The Materiality of Wearable Computers – Craft and Authentic User Experience

Sarah Kettley, Michael Smyth
Napier University HCI Research Group
Colinton Road, Edinburgh EH10, UK
{s.kettley, m.smyth}@napier.ac.uk

Abstract

This paper presents work undertaken as part of the author's ongoing doctoral research into **Wearable Computers**, and the processes for designing personal digital artefacts that exhibit *materiality*. Materiality is discussed in its associations with contemporary craft, and as a means by which tools may cease disappearing in the obsessively rational quest for what Heidegger called *readiness-to-hand*, and instead become more meaningful for users as objects in interaction. The overall aims of the research are to investigate evidence for the growing desire for authentic experience in everyday life, and to evaluate craft practice for its possible contribution to new design and build processes that can deliver this authenticity.

Introduction

The research this paper describes spans two main fields of activity – the arts, and human-computer interaction (HCI). It is differentiated from much of the writing disseminated through arts channels in that it does not concern the use of computers, new media or programming in the production of art works. Simultaneously, it is unusual in the HCI community for its basis in arts practice. Much has been said about the nature of craftsmanship as computing technology becomes available to the practitioner, but little has been said regarding the role of the craftsman's sensibility in the development of computational products. The aim of this paper then is to draw

attention to the positive contributions contemporary craft as a discipline may be able to make to this emerging interdisciplinary field of practice. The comfortBlanket design project is presented as a practice-based attempt to investigate the relationship between craft and product design in the development of a computational wearable concept, which served to further refine a critical approach to this area of design. In the interests of illustrating the link between theory and practice, the user-centred methods are given in some detail, before the critical approach, drawing on literature from HCI, design theory, and market research, is presented as the main outcome.

Background to the practical work

The initial motivation for the comfortBlanket was the challenge to create a device for 'the everyday', described as the 'final frontier' for wearable computing (DeVaul et al 1999). In looking at market research and social commentary, it seemed that 'everyday' people were increasingly demanding what was being termed 'authenticity' in experiences and products, and it was decided to investigate craft as a possible methodology for delivering this type of product. To summarise a complex philosophical area, the primacy of HCI's 'invisible computer' became challenged by the *object* central to all contemporary craft. The theoretical approach towards the end of the paper describes this issue in more depth. In the meantime, it should be enough to think of the comfortBlanket as an attempt to understand the perception of authenticity and meaning in the relationship between user and product. It sought to discover something about the nature of craft within this process, both in terms of process and artefact. Materiality was conceptualised as denoting presence for the user of the product, through its being 'a relevance requiring careful consideration', and the

design specifically sought to encourage this presence through the use of the traditional craft practice of patchworking.

The comfortBlanket

Aims –The aims of the comfortBlanket as a solution to a design problem, to help a defined user 'make the transition from sleeping to waking up and back to sleep again' (D&AD Nesta 2003), were separate to those aims of the wider research into the methodologies of design as a whole. This paper concentrates on the questions the conceptual research wished to answer through the comfortBlanket:

- Did it suggest authenticity in its use of craft techniques?
- Did it embody a potential for personal meaning?

Design - the comfortBlanket used recycled favourite children's clothes and patchworking to combine familiar materials already imbued with personal meaning, and a crafts process with particularly domestic associations, with what were assumed to be less familiar technological components, which might cause concern for health or safety. The element of familiarity was not intended here to encourage phenomenological disappearance of the object, but rather to promote initial approach behaviour, in order to allow the consideration process to begin. It was hoped that materiality would be afforded by the many small images in the patchwork, encouraging the social building of narrative between parent and child, and by socio-cultural associations with the technique itself. Three design boards presented the product as a set of specifications, as part of a user scenario, and as a background design concept respectively.

Design Board 1: Product Specification

The blanket was conceived of as being part product, part service, involving the consumer in the manufacturing process through their role as supplier of favourite used clothing, which the manufacturer would then use to make up a patchwork blanket unique to the customer, with the sensing technology fabric sandwiched between two outer layers. The user was defined as parents and carers of young children whose sleep is frequently disturbed; sleep deprivation can cause stress and depression, and so while it is the child who is comforted in the first instance, the primary user was seen to be the adult.

Design Board 2: Product in Context

The sensors in the blanket pick up movement and temperature information, sending this wirelessly to a processor in the monitor. When a child is about to waken, changes in temperature and agitation occur, triggering soothing reactions from the blanket and bumper in the form of nightlights or recorded sound, such as a lullaby or a heartbeat. Where the child would normally have woken, it is now lulled back to a restful state, allowing sleep to continue.

There was no opportunity to implement the functional design, but research into appropriate future technologies pointed to Sensatex, a proprietary technology weaving sensors and computational functionality into fabric structures (Sensatex.com): according to the promotional literature, this allows the technology to be subsumed into the look and feel of the fabric, which remains flexible.

Design Board 3: Design Concept

Method – Two prototype representations were compared in evaluating the design in terms of its perceived authenticity and potential for personal meaning. The participants were self-selecting carers of children, including childminders, nursery staff and parents from the Edinburgh area, and after a somewhat chaotic pilot session involving small children, the evaluation sessions were planned for individual participants within their own homes. The two design representations given to the participants for feedback were:

- the 2D design boards, aiming to support conceptual understanding, and
- a physical prototype, aiming to support fuller sensorial understanding.

A word concept association method adapted from IDEO's methods cards (IDEO 2003) was applied to these representations to compare the perceptions of the participants to each. The descriptive word cards were prepared heuristically, although extra blank cards and pens were made available to allow unexpected associations to arise. The 2D design boards were considered first, and the physical prototype was concealed until the first activity was finished. Participants were instructed to select descriptions they thought appropriate to the design, placing them next to the boards. They were asked to give a commentary on their thoughts as they did this, and a rich verbal protocol was collected. Once the longer activity of evaluating the design through the 2D boards was done, the participants were shown the physical prototype of the blanket and the bumper to elicit an immediate reaction, more synonymous with the 'shopping experience'. After this initial reaction, which was also recorded, the participants were asked to repeat the word association activity with the physical prototypes. The descriptive words were recorded for each representation in turn, and a guided discussion at the end allowed the participants to reflect on their perceptions, and the researcher to explore any interesting reactions.

The expectation in designing the method was that with increased physicality in the mode of representation, involving more of the senses, the perception of materiality would be increased. In other words, the participants would exhibit both conceptual and sensory understanding more fully, and be more inclined to attribute the design with potential for personal meaning and authenticity. It was expected that it would be easier for the users to critically engage with both technological and aesthetic issues as the physicality of the presentation increased.

Results – design representations

Most participants sought extra clarification of the novel technologies involved throughout, and none used the extra blank cards supplied to write their own descriptions. Although the task was to select descriptions that matched their understanding of the design after looking at all three boards, some participants chose to lay descriptor cards on different boards, giving a finer granularity of feedback.

A participant's completed word association activity with 2D design boards and physical prototype

This particular instance illustrates nicely the difference in participants' perceptions of the product dependant on the design representation given. Here, descriptions tended towards non-affective terms on the specification board, reflected contextualisation on the story board, and focused on personal meaning in response to the concept board.

Specification board	Story board	Advertising board	
Difficult	Engaging	Network	Quality
Confusing	Cute	Different	Useful
Machine	Warm	Soft	Aware
Hi-tech	Personal	Interesting	Safe
Product	Fits in	Connected	Unusual
Technology	Familiar	Made to last	Surveillance
Smart	Lovely	Worn	Heirloom
Computer	Real	Keepsake	Trust
	Friendly	Collaborative	Reminiscent
Attractive	Resonant	In touch	
	Fun		
	Entertaining		
	Easy		
	Approachable		

terms chosen for each board

All participants when asked to place descriptor cards on the physical prototype used exclusively soft and positive terminology – 'engaging', 'authentic', 'friendly', 'personal', 'craft', and even 'cute'. The verbal protocols for this reaction revealed immediate affective responses, suggesting a shift in priorities when faced with 'the real thing':

- "Oh, that's gorgeous! It's different when you see it for real, it's so well made!"
- "It is REALLY cute! Yeah, I love it! The bumper is really cuddly."
- (*participant to child*) "Look at this Harry! Wow! You'd like to look at the pictures on there…yeah! Wow!"

The verbal protocols thus to a large extent supported expectations as regards response, as well as underlining the importance of prototyping choices, and the role of the physical prototype in embodying sensorial design elements.

In general discussion after the activities, participants sought to combine their different models of understanding into a more coherent whole, and these protocols would seem to be extremely useful to capture when attempting to understand the relationship between the two modes of perception.

Results – authenticity

The terms chosen and the verbal protocols supporting those choices were analysed for indications of perceived authenticity and potential for personal meaning. The word association activity uncovered plenary perceptions to graphical and physical representations of the design concept, but it was the rationalising process for those choices that allowed consideration of the participants' underlying attitudes to the concepts of authentic experience and the embodiment of personal meaning within artefacts. Thus, on one level the blanket appeared to work as a product design; emotional responses were positive, and there appeared to be a strong perceived need for the proposed functionality. However, when analysed in light of the aims of the wider methodological research, these responses became more complex, often accompanied by qualifying or even contradictory statements. Firstly, as we know, patchwork was used as technique to suggest authenticity; here is an important rationalisation on the part of one participant:

C: "I'm not somebody who particularly goes for crafty things, I mean, my Mum has run a craft market down for thirty years down in the South-West where I grew up, and you know, they get hundreds of people through the door, wanting individually made stuff, but I'm not, myself, I won't pay a premium for that kind of thing particularly, I prefer, …it seems sort of to contradict

itself, it is fairly contradictory this, …because at the same time I certainly don't want to go for brands, um, and I don't like chain stores in a way, but I do buy quite a lot from (brand name) - there's a convenience value 'cause I can buy it through the catalogue, but I kind of picked them because they're not the most expensive, they're not sort of, (brand name), but they're not the, I don't know, although (supermarket) do do some quite good stuff, you know, but they're not bottom of the range but they work for me, the T-shirts seem to wash OK, and if I can avoid the brand thing it's not too bad, it's sort of, I've found a level that works for me …"

This turned out to be a key response in the analysis of the comfortBlanket's position between craft and product design, leading to a re-appraisal of what craft can mean to different people, and pointing to a semiotic basis for the analysis of different design disciplines both as processes, and in terms of their products. This was supported by a second analysis of other respondents' comments, which had at first been understood to be supportive of the design. Now the terminology around the positive comments revealed a sophisticated reading of signifiers:

- "it *looks* quite traditional I suppose, the fact that it's made from patchwork"
- "it *feels* sort of, um, American Mid-West, you know?"

At no point then, did participants approach the blanket as 'the real thing'; instead it suggested availability of the positive attributes of other socio-cultural milieu. C's response, above, was one of the most prescient, and her unwillingness to be subsumed into homogenised brands was reiterated throughout the discussion. She articulated the alternative to a semiotic version of authenticity by emphasising quality, but for her, 'craft' meant a lack of quality, not a guarantee of it. Her negative experiences of 'individually done' craft products had left her with a distrust of the home-spun, and she had instead found an authenticity in the rigorous standardisation of mass production. Of the high street brand children's clothes she regularly bought, she said:

C: "you know, they have to make sure they're of whatever quality they're aiming for, they do achieve that, because they can't afford to have too many returns, and they need to make sure the sizing works and all that kind of thing …I feel, you buy something which has had to go through these testing processes, it's going to give you better value for money ultimately, for things that have to bear wear and tear, I mean..."

Again, comments from the other respondents backed this up:

- "as long as the technology was good…"
- "quality – that's based on the technology…"

It would seem that authenticity in this type of product must be perceived in both its form and in its robustness simultaneously. As a product design, the comfortBlanket was successful; the readings of it were as hoped for, even to some extent manipulated by the use of specific, signifying, techniques and formal design elements; but as an

example of craft, it fell short of the criterion of the personal visual language that characterises contemporary practice. Thus, it was indeed *read*, not experienced as an authentic thing in itself. This actively forced C, our key participant, to look for authenticity in the quality both of the fabrication of the textile blanket, and of the technology, which of course could not be explored through this non-working prototype.

Results - Potential for personal meaning

The pilot session, conducted in a group, produced a melodramatic vision of a technologised future:

- "It won't be like that science fiction thing, will it, where parents don't go near their children?"

Individual participants took a more considered approach, merely identifying themselves as late adopters despite experience, or even current use of other technological items around children. Both the form and the functionality of the design were seen to offer potential for personal meaning. One participant pointed out that although the comfortBlanket might appear to replace some human interaction, in some ways, it improved on other 'techno' products, such as automated child swings or battery operated mobiles, which in her experience, parents seemed to switch on in order to leave the child. For this mother, the blanket seemed to offer new ways of interacting, through cuddling and storytelling for example, and for this reason, she saw the word cards 'collaborative' and 'network' as referring to the human connections facilitated by the product. Others focused on the recycled materials of the

blanket as a site of embodied personal narrative, which might then be passed down to subsequent children, and discussed childhood artefacts as having a naturally talismanic quality:

- "…a lot of adults love the books that they had when they were children, they still have toys that they play with, but a lot of people really do…"

- "…they might keep it for ever, it's amazing how many people have things they had when they were small…"

And of course, the clear metaphor of the child's comfort blanket influenced participants:

- "…it looks like the kind of thing that might become a child's comfort blanket…you can imagine this thing dragged around…and ultimately they end up with a scrappy piece of the corner…"

The design as a service deliberately sought to strongly personalise the blanket and bumper through the use of favourite children's clothes in their construction, something commented on by all participants. These responses seem to intuit a relationship between personalisation (in the perception of uniqueness), and authenticity:

- "…it's different from (brand names)…this can really personalise, especially when you're getting your cot and things like that, it's nice to think you've got something that is unique, that only you will have as a mum.."

Again, as a product design, the blanket succeeded in suggesting potential for personal meaning. However, the connection between authentic experience and personal meaning warrants further reflection, and is considered alongside the previously mentioned semiotic issues in the next section.

Conclusion & Reflection

The important result of the research was the realisation that the participants were so used to reading artefacts semiotically, that they did not experience them as authentic objects in their own right. The blanket was a symbolically loaded design, but it was not authentic. It used craft as a signifier of what Kalviainen called 'the gift of time', but it was not craft as is understood by today's contemporary practitioners. Similarly, it was a successful piece of product design, but not a successful craft object, and the difference is key in attempting to 'deliver authenticity'.

This important difference lies in the designer's approach to visual language. The product designer skilfully manipulates existing symbolic visual language to create a message readable by the consumer. In HCI, this has become important in usability studies, and informs the understanding of affordance underpinning that ease of use. The contemporary craftsman in contrast, does his best to steer away from everyday representations, instead aiming to build a personal visual vocabulary through direct manipulation of materials in response to experienced phenomena. This is not to deny the power or intentions of good product design; in fact, the reader is probably aware of the current scale of interest in design in emotion and experience. The most successful of these, in Europe and Britain are fusing design and craft media to concepts (Greenhalgh 2003).

It is the human interest that is key to an experience of authenticity, and this is why craft has become a market force to be reckoned with. Contemporary craft offers this human connection through in its process as much as in its products. The process has come to be consumed ideologically as much as the objects which embody it. The intense engagement of the contemporary craftsman with a phenomena through primary research activities such as drawing and modelling, together with his involvement with material further informing expression, means the artefacts created are physical objectifications of a very subjective world-view. Indeed, the craft object can be seen as a meeting place in that it allows subjective meaning to be actively created by a viewer in conversation with the maker through it. In contrast, when existing languages are employed, this meaning has already been arrived at and the viewer remains essentially passive. This active engagement in the creation of personal meaning is a non-trivial goal for design; in fact, it has been defined as the core of existence itself by some philosophers. The intuition that technology alienates us from ourselves is long standing, and has generally been based on the changing physical proximities of people and on the replacement of tasks with automation. This enquiry into the object offers a new understanding of the alienating effect, and points to a possible way of improving the situation through a consideration of what makes agentive meaning making possible.

Further work

As an example of both the development of personal visual language, and the manipulation of material towards this, consider the work of jeweller Adam Paxon.

Adam Paxon, acrylic brooch

Using acrylic, Paxon invests it with value through thermoforming laminated layers, applying time consuming and skilful techniques to the new material. By deliberately using industrial coloured acrylic sheet, he is able to show how far from its original associations and expression a material can be brought (Paxon 2001; Paxon 2003). If material informs the process, then it is just such *intelligent making* that stops it from becoming formulaic (Press & Cusworth 1997), and as the elements of computation become design materials in their own right, it is crafts practice that will allow alternative values and aesthetics to emerge (Pye 1968; Press1996; Orth 2001).

The research done on the comfortBlanket established contemporary craft processes as an interesting avenue for further enquiry. In aiming to treat computational materials as expressive materials much as Paxon's acrylic is, it has to be recognised that this represents a steep learning curve for most practitioners. As a jeweller, the author is not well versed in electronics or programming. Similarly, most computer engineers do not habitually consider the expressions of their work. There has, however, been an impressive precedent in the form of new media, art works achieved collaboratively between technicians and artists, with both parties learning from one project to the next. Model examples of applied art also exist, for example the jewellers Michele Gratiot Stober and Ulli Oberlack have produced compelling pieces using technology,

and Maggie Orth and the Play Studio, Sweden, from more technical backgrounds, produce beautiful dynamic textiles.

The author is applying this collaborative approach, combining a contemporary crafts process with a technical team, to create the next range of work. This will take the form of a network of interactive jewellery made for a specific group of friends. With the support of a residency at the Silversmithing and Jewellery department at Edinburgh College of Art, the author is developing designs that allow the combination of *Speckled Computing* with other more familiar materials. The 'Specks' project's long term aim is to build millimetre sized processors, with sensors and wireless networking capabilities (specknet.org.uk). The current version measures roughly quarter the size of a credit card, and can be built into jewellery to begin investigating possible aesthetic interactions. The networked jewellery will aim to support existing social structures by ambiently connecting the group of friends. The author has been gathering visual research and exploring materials over the past academic year, and the group are now ready to combine this with the computation. The project will offer a further opportunity for investigating perceptions of craft and technology, and to evaluate the authenticity of the final artefacts. It will also inform further inquiry into a possible model for a new design process.

Finally, the challenge this approach presents to the field of Human-Computer Interaction cannot be overstated. Since it's inception in the 1980's, HCI has been in search of the holy grail of the invisible computer. Based on the phenomenological concept of the disappearing tool, HCI would have us not interact with computers but through them. But for computational artefacts to have personal meaning, we must be able to do both. It was stated early on that a motivation for the work had come from

the domain of Wearable Computing; this field also strives after what is called *seamlessness*, the invisibility of the structure making the interaction possible, going so far as to investigate the feasibility of subliminal information displays. So it offers some hope for the future of design and of authentic experience, that this primacy has begun to be questioned by other researchers, not just on practical level, but on a philosophical one. Greenhalgh's promise that the 'poetic exactitude' of the crafts has not only persisted, but that it is 'poised for a radical new phase', could not be better put.

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