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Accident, determinism and hermeneutics: relationships between analogue and digital fabrication.

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Despite attempts to dismiss or absorb it, craft quietly persists, but is rarely considered a contemporary force for change. Could this change with the turn of interest towards a new materialism that places more emphasis on objects and their capacity to empower and/or frustrate the actions of humans?

As networks of binary information and automation continue to fertilise economic and social disruption, the schism between digital abstraction and tangible world experience offers opportunities for craft to materially reconnect. Such a prospect however presents challenging questions for the study and practice of craft, not least concerning the co existence of orthodox and digital forms of materiality. This paper frames how a materially hermeneutic approach to craft processes and values may assist new understandings and possibilities in contemporary craft, ironically perhaps, by harnessing digital visualisation and fabrication technologies as substances and forces of materialisation.

The potential of craft in new materialist theory is described by Bennet (2010) as a human need to 'interpret the world reductively as a series of fixed objects, a need reflected in the rhetorical role assigned to the word 'material'.' (Bennet 2010: 58)

Craft objects, in new materialist terms, could be described as things that embody agency derived from the intimate exchange of tacit and explicit forms of substance and process knowledge between humans and non-humans. Intention plays an important role in influencing agency, and Bennet makes clear a particular distinction between the intentions of craftspeople and scientists.
'The desire of the craftsperson to see what a metal can do, rather than the desire of the scientist to know what a metal is enabled the former to discern a life in metal and thus, eventually, to collaborate more productively with it' (Bennet 2010: 60)

Hermeneutics, the philosophical analysis of interpretations, holds a useful place in science and studies of 'new materialism' because it concerns the ways in which reality can be present for people. Bruno Latour (2008) considers that the penetration of design's concerns to the "inner definition of things' are becoming more hermeneutic, leading to a definition of materiality connecting meaning, hermeneutics and morality.

Donald Idhe (1990), the North American technological philosopher, has argued for a 'phenomenological hermeneutics', one that is expanded from its original linguistic-centred interpretation to one that includes lived perception - a type of material hermeneutics. Idhe makes the point that even in science, which prioritises evidential reason over perception, sensorial perception is fundamental to understanding the scientific process, particularly the way scientific observations are in many cases mediated by technological instruments that necessitate interpretive perception. The 'reality' of phenomena such as brain activity, micro-organisms, or invisible forms of radiation emitted by stars, exists because it has been 'translated' by technologies into perceivable phenomena. Without instruments such 'realities' could not be perceived by humans, or interpreted by them. Similarly instruments and other objects are themselves constituted of particular qualities that offer humans a way of interpreting them.

Idhe considers that technologies transform what we perceive structurally, either by reducing or amplifying aspects of our reality. Their transforming capacity can readily be seen in visualisation technologies, such as x-rays, that visually enhance internal structures of the subject whilst reducing external surface detail. In this way, technologies are not neutral, but have intentionality built into them through their conception and design. However, despite these intentions technologies are not fixed, and may be adapted for unplanned purposes. Twitter, for example, was invented as a person to person chat technology, but is now used for a range of purposes, including the collection of health research data. How a technology stabilises in our culture will often determine a 'reality' perceived through its use.

Peter Verbeek (2006) distills two distinctions made by Idhe in the relationship between humans and technology. The first, embodiment, is similar to Heidegger's 'readiness-to-hand', where objects become extensions to our body to the extent that we are often not conscious of them in use. In this relationship we perceive reality through technology; for example, a pair of glasses, or a hearing aid. Hermeneutic relations, the second distinction (related to Heidegger's 'readiness at hand'), concerns technologies that are not wholly incorporated into our lives but provide a more indirect perception of reality, one that requires interpretation.

Many of our relationships to instruments which provide us information about the environment, such as a car speedometer or a thermometer, can be considered hermeneutic. Many objects, it can be observed, embody both these distinctions, and close attention to them will reveal distinctive hermeneutic characteristics.

In hand craft the evidence of mediating technologies and their workings is direct and often made apparent by the maker. This could be interpreted as a type of perceptual script for users experiencing connections between conceptual and material aspects at play in the object, and over time an accrued and shared symbolism, embodied in the object's 'readiness to hand'. Evidence might include a tactility that directs the action of the hand on material, an explication of 'essential' quality identifying a material and the process by which it has been worked, a perceptible sense of usability (affordance), and possibly conceptual intent. These become sensorial triggers for the interpretation of particular types of physical objects we recognise as a craft 'thing', that in turn references more complex relational concepts in the social world of craft. A similar type of analysis of different identifiable characteristics could be made for simple mass produced objects, albeit with subtle differences.

A language of sensorial perception is evident in the symbolic aesthetics of Japanese ceramics, cultivated through hundreds of years of practice. Key elements including the imprint of the hand upon the surface of the clay, the wisp of flame impinging the surface of a bizen bowl, or a cracked shigaraki vase have been highly influential, becoming part of the medium's contemporary global lexicon. The acceptance of these qualities embodies a type of 'truth to process and materials' that accommodates the accident. It is epitomised in Japan by Kintsugi[1] , the art of ceramic breakage and repair, viewed philosophically as a celebration of the object's history, rather than something to disguise.

The human attention to accident, or aberration, is a well documented route to discovery common to art, science and craft, but rarely a property attributed to machines. Whilst there is evidence of 'truth to materials' symbolism in mass produced forms, they are nearly always produced with uniformity. Evidence of process is also often disguised where join lines are hidden or the seams of injection moulded forms made almost invisible.

In Arts and Crafts Movement rhetoric, visual uniformity became a moral symbol of ugliness associated with the overpowering of craft by machines and factories that diminish the sense of an individual's personal value from the skilled labour they performed, and correspondingly, the quality of their work. A different, more symbiotic history of craft's relationship to mechanisation existed outside England and Europe. In North America the disruption to craft occurred slowly, over time, prior to the advent of mass production. Giedion (1948: 39) details, across a wide array of endeavours, how 'anonymously and inconspicuously old tools were transformed in to new instruments', notably from complex crafts, (another continental distinction), and how they are influenced as much by modernity itself as by the machine, brought about by a sense in change of time, consumption and a rapid rise in the number of North American inventions during the mid to late 1800s . The forces of frontier necessity, distance from European markets and the scarcity of trained labour underpinned the invention of many mechanised crafts, often associated with agriculture, prior to large scale industry appearing. Such inventions, developed by individuals wishing to improve their craft through activities appear closely aligned with David Pye's ideas of a "workmanship of risk", not through the plans of industrialists.

The possibility of variation is however deliberately embedded in the mechanisation, particularly of craft practices, such as in the lathe and the power loom, where it remained initially under control of the hand. Gradually, through the evolution of selective automated sensing and actuating devices, control becomes more remote and standardised through increasing numbers of fixed variables. These deterministic command systems characterise large scale manufacturing processes and the standardisation of mass production. A systematic framework lends itself to computational intervention and subsequently to disruption through the reintroduction of variable decision making. The first stage of this relatively recent process, mass customisation, relied heavily on CAD software capable of iterative design variability. Initially, machinery was unable to exploit CAD's potential, and mass customisation concept was limited to relatively simple applications, such as the size of chair frames or the colour of bicycle components and cars[2] , restricted by the state of mechatronics.

The transition to direct computer controlled fabrication required new machines, designed to be controlled by 'G code', a simple computer language capable of describing vectors that can select and drive motors that operate tools in one or more axial dimensions. Commonly these devices are hybridised computers: machine adaptions of existing mechanical processes including cutting, folding, extruding and joining.

One machine, however, is different enough to change the way we think about machine symbolism, and technologically mediated craft. The three dimensional printer (3D printer) is the first device capable of producing complex objects directly and solely from computer input. The Swedish group Front Design demonstrates the potential fluidity of the creative process using 3D printing through a video performance showing the designers sketching chairs in the air using light sensors, followed by materialisation of their drawings, appearing as if by magic from a vat of primeval technological soup[3] . Hermeneutic relationships with computing devices are often complex, however this performance presents an 'embodied' vision where the technology is presented as 'ready to hand', hidden from consciousness. Of course this is not 'real', but a useful (if extended) example of how interpretation is assisted by the amplifying properties of visualisation technologies.

Idhe's material hermeneutics highlights challenges in communicating technological complexity, and why reductive explanations are often unsatisfying. The distance of concept from material outcome renders processual understanding increasingly abstract, often only understandable through a specialised language of scientific knowledge. In Abstracting Craft, Malcom McCullough (1996) offers valuable perspectives on how computational design and visualisation has become an abstraction of craft. His rich discussion of conception, making and designing across hand crafted, mechanised and computational modes of production draws attention to the distinctive character of the digital artefact, that, 'although lacking in physical substance, is a thing with appearance, spatiality, structure, workable properties, and a history' (McCullough 1996: 155)
He convincingly argues that despite the abstraction of computational design tools, unleashing their creative potential requires similar levels of skill and sensitivity to that required in the use of more traditional tools.

McCullough suggests that a crafted approach to computing technology entails using 'limited software capacities resourcefully, imaginatively, and in compensation for the inadequacies of prepackaged, hard-coded operations.' (McCullough 1996: 21). He gives an example of how a judicious implementation of "undo" and "save" functions offer opportunities for play, exploration and reflection, characteristics commonly attributed to creative practice. Computing software have further developed massive complexity and choice since Abstracting Craft was written in 1996; an array of operations across different menu structures can be combined in a multitude of ways to selectively act on elements of a design with radically different results. These may be predictable refinements of an intended form or surface, or the unexpected result of combining commands that the software developer had not intended (providing the software does not crash).

Digital artefacts and processes have obvious limitations. For example, the parametric data provided by a 3D computer model concerning weight, volume, centre of gravity texture and sonic properties will not convey their relational kinetic complexity tacitly acquired by holding the object[4] . However they also exhibit unique characteristics, such as a capacity for viewing in non-tangible ways. We are able to see the interior structure of forms though cross section and wire frame diagrams, view and adjust measurements, scale and other parameters interactively, and move through them. The digital object space moves in relation to us, the opposite of that in the physical world. Digital objects also hold a capacity to interchange huge amounts of information via communication channels linking different fields of endeavour. Finite element analysis software, for example, makes it possible for specialist engineers or fabricators to test parameters of a virtually designed object, such as stress fracture or mould-flow characteristics, under different scenarios, before production. This powerful capability harnesses the iterative prototyping capacity of computational design in cross-disciplinary collaboration, between different material and non-material practices, including the traditional craft media.[5]

By linking computational design software and digital fabrication devices digital activities are transformed from discrete design activities to complete prototyping or production workflows, most notably in the 'closed loop' design to production workflow evident in 3D printing. A range of other characteristics separate digital fabrication technologies from those before it. 3D printing presents a unique capacity to physically build complexity, beyond what is normally considered possible by machines or by hand. Comparatively faster prototyping times allow 3D printers to exploit the iterative advantages of computational design, and distribute fabrication across networks to produce identical or differentiated objects. A further difference between 3D printing and other digitally integrated machines lies in the possibility of its material 'universality'. From its beginning printing plastics, the printing paradigm itself, having leapt from two to three dimensions, is now evolving to deliver a plethora of different materials, from plastics to ceramics, glass, fibre composites and living organic compounds, some in photographic colour.[6]

It could be argued that the intimacies of craft, distanced by mechanisation and automation have returned, abstracted, in digital fabrication. With the emergence of complete digital fabrication workflows, control is again in the hands of individual craftspeople. However this return is also a radical transformation, with some processes now located as an extension of one or more hands and minds across computer networks and in studios, connected to shared information, open source computing technologies, and particularly social media. For more than a decade the internet has been a significant facilitating infrastructure for craft thinking and practice, linking communities of creative makers.

The current state of digital fabrication is complex, open and wickedly hermeneutic. By interpreting the various possibilities within a plethora of software and hardware technologies it is possible to discover new conceptual, processual and material applications by connecting them in different ways that disrupt the intentions of their authors. The glass sculptures of Geoffrey Mann, for example, combine elements of videography, 3D computer modelling, 3D printing and glass casting to concretise the flightpaths of birds or the refraction of light from 3D scanned objects. Iris van Herpen's armour-like garments bring a restrictive prosthetic to the catwalk through garments fashioned by a mix of digital technologies.

An example of my own work, Sonic Loop, solidifies sonic data to create a utilitarian porcelain form via a hybrid digital and analogue amplification of its technologically interpreted origin, an oscilloscope wave.

The hybridity apparent in each of these examples have been chosen for their distinction from work that bears the signature of streamlined, digital fabrication enterprise solutions that follow the historical machine development orthodoxy. In them, there is evidence of the exploitation of 'glitches' in software, aberrations in digital systems, reinterpretations of digital material states and their impact on 'non digital' materials and processes. In short, they are interrogations of the hidden hermeneutics of 'black box' technologies that resist our engagement. In the exchange between their tangible and virtual states, ideas and material relationships are exchanged, mutated and finally completed in tangible form, privileging a traditional material state of craft that references the digital. There is however, no good reason why this should not also be critiqued.

A hermeneutically informed approach to situating craft in the digital age may be a glitch or passing moment in the development of craft, but there is also the possibility it can foster interest in contemporary practices that actively seek to interpret and critically engage the significant inroads digital technology continues to make into our daily activities.

Bibliography

Bennet, J. (2010) Vibrant Matter: a political ecology of things. Duke University Press Durham and London , p 58

Ihde, D. (1990) Technology and the lifeworld. Bloomington: Indiana University Press.

Latour, B. (2008) A Cautious Prometheus? A Few Steps Towards a Philosophy of Design (with Special Attention to Peter Sloterdijk). Keynote lecture, Networks of Design, Falmouth, Cornwall, Sep. 3, 2008.

McCullough M (1996) Abstracting craft : the practiced digital hand. MIT Press, Cambridge, Mass., USA

Siegfried Giedion, (1948) Mechanisation Takes Command, a contribution to anonymous history. Oxford University Press.

Verbeek, P. (2006) Materializing Morality: Design Ethics and Technological Mediation Science, Technology, & Human Values, Vol. 31, No. 3. pp. 361-380

1 In Kintsugi, broken pieces of a ceramic form are reassembled using gold adhesives to emphasise repair. In some cases fragments from a different object are incorporated to consciously highlight the aberration.
2 for example the Herman Miller Aeron Chair and Panasonic bicycle projects in the 1990's
3 http://www.frontdesign.com/category.php?id=174&product=660 accessed 15/1/2016
4 Research continues into the development of haptic feedback systems in computer modelling to improve the translation of these properties, an example of their application in craft being the software application Anarchic 3D.
5 These examples highlight some general structural relationships between digital and analogue crafting. It is worth reading Malcolm McCullough's detailed discussion of the construction vocabulary in computational design, found in Abstracting Craft, chapter 6.
6 The accelerating adoption of digital design and fabrication technologies have environmental implications which are beyond the scope of this paper. Some of these include questions about the efficiency promises and proliferation, material toxicity, recyclability, issues of accessibility and object plagiarism.