea a lot more.

You should always go through that stage realizing that it might be a bad idea as well. That's just an essential step onto developing a good idea.

Participant C

It's important, though that you flesh it out at this stage rather than when you've got a prototype sat on the bench, worse, something that you're marketing.

Participant D

**MK: Do you have any suggestions for developing this to make it a more useful tool, or a better process, or anything you want to point out that didn't work for you? Anything you want to point out that was the best thing for you? Mainly, future development suggestions would be really handy.**

Participant A

These (Definitions on chits) are quite technical.

Participant B

I'd have struggled if it was just pen and paper.

Participant C

I think getting all in one place-- Maybe it'd been different if you're not on the table, but getting everything up so you can see it. That makes such a difference. I don't know whether you want to keep it free form like we've done or whether you have a big sheet which is like zones.

It feels like this is probably the first stage and then you probably go through, and once you weeded them out little bit, then you'd start, maybe layering more of these on.

The only thing I would say is this (THE DOMESTIC MAPPING) was quite useful from a start of the discussion. I don't think it was a lot of use afterwards. I don't know what you were expecting, but for me, I didn't refer to it again as an icebreaker to start I through it was break.

Participant D

Where I'm coming from is one of the real challenges with all these exercises is the that we reach this point. After that, we don't know where to go when we end up, which idea should we choose. Anything that you have-- tools or things that you can do. Fine, we got this fantastic picture, four great concepts. That's great. Which one should we focus on to start driving towards the execution side because that's what is going to-

Future Developments for toolkit and workshop

**MK: Do you have any suggestions for developing this to make it a more useful tool, or a better process, or anything you want to point out that didn't work for you? Anything you want to point out that was the best thing for you? Mainly, future development suggestions would be really handy.**

Participant A

You can probably layman term them (the chits) a bit and maybe make them like you say, a little bit more accessible, maybe like they were printed and you could read them a bit more clearly. That's was quite an important element. We looked at those things in two different levels. When you first started talking, I was like, "Woah." You talked about time as well and how you need time to digest things, and I was like, "Wow, going so fast!" It was quite speedy, that bit, in particular. I think the other bits were fine.

Participant B

You have to choose one negative one (theme) and one positive one or multiple negative and multiple positive, but to, not necessarily enforce but encourage people to choose one of each, at least. Just to get into it, because you could have people that have come into a session with an idea already in mind, something maybe that they're working on, an idea they've had a while back and enjoying. I've seen this before happen in other meetings in ideation sessions with people where they come in with an idea and they only enforce their own ideas. I think, providing people with more opportunity to challenge their own idea. I chose negatives one, but it could've gone through and just reinforced my own idea.

Participant C

: I guess if you try to compare all of these against one another, you need to use the same constraints. You'd have to then compare all of them against quality of relationship.

Participant D

You need to have your core domestic values for each of your product and compare them. You need to develop multiple concepts and really compare. Within the self-expression, how much is that concept is playing, weighing against the other one. That's the only way you could. That's why I'm trying to...

Where I'm coming from, MK, is like you remember when I first started the discussion with you in terms of doing that is, I would like to get a couple of workable for the business too. One side is, "Okay, we've got a great tool to learn out of it, but I would also like to see some kind of concept coming throughout of it.

So that that becomes a feed for our product generation, product generation to move forward. I want, next step, I would like to associate this with the actual physical product itself and see where we stand.

## PARTICIPANTS

This workshop had four participants: Participant A (PA), a project manager focusing on cookers the only connected product range within the company; Participant B (PB), a member of the Innovation team, focusing on incremental innovations and the application of new technologies to the core product range of kitchen machines; Participant C (PC), team leader of new product design development, focusing on engineering systems including mechanical elements and with little prior involvement in the detail of the IoT and Participant D (PD), head of IoT for the company group, focusing on building competence within the company and driving consumer user experience, mainly in kitchen machines, but also encompassing home control, radiators, humidifiers etc.

These participants demonstrated a good range of expertise and knowledge of the IoT; some had little experience of this sector (PA&PB), with further understanding and experience from PC and high level of experience and knowledge from PD. Within the company, product development is driven by applying new technologies to existing products through incremental innovation and developing insights into user experience through design and trend identification. Across all participants there was a clear focus on the kitchen as the main area of interest, presumably due to the company profile; this is suitable company due to this concern fitting into the previously identified domestic practice themes of food and drink preparation and sharing the rituals (SECTION X>X>X>X)

what will the outcomes reflect from this?

There is also a range of creatively focused design practitioners and engineering and feasibility approaches between participants – is this reflected in the outcomes produced?

## CURRENT APPROACHES TO IOT DEV

Product development with the company starts from marketing teams delivering specifications or early concepts identified through competitor analysis, using either IoT technologies or user experiences to frame this. This is also informed by looking at current user's activities with connected

products, the benefits they can identify between connected and non-connected products and understanding if there is a genuine consumer desire, particularly from a food preparation perspective. Detailed product development follows a standard design process, with app development developed later on rather than concurrently with the understanding that this development has to benefit users.

The benefits to users are important to these offerings and is typically seen framed as time driven, either to save time or allow multi-tasking in parallel living to allow users to put use a machine to cook and do something else, while checking progress on their phone. There is also the understanding these product could assist users to become better cooks, with apps that teach users step by step in a very simplistic manner to guide them through the process. There is some sensitivity to experiential elements, as using the kitchen products and being hands on were identified as important aspects, with understanding that IoT products had the potential to detract from this engagement and experience.

#### **GROUP DOMESTIC SPACE SETUP AND USER SELECTION**

A number of cards were provided to allow the users to setup an example domestic space, with the intention of contextualising the places that the concepts developed would take place and to provide a sense of interconnection between practices and concepts developed around these.

Participants engaged with this process, stating that it was like a puzzle, developing a home with two floors. Through this process the participants considered the different spaces of the home, the order in which they were arranged and the overlooked elements, such as the toilet, which was added after the rest of the ground floor and the start of the top floor. The space itself was described by PA as 'the quirkiest house build ever,' with the first floor consisting of an entrance, leading to a toilet and a hallway. This led to a staircase and the front room, which in turn led to another hallway, connecting to the dining room and the kitchen, from which was a utility room. The staircase from the hallway led to the second floor hallway, which linked the bathroom to three bedrooms.

Following this, the group selected a range of users to develop their concepts around, with participants developing imagined relationships between them. Albert and Penny were immediately thought of as the grandparents, Maisie as their grand-daughter and the child of Katie's first marriage to Charlie, with Moses her step-father and preschool teacher. The domestic space setup, combined with the range of users helped to frame this selection as a family or community that would interact and share this space, rather than individuals in a room, creating a multigenerational family that interacted across this space. Participants stated that this was more realistic and that they were arguing over which of these 'pretty standard people' they would sell their product too, whereas any of them would be good. However, some of their research involves participants over 70. However, participants felt that this represented not only a broad spectrum of their market, but a family that might buy and use their products.

#### **THEMATICALLY IDENTIFIED FEEDBACK/IMPACT**

The workshop process clearly impacted on the development of PA's concept, which moved from a relatively simple automated system of providing milk to Maisie, to a more complex understanding that considered practice aspects, UGVs and DVs. This change can be attributed to elements of this process, including the UGV, DV and practice understandings.

Practice aspects helped PA to consider these elements in more detail, including the times of access, the spaces this would be situated, the objects involved, the words and acts needed and the intention of the concept. Furthermore, PA was able to critically evaluate these elements, identifying that this concept could limit future competencies by minimising engagement in the materialities of using a hob and saucepan to heat milk, and that this might have an impact on future practices. PA also identified the social implications of removing the words and acts of asking for permission to drink milk.

The DV of quality of relationships and responsibility could be argued to have supported PA in by contradicting their initial concept, forcing PA to considered the implication so pressing a button to get milk and how this automatic system impacts on quality interaction between child and parent and augmenting parental responsibility by shifting this into the interaction with the concept's interface.

The UGV of negative opinion of loss of social/physical interaction and positive understanding of convenience were useful to the participant. Even though loss of social/physical interaction has similarities with the DV of quality of relationships, this UGV prompted consideration of how this could be countered or viewed positively and a re-evaluation of interaction in maintaining the device; however this could still have a negative impact on the child to parent social interaction.

At the evaluation stage of this process, PA's opinion had shifted from a mainly positive perspective

to understanding that there were negative implications of applying the IoT in this manner. In particular, they had identified that the interaction between parent and child was mediated by the object and that there were negative implications due to this that related to practice elements.

### **GENERAL OBSERVATIONS**

Overall – everything was an app!

Practice impact – from real examples UGVs of past participants. More effective than building a practice as per last research activity. Take it and break it down and then build lo version seems to be more effective...

Review of write up to id where the value comes in and if it affects by process?

Little physicality

Impact of process

### **Background & Expertise**

#### **Participant A**

I'm a project manager and I look after the category all in one cookers. At present that's only Kenwood. They are presently the only connected products and things in the home.

#### **Participant B**

I work in the innovation team here at Kenwood. I work on a broad spectrum of things, but it tends to be looking at incremental innovations and new technologies that can be applied to our core category of products. It's not strictly limited to our core categories, which are kitchen machines, food processors, hand blenders and those sorts of things. It's exploring the wider technologies that are out there that could be applied for the future as well as researching new innovations and gathering insight and trends within the food space.

#### **Participant C**

I'm the team leader for the design development of new products, mainly from the engineering systems overview side. This is the mechanical side and also making sure electronics ties in well from a system architecture point of view, not getting involved in any of the detail seen in the IoT but obviously from a testing, proof of principle point of view and all that. I've got to make sure that the products deliver

#### **Participant D**

I'm responsible for the Internet of Things for the group, the DeLonghi group. My area of focus is building the competence and also responsible for driving the user experience for the consumer products across different categories. For Kenwood maybe on the kitchen machines and food mixers and those kinds of categories and coffee machines. Then, overall the home control domotics products, the radiators, air conditioners, humidifiers and those kinds of things. So that's my role within the business.

### **Current approaches to IoT development**

#### **Participant A**

Marketing and product managers tend to deliver specs or ideas around different things we hear. RF and his team, innovation team can understand what's onboard, what are we looking at, different competitors, understand what they're doing in the market around perhaps a user experience or IoT technology and then from there we would work across the categories to demand what we want from our product and then we would touch base internally to understand if there's something we could execute so link up with the engineering teams.

I think a lot of it will be driven around time. There's this focus on time saving and multi-tasking so a lot of our consumers tend to be-- people are increasingly more and more busy and they don't want to spend time necessarily, or don't have the time to spend in the kitchen cooking something but they still have a focus on being very healthy, so they want to make food from scratch. What we try to facilitate with the connected products is that a consumer can kind of throw it all in and press go on their phone and then wander off and do something else. Their phones with them all the time so when that process has finished and they need to move to the next step they get this notification on their phone. They can go back, interact with the appliance again when they need to. It's about kind

when that process has finished and they need to move to the next step they get this notification on their phone. They can go back, interact with the appliance again when they need to. It's about kind of like this parallel living so they can look after their kids if that's what they're doing or watch TV or go and do the gardening but they can also just know that their food's being prepared for them in the kitchen at the same time.

So there's that element of focus, but also around assisting people with becoming better cooks. The app that we have at the moment really focuses on step by step so it really is like "add this, add this, add this" very very simplistic for the consumer so if it's not something you're very confident in it guides you through that process. What we have here is that our development recipe team who create the recipes have implemented them in the app so that if you add, I don't know, the flour and the milk together for a béchamel sauce for example, it sets the time, the temperature and the speed automatically. So that process works, so it's not something the consumer has to go and find out if they're not sure. It's kind of filling in that gap for them there so if they're not confident around something, or unaware, then that information's being fed to them.

#### **Participant B**

It's not something I've personally been involved with a colossal amount but my involvement would be finding out people that are doing connected products and having a look at what they're doing and what kind of benefit they can find to the consumer and then just understanding if there's this a real consumer desire, consumer need around that as well, just gathering and researching.

I think in our team especially, we've been taking on the more food and consumer-centric approach trying to understand whether the finished product and the experience would be beneficial if it was that connected product as opposed to a non-connected product. Typically, especially in baking, which is a huge part of our business, these stand mixers, a lot of the benefit and joy of baking we've seen this experiential in this, it's using the products and it's being hands-on and it's understanding whether the Internet of Things can fit into that space or whether you're possibly detracting from that experience.

#### **Participant C**

From an engineering point of view, currently it follows our standard the stage-gate process. It comes from ideation, proof of principle, prototypes and all that sort of stuff. It also ties in to some of the IoT stuff but from a project point of view, it's not really treated that differently from another connected project. We find extra bits bolted on and a lot of the app development things tend to happen quite later on in the project because we need a base product to work around. That's it from the standard product stage gate process.

I think most of us are from a design background and we understand that you don't just bolt things on if there's no user benefit. There's going to be a user benefit to it.

#### **Participant D**

##### Elements of toolkit and concept development

#### **Participant A**

##### ***Practice Examples***

Oh I got the curtain one yeah.

Looking at a bookshelf.

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##### ***Ideation Stage 1***

I have been looking at the bookshelf and I was like completely stumped initially but I started thinking about--

##### **CONCEPT 1**

Well I was thinking about Penny actually. So I was thinking Penny, I don't know if she likes cooking but she can like cooking for this example. She has got a lot of old recipe books. Maybe actually all the family want to use them so she's got all these old recipe books. You can't actually get them anymore because they're that vintage. They've got quite a lot of old family recipes in there so I thought instead of having to re-buy them on Kindle, which you can't actually do anymore, you should be able to scan the book bar codes and there should be system where you can access these books now.

If you already bought the book you can have it in a digital version automatically without having to re-buy on Kindle. From there I was writing a few other ideas and I thought actually maybe she prefers cooking out of a recipe book. Maybe she doesn't want to be necessarily following on a phone. There's a particular recipe she loves that she wants to make, call it shepherd's pie, she knows she has it in one of her books but she doesn't know what book she has it in. So she can ask Alexa or something, I want to make that shepherd's pie recipe, I know it's in one of my recipe books, can you find it for me or let me know what the book's called and the author. So she can go through the books and find it and get the book out and read it from there. Like your own personal recipe database.

That was from the bookshelf point of view.

## CONCEPT 2

My other one was making a hot drink and I thought about Moses and Maisie for this one. Moses is doing his yoga. I can imagine he is probably an early riser it's quite a simple idea but his alarm goes off, it sets him off the machine goes off at the same time as the alarms or thing or 10 minutes later, makes him a green tea or whatever he wants to. Maybe we'd like warm milk but she could only have her warm milk if her parents go to the kitchen and pour the milk and get it ready for her. Maybe there could be a system whereby she knows there's a special button that she's allowed to press on this machine that will dispense it into a special cup that set up for her so she can like access it herself, to get to that little bit of independence so she doesn't have to go out.

Yes, it's not too warm and it's non-spill, so it filters through like a lid or something.

Yes, so just like so she's got that little bit more freedom, her parents can do what they need to do.

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### ***Domestic Values***

Friends and entertainment, self-expression, responsibility, architectural style, and permanence.

Actually, I got a couple for the reverse, that contradict my idea. I've got permanence, as well, the continuity at homes, building on the idea of, you can keep these if we do integrate personal recipes into that database system. You're keeping the permanence. There's old traditions, you're keeping alive through that. Then, on the reverse, picked out a couple like quality relationships. Obviously, that's something really important, but what does it mean for Maisie when her mum and dad aren't interested in getting her milk for her at four years old and she's to press the button on her own. That interaction between parent and child that's probably very important at such a young age. I thought that was a little bit contradictory and the same falls with responsibility. Is it a parent's responsibility to execute that or is it not? Does it bring into question some areas there?

### ***MMC & Practice Aspects***

Okay, so what space, objects, time, intentionality, experiences of the world...

### ***UGV***

### ***Final discussion***

So, milk for Maisie. Kind of this concept of allowing a child perhaps to have a little bit more like responsibility in the home for like to getting themselves a drink if that's something that they want instead of always having to like to- to their parents and having to ask. So, I kind of like personally went through a bit of roller coaster with this one because first I thought it was a good idea, then I thought actually maybe this is kind of a negative thing like it's actually limiting like those social interactions that are probably really important for a child.

So I'll run through it with a little bit of structure, so time, I guess it's always running in the daytime so it runs from 6 am to 6 pm and it will only dispense the milk twice a day in a limited quantity. That kind of plays into objects. As it's an IoT device, it'll be accessible via an app so a parent will be able to look at information such as they could probably limit that time further. If they wanted it between 8 and 3 they could adjust those time frames, those parameters, they could put in different things like the quantity of milk they want it to dispense and a few other...I've got loads of notes but I feel like they've all moved. Anyway, that sort of thing.

And then in terms of space, so the appliance will remain in a communal space, kind of in the kitchen area. I mean the kitchen is becoming increasingly open plan, part of the home so it's not like she's going to be in there on her own but I mean it could be a possibility and it would be kind of worked around so that from a technical point of view there wouldn't be any harm to her. With the space

thing I thought also, and again with objects you'd need to have an understanding of how and when perhaps the appliance is running out of milk, so you could have it then speaking to B's fridge and understanding is there any milk left in the fridge or is it something we need to order in and that could be a notification through some sort of merged system or whatever, however that would work. So the intentionality around here, I think from a positive side it would like kind of to teach Maisie a little bit about responsibility, so the fact that she only has provision to get it twice a day, does she have the ability to wait or is she like drinking one at 8:30 and another at 8:45 because she's like, "I love it so much I want it right now." But then she realises, well that's it, I'm done so is that actually having a positive impact on her and teaching her from a younger age "okay I've been given two but if I eat it all now that's it for the rest of the day." So is that encouraging decision making there?

Again I did counteract myself a little bit here. I don't know if this was potentially like a negative thing here. Was it removal of responsibility for a parent and did that mean that the relationship could become more about a parent's interaction with the appliance and the child's reaction with the appliance than the child to parent relationship? Because you're kind of like a giving person and a child respects that but what does that mean long term for that child if they're always expecting kind of those results from an appliance and not necessarily from a human? But I didn't know actually I was kind of thinking perhaps on a really long-term level maybe a little bit too deeply but actually what would be the implication for someone if that was an introduction to how they were being given something?

And then to words and actions I thought that it fundamentally removes that action of asking permission, so as a child you have to ask your mum and dad for everything like that's just how it works and I didn't know whether that was a good thing or a bad thing, that kind of automation? So did it result in kind of loss social and physical interaction for that child? I kind of think that actually...and also kind of negatives, like what impact does it have for future activities? Does it limit creativity? For example, if you're boiling milk on a hob then you kind of have that interaction with the hob and that becomes part of a wider eco-system of cooking things, whereas if you only always pressing a button like what does that mean for the way you like to eat and how you'd like to access food and how you'd like to cook for the future? Does that mean like the microwave's the one to go to because it's one click? Or ordering food online is the only you kind of know how to do, so I didn't know-

No I don't think so. I think there was certain elements where interaction was actually required for example, say there's this special cup that you slotted in, that would have to be found, washed, there would have to be some *priority* of interaction there. There were elements of it not being entirely automated.

I did write that the app can locate the mug. It can locate the mug over the app.

### **Scoring**

I think it's low for quality of relationships, but that being said I think there's a good argument for cognitive learning. There was a study that showed that children who couldn't wait for things, who knew the whole marshmallow test, those who could do that scored better in their tests and all that sort of stuff.

**MK:** In terms of quality of relationships it's middling, low?

**Participant D:** I would say low.

**Participant C:** If that's the case I'll probably give it like a 5.(Neutral)

C: Say if we're still talking in the context of milk and not anything else like just nutrition, it depends on the individual, but if Maisie's asking for milk a lot, if it's an essential part of her diet as a child then it's very convenient.

**MK:** How do you feel about this with the theme of loss of social and physical interaction?

**Participant C:** It's definitely less.

**Participant D:** I don't think I agree with Participant B here because it's knowing what I want and if my mum and dad cannot give it to me anyway I need to, even if I ask my mum and dad and they need to go to this milk dispenser to get the milk for me. The milk dispenser is just an enabler to give a cup of milk. If I wanted I would go into the fridge and take it. It's more of...as long as it's within that context, I don't see really a big social interaction is missing because once I learn the behavior of, "If I need an ice-cream I need to go to the freezer to take it, if I need milk I go to the dispenser to get the milk."

## **Participant B**

### ***Practice Examples***

Putting the children to bed, dressing, washing, leaving a note

I've got doing housework.

Yes, I've only got one so far, which is the looking in the fridge.

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### ***Ideation Stage 1***

Yes, it was Moses and it was the practice of repeatedly walking up to the fridge out of boredom or hunger or whatever to look for something to eat and it was encouraging his experimental cooking side. He really enjoys cooking either for guests or maybe it's for himself. I saw a scenario where the weekly shop would be the list of ingredients would be imported to his freezer through some mechanism, that could be directly talking to the store or scanning a receipt or something. Then, instead of walking over to his fridge/freezer, he can open an app and the app will tell his fridge either give him suggestions on pairings or complete recipes or dishes or things that he could make with what's available in his fridge without having to go and check. Because, sometimes you have look for things that are just ready to eat rather than ingredients. I guess it's encouraging his desire to want to maybe cook more.

There's some work on that on the fridge that maybe did that but I didn't think there was an element of it suggesting what to cook, what items are going off.

Maybe in a system like this, maybe it can educate as well? Maybe it can suggest to check that's something's off?

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### ***Domestic Values***

The emotional environment is interesting, making sure that however, your products talk to you, if they are intelligent, it's emotive and not like, just logical.

I've chosen self-expression and then emotional environment. Self-expression. I guess, the people that are interested in cooking and are devoted to it and have it as a passion or a hobby. I'm going with the fact that Moses', our persona is like that. That self-expression is a big part of it. Any system that encourages or enables him to cook more should be about emphasizing self-expression rather than giving him the straight up. "You have this. This is the most logical solution." Being more holistic than that and saying, "you have this and these are some good pairings." Let him make the decision to make it about his thought process. Then I think, that ties quite closely to emotional environment. It's more emotive experience as well as enabling someone to cook, especially in a family setting. Then it allows you, or enables you, to be able to cook for the other people around you more frequently or more often. It would say, well, "you've got everything for a cake and you've got a bit of time in your schedule. Do you want to make a cake with family?" I think, encouraging the love behind the cooking. Not saying that these people don't have that love already. It just makes it easier for people to grow and create.

### ***MMC & Practice Aspects***

Yes, the time as well. It was encompassed all times because you're either shopping, you're subconsciously planning meals or consciously planning meals. You're physically in the kitchen cooking, but that could be at any time of the day other than maybe the middle of the night.

### ***UGV***

The idea is to counter the issue of dependency.

Yes. The provocation is that, ultimately, if you're just relying on suggested recipes, then you might not develop...you might outsource your creativity.

I'm not worried about the removing human interaction because it's not cooking for you. Its suggesting-- if it was good it would be suggesting ideas that were very feasible. So, I guess it's just the worry that you'd become dependent on just scrolling through and finding something you wanted to cook, but not actually using your own creativity in certain things, and that's so imagine a world where absolutely, hypothetically everyone used this, that no new dishes would be created.

So, I've got counter dependence by offering ways of creating new dishes?

Yes, that's true. Or you could use some kind of machine learning. A lot of people cook with sweet potato and this ingredient. It goes well with-

(to themselves) Minimal impact on the environment and resources...

So like, say, objects or food something that can detect the utensils or equipment you may have. Intentionality is shopping habits, cooking methods, preference on cooking methods, words and acts like lists, when you're physically making shopping lists?

As an act you can record. Is that along the right lines?

### ***Final Discussion***

The last stage in the summaries we made were in the purple but don't even try and attempt to read my writing. It was just thinking really about these being the inputs and these the considerations and what. I was just trying to summarize exactly what the system would and wouldn't do or what it would take and what it would turn it into. The two things that emerged from it as important at the end is, maintaining your creativity as someone that wants to explore cooking as well as reducing food waste. These are two that I picked up on as I was working through this and more obvious ones as well. Encouraging more frequent cooking and using up what's going off, not just in the sense of food waste, but just that principle of having spent money on food and wanting to use it, and there could also be health benefits as well included. It's really looking at taking information like your shopping lists, your cooking habits, maybe inspiration that you've seen online or that you've discussed with other people. Or inspiration that could be offered by supermarkets, like you said if it's being paired up with Ocado or Waitrose or whatever.

I've got for words and acts things like making, making lists and the cooking and the prepping. Intentionality, your shopping habits, your cooking methods. For objects, type of food and the utensils that you need and what cooking utensils may influence the recipes that you get to use as well. For time, the times that you cook if you're at having to cook dinner early for Maisie and know that and offer different suggestions and different times. What I've written down is that the system should challenge your preferences. I was thinking in most cases, in a lot of apps and IoT systems, it's about learning what you like and offering more of what you like, whereas I think it's important to not do that. Obviously learn what maybe ingredients you buy more often, but suggesting recipes that you may not have tried or particularly like or something that's not along the same theme as what you're already cooking.

If this is replacing the process of, "Shit, what am I going to cook tonight?" then it needs to challenge that because it could be so much more efficient and it's working with a library. Even if it's just giving you BBC Good Food, which has a limited library of recipes, then it's going to be able to offer more than you could come up with yourself. They're all pre-made so I think it should be a system that doesn't just learn what you like but it challenges what you like.

It was this process, it was dependence on coming up with your own ideas, so if this is doing it all for you then you could just get into the habit of, "I know that if I buy tomatoes, courgettes, aubergines, eggs, it's going to offer me quite a large number of recipes and I can just choose from that." You don't then alter your cooking behaviours. I suppose instead of just offering recipes of what you have in the fridge, but maybe saying, "If you bought this, you could try this new dish." As well as including community recipes that people could submit and just build an environment.

That's the thing is once you get away from the idea that a recipe is a good way of eating those ingredients, it's just one of a billion combinations that you can have, an infinite number of combinations you could have with those few ingredients. There's no right or wrong in cooking. I think trying to just not get rid of that independence.

Yes. It's not going and finding a recipe, it's assisting you to be creative with what you have.

### ***Scoring***

**MK:** There were the four things. Self-expression, emotional content, I think it was? Emotional environments, the idea of dependency being a negative thing and minimal environmental impact being an attribute you want to try and meet. So how much do you think this helps meet self-expression?

**Participant C:** I think it's good, but it's all down to the implementation of it. Because in its raw form, it's basically "I've got the recipe, I'll do that." There's no self-expression. The sort of stuff you were talking about towards the end, if that could be incorporated in a usable way, that encouraged it, it's got to be better than neutral.

**Participant A:** It's down to the user as well and how much they want to do that.

**Participant C:** It's recommendation.

**Participant D:** I feel the self-expression or the expression will be on the lower side because you've already pre-empted their...already given them the template to start with, the level of self-expression because you might be ending up in a situation and if I change this, then I'm not sure what it's going to be. So, more often you tend to follow what's being given rather than the...I'm not saying everyone, but it's a natural tendency to end up doing what's there to get the best appreciation for yourself that you've done the right thing. This is just my feeling, though.

**Participant B:** I think for someone who may already be explorative with their cooking, then it could nurture that, but for someone that was really still just very curious it maybe could dampen it but I suppose it would work well for the people that just cook the same thing every day.

**Participant B:** Yes. I think I said it totally depends on the person.

**MK:** What about the emotional environment then? A place where love often signifies a home. Maybe love is a very strong word to use in this particular one, but maybe love through food.

**Participant D:** Since because still you are doing it, so it's like you know what you are making. Being part of what you're eating is really... Rather than buying prepared food, compared to that, it's a bit more of an emotionally charged thing. Whether if I have put all my effort to make this. Because still bear in mind, even if it's a very simple recipe, still, I have to do this whole exercise, so I have to be emotionally involved to make that recipe even if I'm following step by step. You know what I mean? Sometimes you may end up doing two hours of this cooking and you don't want it to be that time looked wasted.

**MK:** Dependency being seen as a negative thing.

**Participant A:** I think you'd become quite dependent on it actually.

**Participant C:** I think if you want to. If you want to be dependent.

**Participant A:** It's so helpful. Why wouldn't you become dependent on it? I feel like it's a cool thing. I'd use it. It's hard work having to look through recipes, especially trying new things.

**Participant B:** That's the thing, is that's what you do anyway, right? You go online and you Google cheap recipes, cheap healthy recipes, you go on the top 50 list on BBC Good Food you power scroll through it then you choose one at random and then you decide you hate it.

**MK:** Environmental impact?

**Participant A:** I think it could have a positive impact there. I like it. Best by dates. I think it's quite a positive thing.

**MK:** In terms of food waste?

**Participant A:** Yes.

**Participant C**

**Practice Examples**

Listen to music.

Checking emails on mobile.

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**Ideation Stage 1**

Cool. So I was looking at listening to music and I was thinking about, I was really thinking about the couple. They probably still want to have dinner parties or maybe just the two of them. The idea would be you'd pick a recipe you wanted to do and it would say this is the sort of music you want to listen to. So it creates the ambience around the evening so it's really more for special occasions just to set the ambience, suggest a playlist. It could suggest other things. What film you want to watch to go with the area of the food or vice versa. You might have a movie planned and it's oh yeah do this because they eat this kind of food in the film or something. You might have Pulp Fiction, let's get McDonalds. So that's one idea so it sets the ambience and the so it could talk to your devices, your Alexa or Echo Dot or whatever or maybe the lighting as well? All that sort of stuff so actually you could create a whole kind of environment. So now the eating food becomes more of a kind of theatrical thing. The other one was just guided audio, tell you what to think and when to do it. That was the idea, create this environment.

### ***Domestic Values***

For critical experiences, I have knowledge, privacy and work environment.

I've got meaningful places, because it's going to help generate an environment where people can have specific, but not necessarily critical events. [laughs] Friends and entertainment just because it's going to help with that and architectural style. I was thinking about this and saying, "Well, what does this do?" Depending on how lighting and music affects it you're actually effectively changing that environment which is something we're looking at.

### ***MMC & Practice Aspects***

Yeah, on objects. So words and acts, words and acts. I still don't know!

### ***UGV***

Have no subscriptions or continued payments?

From a business point of view, how do we deal with that? Do we say, "There's revenues streaming in the subscription." So does it assist actual physical product selling. Something like that you might buy the Italian food pack?

### ***Final Discussion***

We're talking about this creation. So basically the meaning is creation of environment to enhance food and create a deeper, deeper experiences. That's the aim and also looking at shared the experiences. You probably wouldn't do this for yourself on your own. We're looking at not just setting the scene, but also how the scene can change between courses. So, you've got various inputs that can be used for that place, table setting on there, when plates come off the table. You know that you're getting on to the next course, so cueing whatever your next experience is.

Basically being able to monitor and recognize difference between courses, change the environment and looking at time, primarily evening. Shorten that down to be honest, most likely to be weekends, biggish occasions. I'm also thinking, maybe it could also in the morning for breakfast, so when you wake up maybe it sets an ambience which gets you ready for your day, that sort of thing.

Also it could tie in with calendar, so looking at setting dates, looking having an event time with that, so it could collect available times. Also maybe as the evening goes on, the lights could even get dimmer or brighter if you want people to leave.

So, we were looking at the attributes, increase human interactions and assistive. Thinking about collecting info without needing to communicate explicitly, you can bring people closer together, and send emotions. Which I think...that's quite key.

### ***Scoring:***

idea of friends and entertainment being an important part of the home??

**Participant A:** Yeah, 10 out of 10.

**MK:** Then the architectural style of the home being important.

**Participant A:** There's quite a lot of different elements that would have to come into play if your table was going to recognize when your plates are being taken off, and music was all going to be incorporated.

**Participant B:** Placement of the smart lights as well.

**Participant A:** There's definitely a lot of talking.

**Participant B:** There's need to be quite a dedicated host to setup a system that works, optimally.

**Participant A:** An IT guru. "No, this isn't working. The internet's gone down. Ahh!"

**Participant B:** Normal dinner party, crap music.

**MK:** How meaningful do you think this is?

**Participant D:** Managing other people's preferences in terms of the music and tastes and things because when you have groups of people that if you don't get....friends' place, how different settings would....

**MK:** How about the meaningful nature of it, then?

**Participant A:** No. I think it's become less meaningful, personally. Only because I just think there'll be so much focus on the technology. There wouldn't be any focus on social interaction in the same way.

**Participant C:** Would it spark conversation? Because that's what I was thinking about. It'd be quite-

**Participant A:** Yeah, but only between, I mean this is very stereotypical, actually I'm not going to say it. I was going to say only between men cos we'd be like, god there off off again, and then we'll talk about...

**Participant C:** Also thinking about, say if you for an Italian, "Ah, remember when we went to Italy" and blah blah blah. You should go to Italy, because blah blah blah."

**Participant A:** Yeah, that'd be cool. I think it can swing both ways, couldn't it?

**Participant C:** Is it meaningful to that or is it just kind of like a-

**Participant A:** A gimmick?

**Participant D:** It depends on what's your overall objective. Is it about bringing people to together for that day, for an event. Similar to that one, whether it's likely in a much more ... technical technological...If it is purely about me coming there to listen to music and changing of lights, that is a gimmick, but if I'm getting to know people and talk about it. This is a means for me to come out of my everyday routine and do this one that looks slightly different.

**Participant A:** It's almost that none of this stuff should be mentioned. There shouldn't really be any conversation about it, because it should just be...It should be invisible.

**Participant B:** [inaudible] I see it as a sliding scale on where at one end it will never lose its novelty, because it's just dimming the lights, setting some nice music. Generally just offering some classy recipes, all of which you already do now. Just you have to put more effort in. Or it could be a fully experiential thing, which would obviously lose its novelty, but you wouldn't do it all the time.

**Participant C:** It was theatrical, wasn't it? There's two ends, isn't there? It's like clowns on stage, like big bright lights...although there's something a bit more classy in mind. Subtle..

**Participant C:** It's to spark conversation

**Participant B:** But it can record conversation, then target advertising to all of the people that were there.

**Participant D**

#### ***Practice Examples***

Having a family meal, cooking for guests.

This has become relevant as well, washing up after you cooked for your guests.

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#### ***Ideation Stage 1***

I just want to focus on one thing, which is having a family meal. I chose the granddad because it gave us an—I just want to write it down. It's basically having a family meal to do with relatives and everyone where every Sunday we all meet and have a lunch, and my granddad, who I never met, set that up. Granddad was a 74 years old person and definitely did not grow up with the technology where we are today. There is an interesting research that shows that they are the most likely people to use Facebook, to look at the Facebook marketplace and things. Today they have collectibles and they want to sell it. They are constantly on Facebook, social media, more than anyone else. There is a research that proves that people over 60 years have been using Facebook a lot. That gives me insight, okay fine, but again, they are not technologically savvy and also they don't understand the whole app experience. As soon as they let's say receive a spam email they don't know what to do next. Those kind of things.

I was thinking earlier how Internet of Things can play a role in—this has been a tradition? I don't want to take tradition away, but how I can engage my grandchildren and my children who are currently living in this digital world to be more part of it with the technology around them. The IoT is not physical product but this whole idea of it being an ecosystem and an experience where the granddad is driving this whole experience at home, but he's using the technological means to drive this. It's basically to start with the family meal planner, so you have a family WhatsApp group anyway so you plan the activities and all those kinds of things. Then scheduling for the week. Each week, there is a theme that you set. The grandfather's looking into Facebook, Instagram and gets

lots of inspiration from what kind of themes for the week should be. He's already published a nice little profile picture on WhatsApp to say this is the theme for this week. The whole family is actually waiting to get to the day because it's going to be a fun and great event. Under recommendations from the influencer, coming from the granddad speaking up, what is going to be interesting is we have this AI algorithm that enables you to manage your family now to know what's the dietary requirements are, which has been really a difficult one. Because planning a family meal is okay, but I need to remember if my grandchildren are lactose intolerant or allergic, gluten-free and all those things. Once we have a personal profile, profiling things in the app the granddad doesn't have to think about all this. The system already knows who are my family members and it knows all the allergy information. Once I get the personal recommendation it links to the thing and also giving out replacement ingredients if you wanted to, if I'm allergic, to use the same recipe.

Preparing this whole family meal but becoming more inclusive for everyone in the family because you don't want to exclude, say that that person's is vegan so I didn't cook it, something like that, so we want to bring in that kind of atmosphere. Once you've done that, then the next step is I don't need to remember what I need to order. Based on the recipes I chose the online ordering is automatically done because it's all linked and it's being delivered to you. Every week on a weekly delivery because it's a weekly tradition, it's automatically on a Friday evening you get it delivered on time and all these recipes come through. All these hidden barriers and all these things have been removed because all you're doing is choosing what the theme for that particular week is. The system is automatically generating and these things are being shared within the family.

Kind of like a technological means to satisfy what he doesn't need to think about. At the same time families are more comfortable to learn what has been happening because they are all constantly on the phone, so that's the idea.

Like Google Lens right, it's really cool. Even food pairing can be done, like you know if you have wine because lots of wine manufacturers are today just constantly, even in the restaurants, you could actually, they could give you your menu and you can actually get the app to recommend what wine you want to go along with it as a food pairing. It's becoming a big business based on the base flavour.

If you have ten people coming through and six or seven of them have no issues and three of them have a specific requirement, one thing is you don't want to let them be odd there because we have the inclusive ideas, the inclusiveness. At the same time you don't want to, you don't know how much to spend and how much you wanted to cook because lots of times when you cook for multiple people you can't-- definitely the people who are allergic they won't take the other dishes but the other people might.

Just kind of balancing out how much of a meal servings I need to prepare and doing all of this calculation is really helpful like okay fine if I take a couple of things and just putting this, which is very difficult to work it out.

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### ***Domestic Values***

The first one is happiness. This is a family meal, the experience of happy events and general feeling of happiness are integral parts of home. That's the whole point of the objective of that particular idea itself. It's going to stay. Then preference to return, being it's a tradition that's been followed for a long, long, long time. In terms of locus in space, and you're constantly bringing back the attention of people coming back, and even when the grandparent is not there, still, it's been followed as a family tradition. Once again, it goes on really along with the whole thing. Then again, time perspective, which is similar to preference to return. Places exist as home, whether it's in the past, present, or in the future. That's the whole point of the combining these three things together to work with that particular concept of going along with it.

### ***MMC & Practice Aspects***

Intentionality - Bonding, happiness.

The main intentionality is basically, leading the family together and build happy kind of that's the main intentionality.

Do objects become the material part of it?

## UGV

These three attributes seem to go really well with-- it's really a must things for those things because one thing is about. No-no, well, okay, if you want me to choose any one of them based on the meaning that's being offered and everything, I would choose **personal [unintelligible 01:43:37]** as one of the key things because this is under the assumption these people are already there. So, maybe that's the case. If I want to choose only one, it may be an old person and I don't want to fail and if the family...but otherwise, these attributes are a must to make it work because I want the information because I can—I'm trying to learn the family, know about their interests and everything I need to have an... under the assumption that these things are already cooperating. In terms of the themes it a social, emotion go hand in hand, changing practices, ok it changes the practice but you're already learning the WhatsApp...I think I'll go with social..

This makes sense, in terms of say this is every week Sunday lunch. In terms of the time further detailing down, say deliver your ingredient on time, knowing what's in the fridge, getting meal time, informing appliances such as preheating the oven, switch on the dishwashers.

**MK:** That's the outputs and it's reading these things into making decisions based on that. Bearing in mind that it's trying to be social and have no failure states.

Causing happiness.

Because for me the intentionality (of the IoT) would be have no failures.

## Final Discussion

Still talking about the family meal planning, the primary user being the grandfather. With that in mind I think the key IoT attributes would be...We'll start with the meaning part. It's about tradition and being social and bringing the family together and bonding and creating this happiness. It's basically continuing this tradition even when the grandfather is no more. It's about making sure the family is always living together and having this family fun time. That's the whole idea.

With that in mind, considering the older person who will not be into the technological area, the key attribute, key point of this whole success of this concept is about have no failure states for two reasons. One thing is I'm not confident if something fails, I cannot go and fix it. The second thing is I don't want to ruin the family dinner because it's a really important thing that's happening every week and that's the time everybody get together. You don't want to come there and talk about the food not being good. That's the reason that this becomes really a valuable attribute so I want IoT to provide it.

From the idea of the key areas of that time, in terms of time, it's about making sure to deliver ingredients on time, making sure everybody's reminded when the dinner is happening, that making sure aspect of it. Also, one of the important thing is knowing what's the personal preferences are and the likes and the dislikes and taste, and how intuitively I can gather this information. It's not anymore an app asking lots of hundreds of questions to know about you. I need to know an interesting way, an interactive way for the grandfather to actually use this device to know people's preferences and elements and how people can share this information together. About the spaces, the key thing is about the physical space, the dining table and all those kind of things because you want to make sure it's all set up in a right form and the right way so that people can get the chance to speak. One of the most important things also is simply how to think, because it's a weekly time, people might be living in different parts of the city and they might be coming in. So you need to think about where the event is happening. Of course, it's going to be in the same place more or less, but even if you do not have a parking you need to sort out the parking. All this kind of, then once you expand this in the Internet of Things and all that, you can enable like recent technology of knowing where the parking space is and if you're living in a space where there's not enough parking space, how do you allocate bringing people together? It is any point of time making sure how we can bring everybody to that spot always without having any issue as much as possible. That's the whole idea about it. Then also about monitoring available ingredients. If I'm looking at the fridge and what I'm purchasing it and how much I've consumed previously and ordering those ingredients.

One of the other things I was looking into is going beyond the dinner, you are not going to just walk in there and have your lunch and walk away, right? You need to have an after meal spending time and what kind of activities you can organize it accordingly to do that. Intentionality is more about bringing the intuitiveness, reliability and confidence. This is the three key intentionality that I want the IoT to be offering it, because eventually you want to be a very clear and a very more seamless user experience for them to follow through. Because bear in mind, this is not the once in a while event, it's going to happen every week. It means I'm going to continuously using this system and I want to do this as seamless as possible.

The objects wise, definitely in a social messaging chat group like WhatsApp that is already, even though it's not physically present, but virtually go talking to each other and getting to know each other and knowing what's happening, really. Features that manages technology that can aid technology that manages people's preferences and recommendations and trying to combine with the parts, elements of what's in the fridge and trying to bring in these together.

The other ones could be the orchestrating the cooking process as well. Generally, when you have a family dinner you're not going to just make main meal, you're going to make a starters and a dessert as well, but sometimes you need to start at a certain point first. Before we go in to the starting point, how can you do the actions rather than thinking about a particular meal or a main or a dessert, a starter, thinking about the whole event as a thing. What activity needs to be done and orchestrating each of the steps one by one. Then the words and acts mainly planning, ordering and also talking to, you know, once you're finishing up with the meals and stuff, dishwashing and how do I say that when the event is done, what things goes there.

### **Scoring**

**MK** The key things were that it has no failure states

**Participant B:** I think if it's considering everything, then the app itself, theoretically, if it's considering everything like parking spaces and public transport, and the availability, then the app may not fail, but in reality people may still fail.

**Participant A:** So the app might be fail-safe, but life is always...there's no such thing as fail-safe.

**MK:** Yes and sociality...

**Participant A:** Yes. I think it is.

**Participant C:** Yes.

**MK:** Then also happiness, which is one of domestic values, this

**Participant B:** Very happiness oriented.

**MK:** Then preference to return,

**MK:** Works towards it. Okay. Does it have time perspective?

**Participant A:** It definitely has this kind of thinking about the future, whether it has any focus on what's already been done, or what people have already enjoyed from a food perspective, you know what I mean, like ok, it kind of brings back the thoughts of there's a particular recipe in the library that, I don't know...but I think it's definitely more future oriented than perhaps learning from the past or the present. That's probably something that could be incorporated in with a little bit more thought and development.

**Participant D:** My intention with talking about the past, present and future was it's about maintaining the legacy within the family dinner. So to going through that, okay, my grandfather used to do, and I'll be doing it. I'm not sure whether if that was the intention.

#### Evidence of Process on Thinking

**MK: Has this process helped you see that the home is a different space to the sort of other IoT contexts? Because you tend to work in the home anyway as this company?**

**So has this changed your understanding of what the home is?**

**How people consider it and the things that people think are important to it? How has it changed that?**

#### **Participant A**

Yes, I would say so when we're talking about the values of the home, and talking about relationships, et cetera et cetera. I wouldn't say there's something necessarily would perhaps considered if you were talking about using your app to try and find a car parking space. So there's home values that we all discuss, we've all ranked them and said, "Actually, you know the relationships is really important, et cetera, et cetera". So I would say I wouldn't have thought of those things before, but actually thinking of them now. They're probably more important than we necessarily give them credit for.

#### **Participant C**

I think the interrelation between things. This has helped me think about a lot more, which I guess is what about the Internet for Things is. [laughs] So it's definitely helped with that.

**MK : So if you were thinking about the home is a different space, to say the office, you know, and you were designing a product for the home as opposed to the office, what kinds of things would you think about having been through this?**

#### **Participant B**

I think more the emotional aspects of things like highlighting...I mean some of these cards highlighted how a home is like a very emotional place for us and like a very safe space for people. I think in most cases, and that's very true. Sometimes it's easy to slip into the habit of thinking of the home as like a sterile kitchen, which you would just plonk your machine in. Your mindset when you're home is totally different to when you're anywhere else. I think it bought that to my attention a bit more.

#### **Participant D**

Who would look into the procedures, very important point of bringing technology into the home. It's about how even when the failure state, because once you start depending on something to do something and if it fails for whatsoever reason. Then you don't know how to then react or inform yourself to what you should do next. It's basically just affecting the confidence of yourself. That's something a problem which means I need to now consider things which I may or may not have considered previously, like creating this intuitiveness and seamless integrations between these things.

Do things, because if I'm relying on myself, I know my ability, what I can do it and so I will stop or do things. Once you become totally relying on technological things to actually enable you to do you and do a normal task. Then it becomes a barrier if something goes wrong, because you don't know, "I need to wait until somebody comes and fix it for me", or these kind of things because there's not enough knowledge or the knowhow within the consumer side to accomplish that.

**MK: how has the inclusion of user practice helped form your concepts? Because from what you've said, removing the ability to do something. The competence of doing something is a barrier to then continuing that practice. So has including practice as a concept in this helped you think about how those elements affect further concept developments, and the problems inherent in some concepts that are very automated?**

#### **Participant A**

I think with my one, because she was a child and you were comparing the competencies of an adult. There were certain things that she couldn't do such as refill it with milk for example. You have to then pull in that competent being to be part of that. Actually it did make me...I was just like, "Oh yeah, I'm sure. Do you press the button and you get the milk? Fine". I was like, "Hang on a minute who's going wash her cup up? Who's going to fill the milk up?" There was all these things that perhaps, if you're just thinking you would, "They're competent, they'll be able to do it", but as soon as you start thinking about them being a child and therefore not having that competency. It did open up a few more avenues of, actually, well that's kind of almost-- Is it a negative thing that those things are all automated now? If the whole process isn't automated, so?

**Participant B**

You assume that everyone's capable of everything. It's a reminder that you do need these set of competencies in order to utilise the system.

**Participant C**

I mean the interrelation of all of the factors that create a practice is something new to me. I can't tell you exactly which ones it is, but obviously it's a combination of all these things. That's quite interesting.

Yes. Potentially that's where the product if you were selling it, would fall down. You could end up focusing on, "Oh yes. It does this." I've still got to do this, and this, and this.

**Participant D**

Yeah, definitely. Yeah, definitely.

That's where the opportunity for you to find, because the new innovation to come through. If you see lots of technology that's there or even the new designs. It's been an evolution of improvements, reaching the point of being matured and being more appreciated by the people. So by introducing IoT in lots of areas, yes, it solves the problem, but it doesn't...it solves the problem in a particular context, it doesn't really take into account the other external factors that creates a new problem which we are not aware of it. Which is slowly...and it involves education of the users as well as a technological improvement at the same time to go hand in hand. It needs to work together...

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context, it doesn't really take into account the other external factors that creates a new problem which we are not aware of it. Which is slowly...and it involves education of the users as well as a technological improvement at the same time to go hand in hand. It needs to work together...

**MK: So one thing I'll be looking at through the whole process is this idea of the qualitative of what we do, the experience of the home. The quantitative of the IoT is very driven by data detection, analysis, and then making something happen. Do you think there's a boundary or split between the experience and the quality of things? As conducting them yourself and the quantitative nature of the IoT being quite automated and doing them for you? Has that come through this workshop? Has that made you reform how you think about what the Internet of Things is for people?**

**Participant A**

: Following on is the business about time saving, but it's also what I said at the beginning. Is it a chore for you? Because if it's a chore then automating it is fine. If it's not a chore, it's something you enjoy, then automating it probably isn't something that you want.

**Participant B**

Yes. Obviously, it varies from person to person massively. For me, having a cake at the end of baking is the least important bit for me, that's all. It's, well actually the least important bit is buying the ingredients because no one likes doing that. It really is about--

**Participant C**

: To an extent. I think it has, but with our particular products, like cooking. It's quite a human thing, and I think we're all fairly aware that what we're doing is taking away that touchy-feely aspect to it. So there are some things that, yes sure you want to automate it because they're- : -They're the mundane things. It's like, "Yes, I could chop all of these carrots by hand but I've got something that does it." That's fine but when it comes to kneading dough and things like that. Some people actually quite enjoy the process of kneading the dough.

Well the thing is, if it's not cheaper, then it's got to enhance something. It's like cake mix, it's like, "Well you know I can add water, but I still got to bake it. So why don't I just buy a cake?"

**Participant D**

I think there is a really clear distinguishing, like what IoT can bring because of cooking itself. Maybe I put it this way alright. As a user there is a level that you cannot do it, you rely on technology to do it. For instance, I cannot heat right? Similarly, I can mix it only to a certain level. So that's fine when you're relying on a technology to do it, like our appliances. Where if I wanted to chop one cabbage, slice one carrot, I would use a chopping board and knife. Because the time I take to take a food processor, chop it and slice it and washing it back again, drying it up, putting it into the cupboard. Generally, it's shelved off enough people never use it. But if I say we have a guest coming up, I need to use three kilos of carrots, then I have to use the technology to do it. So these are physical activities that where technology similarly...it's a similar logic applies for IoT as well when the technology we use. I see more value for IoT outside the food preparation itself. The cross integration and all this linking, ordering things, and stuff. Where okay, yes, I need to put the effort, but I do not have lots of information about the nutritional thing. I don't know how good the quality is because when I go to the shop, this is what I look for. Where does the product come from, or or the provenance come from? Is it being factory or is it being organic? All of these things. If this information can be collated and give it in a format where it talks with each other, okay, my decision is much quicker. An as a user generally, we want to make a decision quicker because it keeps you happy when you make a decision quicker. For me, that's where the real value IoT is adding if I enable to make decisions quicker, then still let me do what I need to do. Then that creates a beautiful experience for me.

**MK:Has this made you rethink how the system of the Internet of Things shaped the products you use, the way you engage with it, and the practice you do? I think we've kind of covered that slightly already. Is there anything else you want to add to that?**

**Participant A**

**Participant B**

#### Participant C

: It probably dependent on what stage you're looking at it as well. If you're looking at it with our products in mind, but if you're looking at it from a complete new idea, then it's that things like the fridge, but that's different.

#### Participant D

Well, because I've been very closely involved with this IoT side of it. I still feel that it's not shaping the actual physical product itself so much. Other than the fact that you are actually enabling the machine to talk. Nothing more than that, right? Because it's not...the fundamental intention of this machine is not to be an IoT product it's to bake or mix a cake batter, right?

So that's the intention that's not change, which means the form and the shape and the user interaction has not changed and we do not have screens on these machines as well. So the only thing that has changed is the thing that sits outside the machine itself. So still I'm not convinced yet the fact that it has changed the product what we are designing it to it's fullest extent. It depends on the definition of what the product is. Take a purely physical product, I would say no, not changed much. It stays as it is.

[Feedback on toolkit and workshop](#)

**MK: This is interesting, because that leads me into a question about this overall method is, do you think that what we've done today has helped to make the user central to the process of developing ideas rather than that technology? MK:** How has that happened? What parts really helps you get into their head, and understand how to design around the user and the experience rather than the technology side of it?

#### Participant A

They're hard as well. Looking at a bookshelf? And then when you ask us to do our thing, I was like, "I'm going to change my cards out". It's not so easy, is it? Especially when there are things that are around the fridge-freezer thing, you heard of in the background. I was like, "Bookshelf, oh my God, what am I going to do?" I would definitely say that when you're thinking of people's habits a little bit more or you're looking at their activities. How can you improve those? It does make them a lot more...

: It wasn't really about...even though we chose the people first they weren't the main driver. We read what they did, we read that they like cooking, but that didn't really mean anything. It was only where, like you say, where we had these, like you're practice examples. You were just like, "Okay, now I've got to try and think of something that's going to benefit this person".

: I would say from a marketing perspective what's made me realize that we have a lot of these personas of people in our segmentation, who don't necessarily have many of these motivations when we're developing. I would say we're lacking motivation.

I think this has been great. I want some of the cards! I want to do it again. Everyone should have to do it.

#### Participant B

Definitely. It's been really good.

I think just starting from house, person, action, it's like, every time because it's so difficult to think of things outside of a context. When you're trying to come up with an idea for like a system or a product or anything in really any context. Unless you have this really well-defined set of actions and persona and environment, which we had here, which we established at the very beginning. It's very difficult to explore any detail because you get caught up in the first stage just thinking "I can do this or this or this or this". Instead of following a route from "I have this precise scenario" and then you can develop the idea further. I think that's what I liked about it.

That's also a much greater challenge to consider every single stage; in this we only had one stage. We had one action that we did. I can imagine it's a lot harder to stick to when you've got so much to consider. Maybe when we do this, again, we have real-life examples of what you've identified as key motivations. The top 10 key motivations when our average 39 year-old consumer decides she wants to bake a cake for any...

I really enjoyed it.

**Participant C**

I think the practices. That was pretty, pretty key, because it's these are the things that people do.

Yes, pretty useful.

**Participant D**

I think you start with the user as a starting point it's completely. It's not even a user actually it's you start with the motivation. What's the real motivation you want to start with, and then you end up defining the user to it to associate a user. You start linking these two things, the personality and the motivation together and start building your story behind you.

That's never going to change whether you are with an IoT or a blockchain tomorrow, or not. That's not going to change. Maybe the way I would read a book and I'll go and select a book on a bookshelf would change and stop going to a physical bookstore. I may be going into a Kindle and searching for it, but that might change. Really, the intention is not changing and that's driving experience.

**MK:** Interesting. Just two, three more quick ones. How did you find the domestic values? The user-generated values, these attributes and themes? Were they useful for framing the development of your concepts?

**Participant A**

: Yes, I went the other way. As I was going through my idea, I actually decided I didn't really like it. I thought this isn't very nice. I don't think it's a good idea like a turnaround. I was like, "This is rubbish. I don't want this poor child to have to be pressing a button all the time." I thought it wasn't very good for relationships, so I picked one that was quite negative, like what does actually this do for relationships like a contradictory one. I won't want to-

**Participant B**

Yes, it's brilliant, I found so far that it's incredibly thought provoking.

In my field which is just exactly that, it can be a real challenge sometimes to rephrase, rethink about problems.

: I found the red ones, the negative IoT themes ones to be more interesting. I think, not necessarily, more interesting, more helpful because I realize for the first one, What were the red ones again?

I only chose positive ones and now going back and I wish I'd done more negative because when I chose this one...It just helped me sculpt the idea a lot more.

You should always go through that stage realizing that it might be a bad idea as well. That's just an essential step onto developing a good idea.

**Participant C**

It's important, though that you flesh it out at this stage rather than when you've got a prototype sat on the bench, worse, something that you're marketing.

**Participant D**

**MK:** Do you have any suggestions for developing this to make it a more useful tool, or a better process, or anything you want to point out that didn't work for you? Anything you want to point out that was the best thing for you? Mainly, future development suggestions would be really handy.

**Participant A**

These (Definitions on chits) are quite technical.

**Participant B**

I'd have struggled if it was just pen and paper.

**Participant C**

I think getting all in one place-- Maybe it'd been different if you're not on the table, but getting everything up so you can see it. That makes such a difference. I don't know whether you want to keep it free form like we've done or whether you have a big sheet which is like zones.

It feels like this is probably the first stage and then you probably go through, and once you weeded them out little bit, then you'd start, maybe layering more of these on.

The only thing I would say is this (THE DOMESTIC MAPPING) was quite useful from a start of the discussion. I don't think it was a lot of use afterwards. I don't know what you were expecting, but for me, I didn't refer to it again as an icebreaker to start I through it was break.

Participant D

Where I'm coming from is one of the real challenges with all these exercises is the that we reach this point. After that, we don't know where to go when we end up, which idea should we choose. Anything that you have-- tools or things that you can do. Fine, we got this fantastic picture, four great concepts. That's great. Which one should we focus on to start driving towards the execution side because that's what is going to-

Future Developments for toolkit and workshop

**MK: Do you have any suggestions for developing this to make it a more useful tool, or a better process, or anything you want to point out that didn't work for you? Anything you want to point out that was the best thing for you? Mainly, future development suggestions would be really handy.**

Participant A

You can probably layman term them (the chits) a bit and maybe make them like you say, a little bit more accessible, maybe like they were printed and you could read them a bit more clearly. That's was quite an important element. We looked at those things in two different levels. When you first started talking, I was like, "Woah." You talked about time as well and how you need time to digest things, and I was like, "Wow, going so fast!." It was quite speedy, that bit, in particular. I think the other bits were fine.

Participant B

You have to choose one negative one (theme) and one positive one or multiple negative and multiple positive, but to, not necessarily enforce but encourage people to choose one of each, at least. Just to get into it, because you could have people that have come into a session with an idea already in mind, something maybe that they're working on, an idea they've had a while back and enjoying. I've seen this before happen in other meetings in ideation sessions with people where they come in with an idea and they only enforce their own ideas. I think, providing people with more opportunity to challenge their own idea. I chose negatives one, but it could've gone through and just reinforced my own idea.

Participant C

: I guess if you try to compare all of these against one another, you need to use the same constraints. You'd have to then compare all of them against quality of relationship.

Participant D

You need to have your core domestic values for each of your product and compare them. You need to develop multiple concepts and really compare. Within the self-expression, how much is that concept is playing, weighing against the other one. That's the only way you could. That's why I'm trying to...

Where I'm coming from, MK, is like you remember when I first started the discussion with you in terms of doing that is, I would like to get a couple of workable for the business too. One side is, "Okay, we've got a great tool to learn out of it, but I would also like to see some kind of concept coming throughout of it.

So that that becomes a feed for our product generation, product generation to move forward. I want, next step, I would like to associate this with the actual physical product itself and see where we stand.