# An Engagement with Emerging Technology

In this text Sarah Kettley examines recent developments in digital jewellery, reflecting upon current debates and emerging technologies and how these have informed the development of her own practice.

Sarah Kettley

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**Exploring the use of miniature networked computers in contemporary jewellery practice**

**Background**

This article begins to map a new area of craft practice - that of digital jewellery. It draws together work undertaken in my doctoral research and as an Arts and Humanities Research Council fellow [1/2/3] and contextualizes it with reference to related theoretical and practice led research. By way of introduction, this section outlines my personal motivations for engaging with emerging technologies, describing the technical visions that have inspired my approach.

**Personal Motivations**

My own interest in this area was sparked when I retrained in Multimedia, having decided to leave jewellery behind, and I was introduced to the concept of Wearable Computing, in which small computational products are worn about the body. Definitions of 'wearables' generally agree on their being contextually aware, that is, containing sensors, and being unobtrusive to the point of being invisible, either literally hidden in the seams of clothing, or no longer noticeable by virtue of being a familiar part of the wearer as 'dressed body' [4]. However, as a jeweller looking at the objects produced by the research and commercial wearables communities in 2002, it seemed obvious that their stated aim of becoming 'everyday' [5] would remain an unreachable dream until the relationship between formal properties and cultural roles was more seriously considered. Design solutions at that time consisted largely of strategies for strapping existing hardware to bodies, shrinking hardware without addressing its formal characteristics in any other way, hiding it completely, or adopting the persona of 'borg'. Culturally rich phenomena such as jewellery were habitually treated as a resource to be plundered in 'proof of concept' projects, leading to the current misplaced notion that 'jewellery has been done' in terms of, for example, networked technologies [6]. This kind of misunderstanding of the importance of systems of dress, and more fundamentally, of the importance of materiality in design, reveals fundamental issues inherent in the questions I set out to ask of the design process: What would a craftsperson make of an emerging technology? What would a jeweller make of wearable technologies? It seemed important to address these questions through practice-led research, and I looked around for a technology which would allow me to treat it as material.

**Speckled Computing, Ubiquitous Computing**

The technology I have been using over the past three years is called Speckled Computing (Speckz), and is still being developed by a European funded Consortium of five Scottish universities [7]. Napier University in Edinburgh, where I am based, is a member of this consortium, contributing expertise in algorithms and application development for evaluation with users. I work within this second category as part of the Centre for Interaction Design in the School of Computing. Speckled Computing aims to become the 'generic enabling technology' for what is a much larger shift in computing, Ubiquitous Computing. This section briefly describes this important concept and gives some ethical arguments for creative practitioners, and in particular Craft makers, to become involved in what might appear to be an antithetical field, before returning to what 'Speckz' can actually do, and what I did with them.

The vision of a world imperceptibly embedded with miniature sensing nodes, capable of sharing information and effecting change in the environment (for example, opening the door of your home as you walk up the path), is commonly attributed to the late Mark Weiser, a computer scientist at Parc Xerox. His team developed a series of wirelessly interconnected and location aware pads, tabs and boards of differing scales, which could be moved around an environment in the manner of post-it

notes, sheets of paper and blackboards. Weiser's important position papers outlined a world in which every surface would be 'smart' and connected, and in which the computer was no longer a grey box on a desk, but a phenomenon embedded invisibly in the familiar world [8/9]. Twenty years on, the enabling technologies of, for example, Smart Dust (Berkeley) [10/11] and Speckled Computing (Scotland) [7/10/12] are taking what is still a relatively benign and contingent situation, and are rendering it unimaginable. These technologies may be considered *pervasive* in that each node, or 'Speck' can sense, process and transmit information. They are potentially self-organising and are envisioned as being deployed in far larger numbers, sprayed or painted onto surfaces or embedded in materials.

There are strong ethical motivations for the engagement of craft practitioners with fields of emerging technology, on several levels. The most obvious of these, the mark of the maker, is a romantic notion that has led to Craft being labeled Luddite in its attitudes [13], and yet this concept is a serious one in answer to undeniable feelings of alienation in experiences with spatially and temporally distributed systems. Craft is also claimed to contribute to more sustainable models of consumption through the creation of contexts for significant owner/object relationships [14/15], and in its emphasis on the physical, obstructs the leveling of the 'law of proximity' which underlies our strange experiences with immateriality [16]. In addition, design has long realized its responsibilities in bringing imaginary worlds into existence [17/18], and as the 'design of social interaction' becomes more prevalent (due to increased immateriality), Craft may offer a richly considered alternative, treating people as more than a collection of problems to be solved, while offering desirable product experiences [19]. And finally, emphasizing the need for a hybrid of the material and immaterial, current thinking in cognition, social networks and human experience all point towards a strong interconnection between what it feels like to be, and the nature of what we encounter in our environments [20/21/22]. How meaning is created through associations between things and people, the way in which courses of action are implicit in formal and cultural structures, and the importance of the body in empathic understanding, all suggest that the way in which products are conceived and introduced to the world have an impact on what shape that world takes and what it means to be a part of it. The resonance of a material object may now reach further in all directions, while immaterial systems are here and there simultaneously; whatever it is the designer brings into the world now has an impact on many more individuals and networks, whether in physical proximity with the object, or far from it, and the course of its influence cannot be projected. To design simplistically or produce cynically is undeniably unethical in this situation, and responsibility must become pervasive and fundamental.

In light of this interconnectedness of things, the significance understood to be inherent in jewellery suddenly expands to include not just the relationship between one wearer and object, but a whole, complex network of inter-subjective being. Jewellery often aims to make the one-to-one relationship between owner and artefact more meaningful, and this can offer a valuable and legitimate approach to sustainability through the extension of the object's lifecycle. But jewellery offers a more sociable view of the world as well, and this is what is needed in the development of meaningful networked products.

To summarise these points then, Ubiquitous Computing poses interesting problems and a pressing ethical situation for design in general, and for craft practice in particular. The utopian ideals of its original developers for an unfailingly helpful technology have been reflected back in the dystopia of much critical work (see for example *Tagged*, at Space Media Arts [23]), and this is creating a problematic dichotomy [24]. Might Craft offer a complex approach to a complex situation? Contemporary Craft encompasses the familiar and the strange, if not always the provocative, and McCullough has shown that the programmer may also be a craftsman [25]. What then might Craft look like, in the face of such intangible materials as social interaction and Ubiquitous Computing? These have been the key questions guiding my research over the past four years.

**Inter-disciplinary practice**

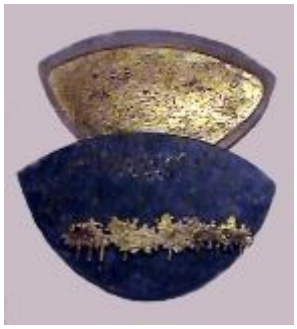
This section introduces some related theory and practice in inter-disciplinary work before describing my own experiences in working across boundaries.

There are a number of other notable jewellers engaging with technology in the UK, and in particular I would mention Jayne Wallace, Ulli Oberlack, Hazel White, Norman Cherry and BioJewellery. With the aim of contextualizing my own work, I have conducted interviews with these makers, and although their practices deserve separate treatment, it is useful here to draw out some commonalities in approach. These include the building of collaborative teams and shared languages over extended timescales; varied forms of co-creativity (see also [26] for related findings); and importantly, a much deeper human involvement throughout the process, as a result of collaboration and user-centered techniques borrowed from Human Computer Interaction (HCI) and design. One common term not normally associated with craft or fine art practices is *iteration*. This denotes an unfinished work shown in public, with the aim of using public feedback to improve on some future 'finished' instantiation of it.

Both this display and the involvement of non-expert opinion would more normally be considered anathema to what have been at times highly autonomous fields of creative production. Technologies that highlight interaction (whether between humans, or between human and system) challenge this autonomy to the extent that what is considered material must be reconsidered, as well as methods for working that material (an excellent example is the 'beta-space' at the Creativity and Cognition Studios in Sydney, where interactive work is piloted with the public [27]). 'Material' now must now also cover what may be inferred rather than seen or felt, as in Dunne's work which makes electromagnetic fields visible through 'contemplative objects' [28] or in the communications of Speckled networks glimpsed in their changing LED colours - red means on, blue means receiving, for example. It must be understood to cover the cultural meanings that particular works or designs evolve (as well as their ideologies), and behaviour, both of interacting humans and of systems, (as in Brown's Neural Net Starfish, in which a projected starfish appears to live in relation to the nature of the audience's actions towards it [29]).

For myself, I am a contemporary jeweller to be found in a School of Computing. The research has necessarily been carried out across three institutions in Edinburgh, with the craft work supported by the Silversmithing & Jewellery department at Edinburgh College of Art, the Speckled Consortium being based at Edinburgh University's Informatics department, and my own desk situated within Napier University. This arrangement, and my experience walking between these institutions, has seemed to make very physical the borders of the different disciplines involved. I now detail two iterations of my own wirelessly networked jewellery, developed as part of the doctoral research, before describing the current AHRC project, *ensemble*.

Since April 2004, I have been engaged in the collaborative development of networked jewellery using prototype Speckled Computers, or 'Speckz' [1/7/12]. The first set of three pieces (two brooches and a pendant) is shown in Fig. 1, and a series of stills from a video showing the light output in interaction in Fig. 2. The basic function of the pieces is to map the social activity of greeting, and the three distances at which members of a friendship group greet each other are visualised in the LED displays in both iterations. In this instance, the Speckz used received signal strength to calculate distance, and the only sensor used was a touch sensor in the pendant. This was intended to offer the wearer the chance to override evolving patterns of interaction by 're-setting' the visual output of the others' jewellery (although this proved too ambitious for this stage in the project).



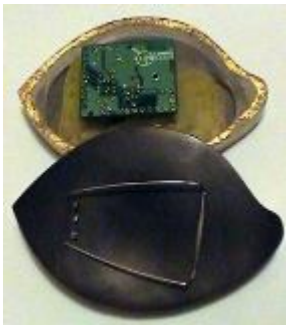


Fig. 1 (3 images above)
The first set of networked Speckled Jewellery from left to right, brooch, pendant and brooch.
*(click on images to enlarge)*


Fig. 2 (2 images above)
Stills from demonstration of Speckled Jewellery interaction, October 2004
*(click on images to enlarge)*

Initial investigations were based on the tangible materials of the jeweller (enamels and precious metals), on the vision for the Speckled Computing (a 1mm cubed node as described above, spray-able and scatter-able) and Orth's far reaching vision for a malleable computational material, in which 'artists and researchers can materially and sculpturally transform physical computing technology from hard,

remotely-designed, plastic shells, into intimately created, sensual computing objects' [30]. However, metals were soon exchanged for plastics, and the forms changed as a result of the author's new technical awareness (metals interfere with the radio signals at crucial short distances, and other components including batteries were added). The fully malleable material proposed by Orth may soon be available to those who intimately understand the technology itself, but remains a far off goal for those with different training; in the meantime, the jewellery followed the modernist and pragmatic route of encasing the technology. The material of social interaction was researched through scenario sketching, lightweight Social Network Analysis [22], and drama exercises. These first pieces were demonstrated at the Creative Digital Interaction Symposium at ECA in September 2004 [31], but were not robust enough to allow any user involvement, thus denying the necessary engagement with the behaviour of the network for expressive refinement.

A second design iteration addressed issues of wearability, user control, power supply and readability of the light output, and further developed the visual language of the work using Perspex, Formica, polymer clays, resin, and precious metal clay, polyethylene 'paper', silver, gold leaf and pigments, combined with the LED displays (Fig. 3). This suite of five neckpieces represented the first fully developed application to use Speckled Computing, although it cannot be considered finished in terms of craft criteria (there is plenty of scope to develop the quality of the light travelling through the materials, and a true craft approach would work from the characteristics of the computational materials themselves rather than creating containers for it). However it has been compelling enough to demonstrate the impact of craft practice to the computing community, and was functional enough to allow further work with social interaction and cultural meaning (Fig. 4 shows evaluation sessions taking place in one the women's homes, and in the Royal Museum of Scotland, Edinburgh) [1/32].

Fig. 3 (8 images)
2nd iteration Speckled jewellery nodes, pendant detail and battery in custom case

*(click on images to enlarge)*





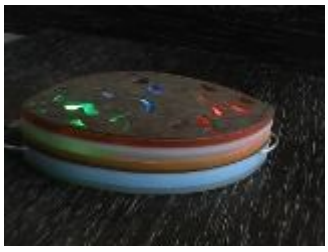



Fig. 4 (2 images, right)
Scenes from the out-of-the-box evaluation session at Ch's home and the task-based evaluation at the Royal Museum of Scotland

*(click on images to enlarge)*

Throughout the work, drawing and sketch modeling, as well as development of non-computational work in related mixed materials and materials tests (Fig. 5a), have been important strategies for informing the design of the networked pieces. These more traditional methods have been supplemented by a range of experimental 'user centered' techniques found in Interaction Design, notably cultural probes and collage techniques gleaned from IDEO's Method Cards, which summarise ideas for understanding user behaviour in real life situations as well as in heuristic studio analysis [33]. In addition, notebooks have been useful for working through interaction scenarios (Fig. 5b), and psychology questionnaires have been borrowed as a tool to stimulate discussion. About eighteen months into the research, a productive method was to present formal characteristics of visual research together with basic functions of the technology materials, (for example, movement) (Fig. 5c).

Fig. 5 a & b (right)
PMC & enamel test pieces
designs for conceptual social interaction

*(click on images to enlarge)*

Fig. 5c
Formal characteristics and functionality

*(click on image to enlarge)*


Frustration seems to be a typical emotional response of artists and craftspeople when beginning to work with technology. For the most part, there is a need to move beyond work which expresses solely the artist's struggle with this new material, towards something more meaningful [34]. For craftspeople, the material is allowed to dominate in a way that is unacceptable in fine art (and in new media art) [35]. Craft allows concepts to emerge through the working of the material rather than starting with an idea and selecting the best tool/material for the job. However, craft also demands a level of expertise with material which takes the work beyond that expression of struggle, and so for both kinds of practitioner, outcomes can often feel promissory rather than resolved. For a craftsperson, then, the electronics engineer, systems expert and programmer all represent levels of expertise with specific materials, which they may aspire to, but which in actuality they must find a way to collaborate meaningfully with.

**Ensemble**

This Arts and Humanities Research Council funded project deals with the social characteristics of jewellery, and has significance not only for the domains of wearable and pervasive computing, but also allows us to reflect on the network of social relationships that jewellery and adornment are a part of [3/36]. It aims to highlight common perceptions of privacy issues in wearable computing through the use of collected fragments of personal narrative, concealed by a soundscape. The audience is invited to enter the space of the installation, and to pick up the pieces of jewellery there, manipulating them and in turn affecting the shape of the soundscape. As participants begin to interact with each other as well as with the artefacts, the hidden personal stories become exposed in a conversational exchange. The concept is informed by the notion of reciprocal disclosure as a means of building relationships between individuals, and as the noise swells within the space, the idea that sensitive information can be continuously monitored in any meaningful way from outside that intimate system is brought into

question.



Fig. 6
Concept pieces for touch and movement based interaction

In this work, there is an emphasis on the dramatic nature of the jewellery, rather than the workmanship, and the pieces suggest broad types of gesture, after the 'affordances' of HCI and design [37](Fig. 6). Again, the work is interdisciplinary, and involves 'users' at formative stages. At the time of writing, this involvement is in the planning stages, but the project is well documented through its dedicated website [3].

**Reflections**

As mentioned above, the ontology of material and concept is relevant to the progression of interdisciplinary work as well as in the characterization of that work as craft, art or design. It can be a major stumbling block for makers more used to developing ideas in their own time, and with the authority to pronounce something finished to their satisfaction. Computer scientists have in common with many areas of design a working philosophy derived from enlightenment ideals, in which an idea takes precedence over the rendering of it. But increasingly, this position cannot hold, as HCI and Interaction Design exhibit a deepening interest in phenomenology and embodied experience, and this is why it is crucial to be writing about, and of course demonstrating, the practices of Craft. In addition, it has become obvious that these processes may be extremely people centric, both in terms of the inter-disciplinary teams it takes to produce digital jewellery, and in terms of the people around whom it is designed, and who are expected to wear it in whatever context. This is in turn a healthy direction for contemporary jewellery, whose autonomous practices can only be further crystallized by the plinths and glass cases of the modern gallery space. It is hoped that the examples and reflections given here allow others to ask important questions of their own work, of emerging technologies, and of the meaning of jewellery and craft in our lives.

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