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Technological Microcosms – Considering Materiality and Collaborative Practice in the Creation of Wearable Futures

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Abstract

With the increased prevalence of digital technologies in our everyday lives, the questions posed to the contemporary craft practitioner regarding creation of an emotionally resonant interaction between the digitally enhanced object and its wearer have become progressively more prominent in the applied arts. Through examining the notion that human biology is a part of material culture, my research explores how recent developments in material science and wearable technologies can be viewed as contiguous rather than oppositional to the organic processes of the human body and how to bridge the gap between the craft practitioner and scientific discovery. More immediately, this research challenges the perception of smart materials and their application within the field of contemporary jewellery in both an artistic and scientific context through proposing the development of symbiotic stimulus-reactive jewellery organisms. Bringing together digital methods of fabrication with craft methodologies, I use materials such as silicone in conjunction with thermochromic pigments to create objects that respond intimately to changes in the body of the wearer and the environment. Potential practical applications for these jewellery objects exist in the areas of human–computer interaction, transplant technology, identity management and artificial body modification, where such symbiotic jewellery organisms could be used to develop visually engaging, multifunctional enhancements of the body.

Author Keywords

Smart Materials; Wearable Futures; Contemporary Jewellery; Rapid Prototyping; Thermochromics; Collaborative Practice

Research Imperatives

The idea of creating a jewellery organism that comes alive on the body has fascinated and inspired my research ever since learning about the potential inherent in smart materials almost ten years ago. While smart materials have been known to scientists for far longer (Huang et al., 2010) and have been used to great effect in engineering and aeronautic applications as actuators, their use in contemporary art and craft has been sporadic, most likely because of the challenges posed in accessing, processing and shaping them. Many smart materials with the most fascinating characteristics are not yet commercially available to the contemporary craft practitioner, and can only be accessed through a process of seeking out collaborative relationships with the scientific community or industrial producers. How the gap between the practitioner and cutting-edge scientific discovery can be bridged to facilitate such collaborative efforts and benefit all parties involved is a key question of this research. Developing a holistic approach whereby material experimentation and digital production processes are used to facilitate the development of a coherent aesthetic language that supersedes ideas of mere gadgetry and enables wearable technologies to be imbued with life is at the centre of my research. I challenge the perception of smart materials and their application within the field of contemporary jewellery in both an artistic and scientific context by exploring the use of thermochromic pigments and microelectronic components to develop symbiotic stimulus-reactive jewellery organisms that are visually engaging yet multifunctional enhancements of the human body (Figs.1 and 2). The permeation of digital technologies into even the most personal realms of our day-to-day lives has facilitated the acceptance of the concept of cybernetically modified bodies through advances in medical technologies and procedures (Bland, 2010, Clark, 2003). Craft Practitioners who define themselves as *technical creatives,*

Figure 1. The Geotronic Brooch contains a programmable colour LED which is set to beat like a human heart.

Figure 2: Kathy Vones, Geotronic Brooch in darkness, Silicone, Copper, Vitreous Enamel, Sandstone, Electronic Components, 18ct Gold (2013)

"Craft has been described as being "without design" […] It is continuous, rather than discreet in nature, and it is suggested that this is the root of the 'holistic' perception of craft." (Kettley, 2005, p.10)

well versed in both scientific and artistic methodologies and working on the development of wearable futures (Miodownik, 2003), are moving towards a present in which technology could become permanently integrated into the complex systems of the human body. The possibilities and challenges facing the contemporary jeweller in particular, to advance the debate surrounding the modified body and interactive adornment while engaging in successful collaborative projects with partners from the scientific community, will constitute the focus of this research.

Research Process

My research process focuses on the concept of playful practice and its emphasis on material experimentation. The process of prototyping is one of the methodological cornerstones of playful practice and is often regarded as being one of the final steps within the linear process of problem/need identification – visualisation – prototyping – testing applied in product design and its related disciplines. However, it is less well recognised as being an integral part of contemporary craft, and within the context of disciplines such as fashion, ceramics and jewellery design, prototyping is often referred to as making 'test-pieces' or 'mock-ups' – a description that belies the huge potential inherent in this creative process. In her investigation of design principles used with contemporary craft, Sarah Kettley successfully identifies the internalisation of a particular material or process achieved through visceral immersion through manipulation, handling, repeated exposure and drawing as one of the key factors in imbuing crafted objects with emotionally resonant qualities that transcend mere artistic and personal expression (Kettley, 2005). As soon as playfulness is combined with prototyping, a creative process of trial and error emerges that can yield innovative and sometimes unexpected results (Lieberman, 1977). Using design methods such as drawing, photo studies, collage, image boards, experiments, personal inventories, generative design and prototyping (Martin and Hanington, 2012), my research process consists of developing a series of material experiments as well as finished jewellery pieces and objects based aesthetically on microscopic structures found in the natural world. Over the last twelve months, particular emphasis was placed on developing complex silicone shapes with the help of three-dimensional printing technologies that integrate thermochromic Leuco dye pigments to achieve temperature induced colour change cycles. During a series of controlled experiments, ratios of liquid Leuco dyes increasing in increments of 0.1ml were mixed with silicone compounds and carefully controlled amounts of powdered artist pigments to achieve varying degrees of colouration and transparency in the finished silicone shapes. It was discovered that upon reaching the activation temperature of approximately 31˚C the Leuco dyes reach transparency and reveal the underlying pigmentation stemming from the addition of artist pigments (Figs. 3 and 4). Upon cooling, the thermochromic pigments are restored to their original opaque state, thus reversing the colour change. This cycle is repeatable infinitely, although further long-term testing is

Figure 3. A temperature induced colour change cycle (low to high) from magenta to blue in thermochromic silicone samples for the Cocoon Earring series.

Figure 4. Below is an example of the colour range achievable in combining thermochromic Leuco Dyes with Silicone

necessary to check for material fatigue and discolouration. It is hoped that through future collaboration the potential of thermochromic liquid crystals and their spectral colour change cycles can be investigated in this context.

Research Outcomes

The *Cocoon Earring* (Figs. 5 and 6) exhibited at the *Praxis and Poetics* Conference represents the first of my research outcomes to combine thermochromic silicone shapes and a three-dimensionally printed structure with microelectonic components while achieving stimulus reactivity. Unlike its predecessors the *Geotronic Brooch* (Figs.1&2) and the *Mycelia Brooch* (Fig.7), which relied either on pre-programmed cyclical responses or external light stimuli to create interactivity while being worn, the *Cocoon Earring* reacts intimately to the biological impulses created by the human body. Through the incorporation of a pulse sensor in the clip-on earring finding, the wearer's heartbeat is measured continuously when the *Cocoon Earring* is fitted onto the earlobe. As soon as the wearer's heart rate rises from its established base levels, a signal is sent to a small microcontroller. This signal is in turn translated into heat impulses and sent into thin wires embedded in the thermochromic silicone shapes. The heat from the embedded wires gradually starts to activate the thermochromic pigments and the silicone shapes start to change colour as the heat is distributed throughout. If the wearer's heart rate falls back to its established base rate, the wires start to cool and the thermochromic pigment slowly returns to its initial inactive state, thus reversing the colour change in the silicone shapes.

Figure 5. Kathy Vones, Cocoon Earring - first production sample incorporating thermochromic silicone shapes and a sandstone structure (2013).

While relatively large in scale, the *Cocoon Earring* is designed to almost fully envelop the ear conch to create the impression of a calcified growth that emerges from the ear. This further emphasises the concept of a jewellery organism that is intimately connected to the wearer, thus creating an original visual language that transcends functional considerations and focuses on harmoniously integrating microelectronical components and smart materials into an object that is both aesthetically as well as functionally resolved.

Through engaging in a holistic process of material immersion and experimentation I am developing a body of work that is emotionally resonant while leaving space for serendipitous discovery. The rise of *technical creatives* represents a new breed of studio artist, equipped to contribute to the debate surrounding the role of the practitioner in an age defined by digital revolution and material discovery. Against a background of growing fascination with and reliance upon technologies and devices that contain some form of interactivity, my research provides an essential part of developing a discourse on the place symbiotic jewellery and the contemporary craft practitioner occupy within this setting. The challenge to

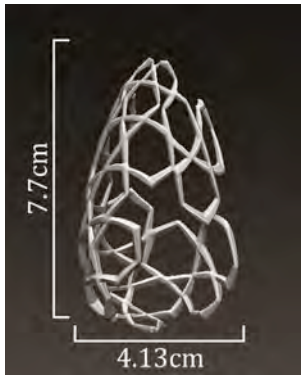

Figure 6. Three Dimensional Design Drawing of the Cocoon Earring

"The real value of a model or simulation may stem less from its ability to test a hypothesis than from its power to generate useful surprise. […] It holds equally true that chance favours the prepared prototype: models and simulations can and should be media to create and capture surprise and serendipity." (Schrage, 2000, p.117)

Figure 7. Kathy Vones, Mycelia Brooch, Sterling Silver, 18ct Gold, Silicone, Mineral (2012).

This piece was inspired by growth patterns of microscopic fungi and the silicone shapes contain UV reactive pigment.

reconfigure craft-based techniques and aesthetic considerations within a methodological framework focused on the user experience of wearing and interacting with stimulus-reactive jewellery objects will provide the basis for the further development of these ideas in a variety of practical applications.

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