Synergies : design--smart materials--ubicomp

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The relationship between people and their objects is a complex one. People use material objects to define themselves, and group themselves into social clusters and communities. Designers create cultural objects, which people consume and make their meanings with. Objects play an important role in our relationships with each other, as bearers of significance and representation.

One of the key aspects of design is the requirement to include different types of thought and knowledge in its scope. 'This involves a highly organised mental process capable of manipulating and blending them all into a coherent set of ideas and finally generating some realisation of those ideas. But design is both everyday and special. Everyone designs to some degree; we assemble our place of work, our home, and the way we look. We express ourselves to others through these decisions.'[1]

The tools of the design trade are space, form, line, colour and texture. 'Designers have an appreciation of people's aesthetic experience of the visual world'[1], as well as people's sensory experience. Designers use an array of materials to fashion objects, from wood, metal, plastic to textiles. If we add smart materials and ubicomp to the mix, the range, type and functionality of objects will be expanded exponentially. Moreover, objects and mediated communication technologies share common attributes in terms of how they enable people to construct an identity, to be expressive, and communicate with people. How do we design for this new genre of dynamically-changeable and appropriable objects, and facilitate the emergent outcome of user dynamics? And how can we facilitate the kind of knowledge flows between designers/developers and users that this will necessarily require?

Socially-driven co-design

This article presents a theoretical method to design output mechanisms for computational systems through user-driven co-design. By output mechanisms it is meant any kind of visualisation, representation or embodiment of 'data' that a person might want to exchange, communicate or express. This article cites work conducted as part of a project called *Communication-Wear*[2]. *Communication-Wear* is a clothing concept that augments the mobile phone by enabling expressive messages to be exchanged remotely, by conveying a sense of touch, and presence. It proposes to synthesise conventions and cultures of fashion with those of mobile communications, where there are shared attributes in terms of communication and expression. Using garment prototypes as research probes as part of an on-going iterative co-design process, we endeavoured to mobilise participants' tacit knowledge in order to gauge user perceptions on touch communication in a lab-based trial. The aim of this study was to determine whether established sensory associations people have with the tactile qualities of textiles could be used as signs and metaphors for experiences, moods, social interactions and gestures, related to interpersonal touch. The findings are used to inspire new design ideas for textile actuators for use in touch communication in successive iterations.

Textiles have a range of tactile qualities, which textile and fashion designers have always exploited as part of their design method to engineer a look, concept, mood. There are well-established descriptors for the sensory associations and *hand* qualities of textiles used in the fashion and textile industry as part of the process to select a textile for a particular clothing application. There is an industry-standard set of bi-polar attributes for fabric hand, e.g., smooth-rough, soft-crisp, cool-warm, delicate-coarse, hard-soft. These descriptors, along with other references, such as colour, shape, pattern, are used by fashion and textile designers as a legitimate design method. These collections then become trends (depending on consumer take-up), and become a part of consumer culture. Fashion is a key component of consumer culture, a cultural system of making meaning, and of making meaning through what we consume; a cultural system of codes. We use aspects of material culture to map out identities for ourselves.

In the same way that youth groups create new languages using SMS, so *smart* clothing will need a design palette or *language*, which users can co-opt, adapt and assign their own meanings to, or make their own meanings with. The team designed the prototype garments and their textiles according to the aforementioned sensory associations, and design principles, as well as drawing upon their own experiences and associations. E.g., a fabric that has a warm handle is generally understood to have comforting associations. During lab-based trial set-ups at HP Labs users experienced a range of sensations in

[1] Lawson, B (2004), What Designers Know, Architectural Press, Oxford
[2] AHRC funded fellowship in the creative and performing arts

garment prototypes within the context of interpersonal communication; using this technique we were able to engage them in deeper levels of discussion about their associations, which revealed insights into how they might use a *sensory* language to communicate and express.

The prototypes enabled users to send a message using either a mobile phone or by gesture. We developed heatable textiles; shape-shifting textiles that moved against the skin, on the arm and on the upper back; and light-emitting materials on the sleeve. The results suggested that a warm tactile sensation delivered through heatable textiles evoked a sense of reassurance and empathy: *"I really like the heat because that's naturally a very comforting and warm feeling."* A fabric that moved against the skin using shape-shifting textiles generated a tickling sensation, and evoked thoughts of fun and playfulness. Lustrous or light-emitting fabrics evoked feelings of radiance and happiness, and having a glow.

We only scratched the surface with this piece of work, but we started to perceive the possibilities that smart materials could bring to new products for fashion and clothing, and for digital communications, and we discerned how the design process could facilitate engaging users in development.

The role of design in multi-disciplinary collaboration

This article references collaborative workshop work conducted as part of an EPSRC/AHRC Designing for the 21st Century research cluster, *The Emotional Wardrobe*. *The Emotional Wardrobe* was about a new genre of 'smart' clothing that facilitates communication, connection, expression between people and things - an exploration of the possible synergies that might arise when fashion converges with information technology and smart materials, and scoping the research spaces and challenges within. In the Wardrobe was: Central Saint Martins College of Art and Design, Fashion & Textile Design (host); Royal College of Art, Fashion & Textile Design; University of Glasgow, Computing Science; University of Bradford, Informatics; Imperial College London, Electrical & Electronic Engineering; King's College London, Management Centre; Vodafone; HP Labs; Oakdene Hollins.

The cluster project comprised a series of collaborative workshops. In order to facilitate effective interaction amongst the team we took a 'thinking through doing' approach. We were conscious not to be bogged down in rhetoric, but to do and make things as a valid form of investigation and understanding.

We started the project by getting everyone to think about fashion and the clothes they wear through two exercises: *'Bring and tell',* where team members brought in a garment to discuss whether it evokes any emotions or memories, whether it has a story, when is it worn? The *'Scrapbox Challenge',* where we each picked a garment that we would not usually wear or that we disliked from a selection of second-hand garments. We evaluated what made it unwearable, in terms of the colour/pattern/texture, and fit with our identity. We reconstructed the garment to make it into something we would wear, using garment construction techniques. We generated stories during brainstorms, which were visualised using sketching techniques by illustration students, so that we had a common understanding of what were discussing. We explored these stories through scenario-building, the purpose of which was to locate a meaningful time and place for technological intervention, and the interesting questions and issues that that posed. We used generative techniques to conceptualise and explore the scenarios: We role-played the selected scenarios and photographed them; we arranged the photos into a time line; we annotated the photos to elaborate the scenario into a storyboard. We produced designs and mock-ups with which we conducted co-design studies with users.

Key insights that arose included: These sectors and markets don't exist. Scoping unknown territory is difficult; therefore, the process of eliciting desires is very important in order to determine catalysts and drivers for this new genre of fashion/clothing, and consumer electronics. We need to engage users from the start (participative design, generative techniques and probes). It is imperative to manage knowledge flows between people to facilitate knowledge creation and sharing; a 'thinking through doing' process using a broad range of generative techniques that mobilise latent knowledge, and help promote a shared understanding. Participative design is a new paradigm for fashion design, where users are co-designers. We need new generative tools for user participation, such as the prototype as social probe. We need iterative processes where the user provides insights, inspiration and feedback – the user creates and innovates! And finally, design for appropriation: New design tools with which people create their own stories and meanings.