

Processes of Artefact Creation in the Hybrid-Reality Engaging with Materials through Material Oxymorons

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Abstract

Yet the nature of all these things must of course be physical
since otherwise they could not impress our senses
—for impression means touch, and touch means the touch of bodies.

Lucrezio, "De Rerum Natura"

The materiality of things represents the connection between our bodies and the physical world. However, in recent years, with the overlay of a new digital reality onto the existing physical one, materiality has extended its domain of existence into the virtual world through haptic technologies. The sense of touch is no longer restricted to a physical contact with any kind of "thing" existing in our world, but accessed through perception of it. By means of neurocognitive processes, which reproduce the sense of touch by stimulating particular areas of our brain, touch lost its direct and instinctive connection with the physical world to rely more on mnemonic processes of virtual perception that construct hybrid knowledge based on digital rather than physical stimuli. This paper investigates what the human relationship with things is in the age of human sense simulation. Also, what kind of sensuous relationship is established with our surroundings when the main territory of material investigation has shifted to the virtual, understood as "real"?

This paper will attend to human-object/thing relationships via the concept of the "material oxymoron". An oxymoron is a figure of speech that juxtaposes elements that appear to be contradictory. The "material oxymoron" finds its hybrid materiality by means of the human's perception of, and engagement, with things. By embracing the hybrid context (between the digital and the physical) in which we dwell, we would like to define a new kind of relationship between humans and objects/things using Malafouris' theory of "material engagement". We will articulate the process through which material oxymorons are constructed, and consider the role of material engagement theory in explaining it.

In the material oxymoron, the surface quality is no longer defined a priori in reference to information stored in the human brain, i.e. what we expect, but emerges from the process through which material oxymorons are created. We will therefore treat materials as mutable things, continually transformed by humans and material actants, rather than treating them as objects existing ad infinitum. By means of material oxymoron we aim to challenge a sensuous discovery of the physical whose outcome creates composite matter, i.e. a materiality that fosters human perception and engagement with the physical world.

Keywords

Artifact; process; oxymoron; hybrid; engagement

The University of Bristol recently published research that challenges the concept of touch by using “principles of acoustic radiation force, whereby the non-linear effects of sound produce forces on the skin which are strong enough to generate tactile sensations” (Long B., Ann S., Carter S.H., Subramanian S., 2014). Researchers Long, Ann, Carter and Subramanian looked at a system that simulates the feeling of touching an object without the presence of a physical object, and without any visual contact with it (2014). By employing the natural "acoustic" properties of human skin, University of Bristol researchers created a "tangible" sense where “dimensional phased arrays of ultrasound transducers enable tactile sensations to be produced in three dimensions in mid-air” (Long B., 2014 et al). In other words, frequencies and sound amplitudes are used as interchangeable data between the object and the human body. In order to allow our brain to "feel" the volume of the object, researchers extended the fields of points that generate the ultrasonic frequencies to maintain continuity among fields in time and space (Long B., 2014 et al). To increase accuracy and details of the actual object they modulate the different amplitudes' contrasts. From the human point of view, the actual geometry is then understood by converting the cloud of points generated by the acoustic field into meshes that reconstruct the object and the hand in virtual space. The mutual physicality of both parts, object and hand, is described by parametric coordinates ruled under the “limit to zero” equation that describes the behaviour of the curvature representing the density of points, hence the physical proximity of the two entities. This research is one of the most sophisticated in the field and aims to extend digital reality to the physical one and vice versa through different applications. The domain of hybrid-real is currently the territory of exploration of different agents, from engineering to design. The common aim is to blur boundaries and improve continuity so that reality can be understood equally, as much digital as physical; i.e. hybrid. For this specific reason there is a common urgency to find direct connections between the two parts, so that they are felt as a continuous field with no division.

The challenge that the digital has introduced to reality is the process of thinking how to make, which doesn't stop with the rapid prototyping revolution, but extends to the heart of how things, from the macro to the micro, are understood.

According to Andrew Benjamin (2006), the digital augments human sensitivity of the physical by means of its relation to representation. The ontological mimetic process by which we reify reality through images (Kant, 1781) matches the machinic process of the virtual, which relies mainly on representation; building make-believe worlds from synthetic visual representations of reality. However, since digital reality entered our "physical" space, visual engagement appears obsolete, as it constrains the other senses we human employ to experience reality. Memories are triggered by images as much as smells that in our brain stage the situation we experienced in the past. However materiality is quite an important element for humanity, as it defines the bridge between our body and the physical environment we inhabit. Nevertheless, in the hybrid-real materials implement their physical properties, through technological innovations such as 3D voxel printers that combine multiple materials to give shape to a composite. In other words, with the emergence of composite materials in our everyday scenario, and haptic technologies, which challenge the perception of physical materiality by joining touch and memories, we are reshaping a new framework based on the engagement we establish with materiality. Within this specific area the material oxymoron concept takes shapes. It looks directly at human engagement with materials by means of process. In the material oxymoron theory, materials are experienced as composite entities whose sensuous perception define the surface quality. Material oxymoron intends to trigger a physical/digital experience of the real based on the unexpected perception of it.

A matter of things and objects

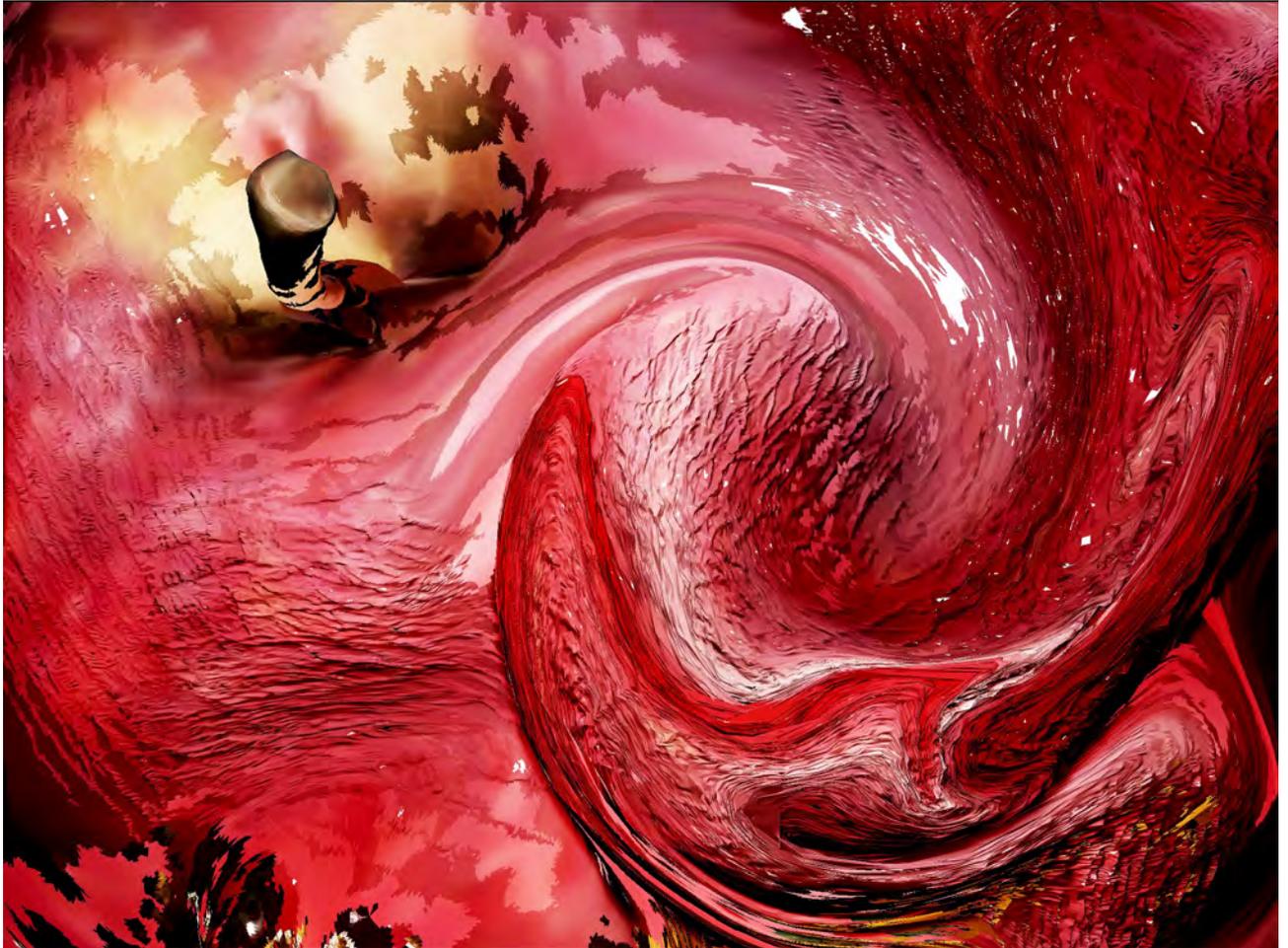


Fig 1. Painting materials and sculpting surface with ZBrush on a 3D scanned apple.

Physicality of the real touches metaphysical territories, if related to ontological open queries that investigate the understanding of the self, as entity belonging to the physical world. According to Lambros Malafouris, since childhood “we constantly think through things, as material culture shapes the manner in which people act, perceive and think” (2013); indeed within the human/object relationship, matter concerns metaphysics rather than physics. Such an intricate relationship is illustrated with the concept of the “cognitive life of things” where objects are “reduced to their ability to act as semiotic mediums of representation to amplify cognition” (Malafouris, 2103). According to the anthropologist Daniel Miller, who finds seeds of the materialist culture in Simmel and Marx, materiality, as a concept, “exists not through our consciousness or body, but as an external environment that habitates and prompts us” (as cited in Boscagli M, 2014). The resemblance of things, indeed, is quite a fundamental aspect in the hybrid reality we dwell everyday, as pointed out by Andrew Benjamin when he describes the representational value of the real in the digital world. Indeed, virtual reality adds to physicality an extra layer of complexity in the ontological system where our physical existence takes form. Within the physical realm we acknowledge our bodies as other matter of the real among objects or artefacts. Malafouris’ cognitive life of things makes us rethink the role of humans in their mutual technosocial transformation (2013). Since the beginning of civilised society, the human being dwells the twofold fascination of learning how matter continuously transforms its physical properties against the possibility of changing them. For such a reason, things are matter that resemble social relationships between people. “Mind

and things are in fact continuous and inter-definable processes rather than isolated and independent entities. By knowing what things are, and how they become what they are, you gain an understanding about what minds are and how they become what they are - and vice versa” (Malafouris, 2013)

The physical world is made of things whose matter is in perpetual transformation (including ourselves). Philosopher Manuel De Landa describes how French philosophers Gilles Deleuze and Félix Guattari shifted the obsolete understanding of matter as obedient entity, which obeys the physical laws, to a fluid active entity with its own physical characteristics (2012). When such a thing enters into contact with a human it becomes an artefact, which is a product of a human’s modification of physical matter. For instance, a clay pot is the result of a direct, tactile interaction with matter.

It is important to notice how an object differs to a thing. Objects are our interpretation of things, through a system of categories that we apply to acknowledge their existence. Indeed, objects are the ephemeral formal constraints that represent things in our mind. According to such definition, the virtual world(/mind) is characterised by objects, as they are artificial entities that human minds have created and categorised. It then follows that design is an act of classification of 'objects' into the world. What happens when design is processed through the virtual world?

Social change introduced by the overlap of digital over physical reality has opened up the possibility of creating, establishing and challenging networks of people connected by entropic relationships. The possibility of a global and fluid exchange of information, transmitted via the digital world, redefined the relationship between things and objects from not only a physical point of view. Thing/object understanding has been influenced by the fluidity of shared information, which engages different agents, human and non-human, in the manufacture of things/objects. For this specific aspect, things/objects cannot be analysed as isolated entities, but as components of a larger system where the human and non-human coexist. “By knowing what things are, and how they become what they are, you gain an understanding about what minds are and how they become what they are - and vice versa” (Malafouris, 2013). Hence, the cognitive life approach emerges, as acknowledgement of a material life that challenges a “methodological fetishism, essential in undertaking this key task of recasting boundaries of mind”. (Malafouris, 2013)

Material engagement

According to Manuel De Landa “the state in which we are born is a state of delirium, in which all the different intensities that have the capacity to affect senses - intensities of colour and sound, of flavour and aroma - exist in an unstructured field”. However, when we grow, we stabilise such intensities by conforming to social rules. Gilles Deleuze draws possibilities of destabilising such social constraints to free our perception of the physical by means of sensorial chambers (2012).

New engagement between human and non-human, via the new relationship between thing and object have created a new route in the cognition of the physical. According to Malafouris, “the extended mind is a new, radical and much contested thesis over the mind’s location” (2013). The dichotomy in discussions of cognition of internal “in the brain” and external “in the world” processes is collapsed by focussing on the in-between. (Wilson 2004; Wheeler 2005; Clark 1997; 2007; 2008; Clark, Chalmers 1998; Adams, Aizawa 2007 as cited in Malafouris, 2013). The internal understands mind without any external and ‘non-biological’ conditions, so that cognition is limited to the internal world without taking in consideration the external environment, i.e. body and matter. Externalism creates the syllogistic paradox by drawing the connection of mind with the external world - environment,

body and matter - thus recognising the importance of external elements in the process of cognition. (Malafouris,2013). It then follows that the extended mind intertwines mind, body and things to shape cognitive processes. Human brain is part of a body integrated in a physical environment so that the human acts on his environment and the environment acts or feeds back. The extended mind draws a continuous process of engagement that describes how humans interact with the world and the other entities in it. For instance, the creation of an artefact such as a pot establishes a relationship between potter and clay, which both exist in a physical environment. The human acts on the clay and the clay acts back on the potter and the muscles in his hands. This process is tacit and ignores linguistic processes. Here we are not bothered with discussions of semantics, but an embodied experience of the world (touching the world) that humans draw on to form knowledge about the environment around them. The human species has always done this as do all other animals.

In relation to the extended mind theory, boundaries hinder a proper understanding of the world. It is useful to consider the world as a complex of things in continual transformation rather than as a collection of objects that exist ad infinitum. However, in human perception, out of necessity, we objectify things generating meaning about them. Mentioned already, an artefact is a thing created by a human. It is evidence of an act of human modification or transformation of matter. When we create an artefact the human imposes an idea onto the world. This can be seen as a hylomorphic process and an anthropocentric one. The artefact becomes an ontological act that relates the human mind to its environment, in relation to the cognitive process described by the extended mind.



Fig 2. Toy plastic-like material is painted on the 3d scanned apple. Then the surface is treated as mouldable like a toy would be. An extra pattern is added to enhance the oxymoron effect.

The material oxymoron process in design

According to Mark Titmarsh “ontology as a mode of enquiry asks what kind of things, including abstract things, can be said to ‘be’”. (2006). In the design process, ideas are transformed into tangible objects. To some extent, the act of design is capable of creating new worlds by embedding in its poiesis a multiplicity of possibilities given by the continuous flux of fields, which are our physical and virtual reality. The design process does not involve an interaction with the physical world as does making a pot per se. However, in relation to the extended mind process, there is an embodied engagement with the physical world.

Contemporary design, in general terms, mainly takes place in the digital world. 3D modelling is a virtual act that gives form, and matter, to virtual entities that 3D printers bring back to physical reality. This process can be described under a looping process overseen by the extended mind. What are the artefacts of hybrid realities?

According to Titmarsh, the act of making requires a “physical and conceptual behaviour, involving intentional activity, pre-reflecting know-how, and a dialogue with the specific material qualities of a medium” (2006). Materials are not passive, as argued by Deleuze, hence making is a kind of dialogue of events between the material and the maker informed by the resistance of the material, which shapes the form of the outcome. The process of making in the hybrid-real intertwines new layers of complexities at different levels. In the

original contrast between objects and things, we cannot limit the space of objects to our mind, as the virtual itself can be considered as an extension of our mind. Objects are not only the formal subjective categories through which we understand things, they become matter of the digital reality, which is constructed under our own 'subjective' understanding of the physical world (objects). When digital interfaces become our tool to create new things, as it happens by 3D printing objects into things, artefacts become products of human action on hybrid matter. As we understand the physical through our body and matter, we replicate the same process when creating new things in the digital world. Design becomes a hybrid loop between the digital and the physical, which gives shape to a hybrid artefact. We call such a looping process the material oxymoron.

However, in the looping process between the digital and the real, something unexpected happens. The hybrid of body and mind are integral to our ontological existence, so it follows that a second level of hybridisation occurs in the material oxymoron, which is the effect of physical and digital when approaching artefacts. This condition is enhanced by the fact that digital materiality has no resistance. "The distance between the conceptualisation of a virtual thing and its appearance on the screen is not readily understood in terms of physical energy or material resistance." (Titmarsh, 2006). As no resistance is opposed, design offers multiple possibilities based on concepts rather than feedback constraints. The increased degree of freedom channels the process of designing towards human sensation of matter. When 3D printing digital artefacts we produce matter based on sensations formed from our expectation of physical matter, constraints that physically do not exist in the digital world. 3D printed artefacts are in-between digital and real; hybrid (oxymoron) artefacts. Under this light, 3D printing becomes an indirect interaction with matter that is capable of generating an uncanny, unexpected and unfamiliar sensuous perception which is the material oxymoron.

A material oxymoron is a hybrid between the virtual(/mental) and the physical, that uses digital languages to mediate the physical process of traditional artefacts to define a hybrid version. The hybrid artefact institutes a new form of interaction with materiality that enhances the perception of the physical world. Material oxymoron establishes and enhances sensuous relationships with machines by means of matter. A material oxymoron is the result of a new kind of design process.

Even if occupying a virtual environment, design creates new physical artefacts using 3D modelling software. This virtual realm is similar to the mind, as it draws on the existing knowledge of the physical world. This knowledge has been established through physical experience, from probing it with senses (especially touch which we immediately implement from birth). Just as the software is an extension of human mind, manufacturing machines extend human physical capabilities to realise 3D models as an artefact in the physical world. As objects are born into the physical world the designer can engage with this new thing through his senses, including touch, via hybrid reality. Synthetic materials are applied to this new thing using a software such as ZBrush, which allows to 'paint' materials on the 3D model. Because of the artificial quality of digital materials, human senses enhance the traditional understanding of matter because of the freedom afforded by digital modelling softwares.

This process of creation is juxtaposed with the traditional formation of an artefact. Consider again the example of the potter at his wheel. His body engages with the material directly. The clay and his hands have a haptic relationship and a feedback loop is established where the muscles in the potter's hands react to the transformation of the clay. Although this kind of material engagement is lost in the process that produces material oxymorons, there is an enhanced perception, given by the unexpected results. The whole process of making is defined by a continuous engagement with matter, but at a different level, which concerns the extended mind theory. Although a physical relationship with the thing emerges at the very last step, a relationship with the artefact is continuous throughout the whole process. As by

definition an artefact is the result of a human's transformation or manipulation of matter, matter in the material oxymoron is always present in different kinds of hybrid states. The human still creates the outcome but his/her intention is mediated through technology. This is not new. A plane may be used to smooth a surface of wood, this is a tool between human and material. However, in the case of this new process, the idea passes into the virtual world before returning to the physical world. The human knowledge of materials is applied in a 'traditional way', to the virtual world; because the process is hybrid, the material is hybrid too.



Fig 3. 3d scanned apple sculpted in ZBrush. Materials and colouration are painted on the original pattern. Through ZBrush the apple transforms its own materiality.

New artefacts

Despite our ability to occupy a virtual space, human sensory experience always exists within a physical world. According to Maurizia Boscagli, "when materiality is separated from its use for humans, it can emerge in all its sensuousness and metaphysical presence" (Boscagli M., 2014). We know the world through our sense of touch, which helps to form in our mind the concept of material. Touch indeed is the sense we use from the moment we are born to navigate and learn about the physical world. It is the bridge between our body and the physical environment we inhabit. Nevertheless, new design has tended toward a translation of physical material into virtual representation; skeuomorphisms of Apple and other companies being a key example. Touch is lost in place of its simulation, which evokes the perception of it, rather than the physical interaction. The material oxymoron describes a new

design process where the physical enters the virtual environment (through the designer's tacit experience of it), but returns to the physical. The virtual is used as a space to facilitate the creation of new artefact rather than being the final destination of a (pre)rehearsed process. Here we establish a design ecosystem where the physical (body) flows to the virtual (mind) and back again in a cycle of production (not necessarily hylomorphic), which evokes materiality as continuous, sensuous thread. This is parallel with the material engagement mentioned by Lambros Malafouris; the mind has been extended with virtual software and the body extended through manufacturing machines.

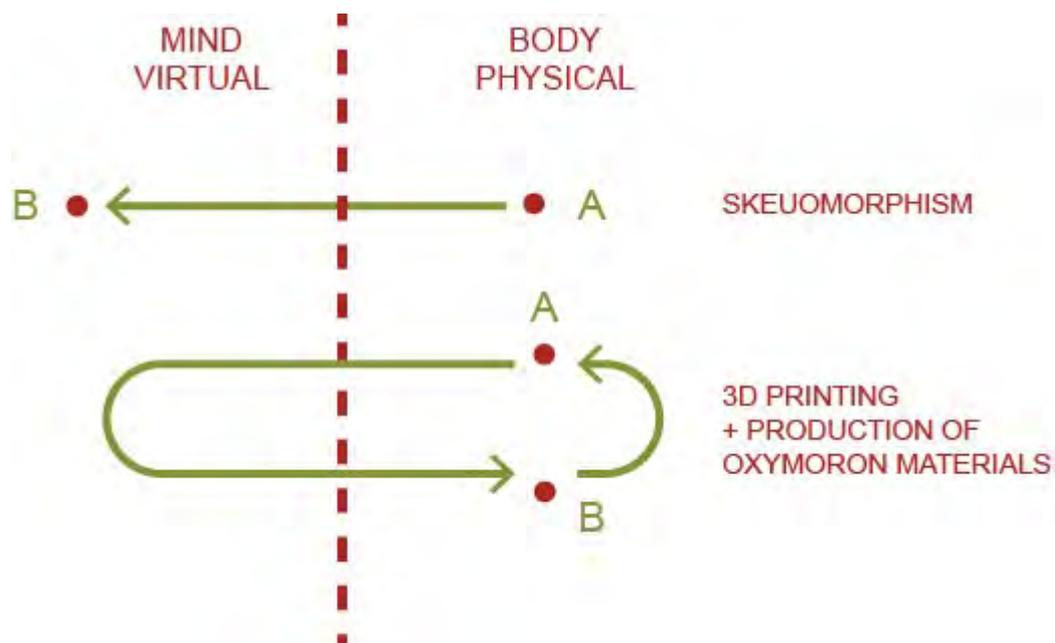


Fig 4. A linear process of transformation from the physical to virtual; a cyclical process of transformation from physical to virtual and back again.

If looking at the possibilities that voxel 3D printers afford, i.e. 3D printers that read 3D pixels (voxels) as physical materials, the material oxymoron becomes process of producing artefacts, which challenge the subject of materiality in its general terms. Through the material oxymoron process, we have the capability of imaging new kinds of things, voxel 3D printers offer us the possibility to combine different kinds of material and colours in the same print. We entered the composite thinking age, where complexity is the continuous thread that constitutes the entropic order of hybrid society. New artefacts may be material sensations generated in the hybrid world. This has ramifications for what it means to be a thing and how they are understood.

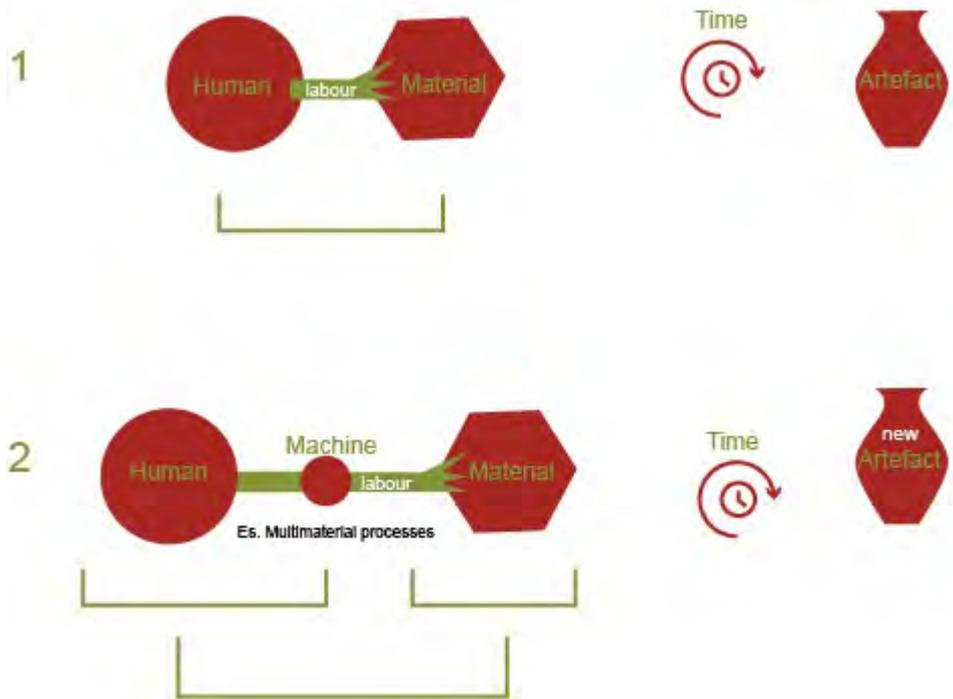


Fig 5. 1. The process of traditional artefact creation; 2. The process of new artefact creation employing extended mind and body in hybrid-reality.

Sensation world



Fig 6. 3D scanned apple sculpted in ZBrush. Materials and colouration are painted on the original pattern. Through ZBrush the apple transforms its own materiality.

Since the origin of civilised society, the intricacy of matter represents the ontological meaning, and substance, of the physical world. Recent studies, like the acoustic perception of touch explored by the University of Bristol, or the whole studies on robotics that look at haptic technologies as a link between the virtual and the physical world, offer pictures of the current direction that seeks an equal ontological approach for the virtual world. Virtual reality is no longer an external part of the self. It belongs to our vision of the real, the physical and the digital, as part of human experience.

This paper described how the poiesis of new things, or artefacts, can extend the "physicality" of real world, rather than projecting its perceived simulated quality in the digital realm. The material oxymoron is a process that aims to extend human sensorial perception of the surrounding via materials in the act of design. It wants to move from ephemerality in virtual space, to become real once 3D printed. The material oxymoron process transforms materiality from the physical to the digital and back to the physical. By targeting human relations with things, by means of the hybrid artefact, we intend to challenge the macro structure of materials via physical components, and the human sensorial act of modelling. Because we are capable of imaging materials that resemble physical properties with synthetic qualities, the human tangible experience becomes the looping engagement with things. Contemporary society is a permanent flux of events, which assembles and disassembles its components in real time. With the material oxymoron, we provide society of

its own matter, which is capable of performing in hybrid reality the act of transformation, for creating, new substance via human senses.

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Dr Laura Ferrarello is an architect, artist, researcher, designer and writer. Her work explores the duality between "digital" and "physical" by means of the information that both domains generate and exchange. Through theory and design, Laura's work explores also the materiality of digital/physical reality by looking at design processes capable of enhancing the sense of touch. Laura's design practice speculates about the topic of urban space, understood as multi-sensorial place capable of engaging citizens through body performance. She exhibited her work at the 2004 6th São Paulo Biennale and 2006 10th Architectural Venice Biennale. She designed the catalogue for the 2008 Beijing Biennale. She received a PhD in Architectural Design at IAUV University of Venice. She worked in Rome (Italy), Los Angeles (USA) and London (UK) in a wide range of projects, from the urban to the human scale.

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