

Northumbria Research Link

Citation: Teinaki, Vicky, Montgomery, Bruce, Spencer, Nick and Cockton, Gilbert (2012) An aesthetics of touch: investigating the language of design relating to form. In: Design and Semantics of Form and Movement (DeSForM) Conference, 18-20 April 2012, School of Design, Victoria University of Wellington.

URL: <http://desform2012.schoolofdesign.ac.nz/proceeding...>
<<http://desform2012.schoolofdesign.ac.nz/proceedings/>>

This version was downloaded from Northumbria Research Link:
<http://nrl.northumbria.ac.uk/id/eprint/9223/>

Northumbria University has developed Northumbria Research Link (NRL) to enable users to access the University's research output. Copyright © and moral rights for items on NRL are retained by the individual author(s) and/or other copyright owners. Single copies of full items can be reproduced, displayed or performed, and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided the authors, title and full bibliographic details are given, as well as a hyperlink and/or URL to the original metadata page. The content must not be changed in any way. Full items must not be sold commercially in any format or medium without formal permission of the copyright holder. The full policy is available online: <http://nrl.northumbria.ac.uk/policies.html>

This document may differ from the final, published version of the research and has been made available online in accordance with publisher policies. To read and/or cite from the published version of the research, please visit the publisher's website (a subscription may be required.)

An aesthetics of touch: Investigating the language of design relating to form

Abstract

How well can designers communicate qualities of touch? This paper presents evidence that they have some capability to do so, much of which appears to have been learned, but at present make limited use of such language. Interviews with graduate designer-makers suggest that they are aware of and value the importance of touch and materiality in their work, but lack a vocabulary to fully relate to their detailed explanations of other aspects such as their intent or selection of materials. We believe that more attention should be paid to the verbal dialogue that happens in the design process, particularly as other researchers show that even making-based learning also has a strong verbal element to it. However, verbal language alone does not appear to be adequate for a comprehensive language of touch. Graduate designers-makers' descriptive practices combined non-verbal manipulation within verbal accounts. We thus argue that haptic vocabularies do not simply describe material qualities, but rather are situated competences that physically demonstrate the presence of haptic qualities. Such competences are more important than groups of verbal vocabularies in isolation. Design support for developing and extending haptic competences must take this wide range of considerations into account to comprehensively improve designers' capabilities.

Keywords

Design, language, touch, haptics, product semantics, sensory design.

1 Introduction

Are talking and making related? Is it important for designers to be articulate about the haptic qualities of their work? This paper tackles two relevant issues: the role of language in design, and within this, whether and how designers are able to articulate haptic qualities in relation to their work. To investigate this, it reviews relevant literature on design discourse and haptics, cognitive apprenticeship, aesthetic frameworks, and means-end approaches. These theoretical resources are used to critique language use in interviews with graduate designers.

1.1 Haptics and Aesthetics

The term haptics [from the Greek *haptikos* 'pertaining to the sense of touch'] specifically relates to touch and the cutaneous senses. While touch was deemed the most animalistic of the senses by Aristotle, and for long after was deemed mere carnal sensation, more recent philosophers such as Merleau-Ponty have sought to reunite the body and mind, and in the case of Wyschograd, highlight the difference between touch (which can be affective, emotional and metaphorical) and sensation [1].

The term 'haptic qualities' is used here to explain the qualities specific to touch. Unlike fixed features such as form elements, qualities are open to interpretation. In design, there are strong precedents for discussing visual qualities based on the Bauhaus and gestalt psychology [2], but we have not yet made a similarly thorough exploration of haptic qualities and their origins and consequences.

2 Relevant Literature

Relevant literature spans language in design, touch in design, intersections of the two through cognitive apprenticeships and criticism, and the role of qualities in designs' consequences.

2.1 Language Design

While there has been a sustained interest in designers and sketching e.g. [3], what is largely unnoticed is that language underpins much sketching and other design decisions.

A strong provocative comment on language comes from Hodges [4], who believes that the so-called soulless modern buildings of the 20th century are a result of designers being unable to communicate their vision to clients. Lawson [5, p.85] notes that while designers may claim most of their thinking is captured in their sketches "100% is held in the design discussions". He also highlights that the concept of the designer-as-sketcher is a modern one, as masons and other craftsmen as recently as 100 years ago dispensed instructions verbally.

A number of other studies have noted the relevance and importance of language in relation to design. For example, Krippendorf [6] draws attention to the multiple stakeholders involved in design discourse. Also, Cross [7] reported on how words could change the direction of design discussions. Language is also key to design placements [8], and Schön's 'appreciations' [9]. The practical use of language for meaning-making is highlighted in Verganti's study of design-driven innovation in companies [10] He suggests that the designers and the other stakeholders involved in the design process create meanings through language, which are shared amongst the various stakeholders.

If verbal language is so important, why has it received relatively limited attention in design research? In part, this could be due to the challenges in studying verbal language within design processes, relative to the ease

with which sketches can be collected and analysed. Design language is often ephemeral: written notes may be regarded as merely aids to back up sketches and prototypes; and critically important design dialogues regularly go unrecorded.

2.2 Touch and Language

So how does one talk about touch? We can understand the means with which people understand touch: Lederman and Klatsky's *Methods of Haptic Exploration* [11] identify six aspects through which we approach objects (lateral motion/texture, pressure/hardness, static control/temperature, unsupported holding/weight, enclosure/volume, contour following/shape). Akerman et al. [12] suggest three global dimensions of touch (hardness, roughness and weight) with implications such as weight implying qualities such as trustworthiness [1].

Much current research on touch and design language focuses on consumer responses rather than the designers' expertise [13], often through use of simple Semantic Differentials [14]. While this can be useful in terms of understanding the language of experts, e.g. skiing [15], it presumes that users are the best sources for both evaluating and articulating haptic language. Such assumptions need to be tested by comparing consumers' language use with designers' language use. Those that do look at how designers approach touch often collapse it into being able to categorise a product to fit a specific emotion, e.g. a glamorous kettle. This rationalising of the senses can be seen in an extreme form in Kansei Engineering, where emotions are condensed into single words that are next used in matrixes for comparing sensory responses [16]. While this does serve some use in allowing designers to consider some consequences of their actions, it also has the unfortunate effect of ignoring designers' discourse related to the qualities of the product, turning our use of our senses and emotions into something that is to be measured once, rather than explored regularly during the design process.

So why is touch marginalized in relation to design conversations? Semiotics – a school of thought enthusiastically adopted by design – has tended to concentrate on visual language and its associated verbal interpretations [17].

One possible reason is that visual qualities can be critiqued via inspection of images with designers

absent. In contrast, critiques of haptic qualities are more effective when both designers and their designed artefacts are present within the research process.

2.3 Apprenticeships: Connecting Language to Making

A notable exception to the lack of attention given to touch and design language can be found in research into communities of practice, notably the concept of ‘cognitive apprenticeships’. Collins and Seeley-Brown [18] have studied accounts from practices such as dressmaking, and attempted to both identify the methods with which students are taught to improve their skills. This has been transferred to non-manual methods such as mathematics and reading, but as Collins and Seeley-Brown note, there are gaps in traditional apprenticeship teaching (namely that skills are taught to students to meet business needs, rather than in a way that best supports learning) [18]. The importance of understanding language – and the means with which it can be carefully combined with making – is well described in research on cognitive apprenticeships. Collins and Seeley-Brown’s investigation into why traditional apprenticeships work revealed that discourse played a key part in learning: novices picked up their cues for critique through engaging with experts and picking up the language. Ackerman et. al [12, p.1713] suggest that “touch acts as an ontological scaffold, which is reflected in language”. This has been similarly noted in wine tasting: when matching words to a specific taste or scent, novices became far more accurate choosing from the words created by experts to choose from [19].

We can conclude from this that novice designers who engage with experts will be exposed to language that will help them to become more advanced at critique of haptic qualities. Such exposure could be direct, via traditional atelier relationships, or indirect, via interactive audiovisual resources. Indirect exposure allows the introduction of innovative approaches to the critiquing of haptic qualities in design, taking novice and experienced designers beyond existing craft practices and expertise.

While designers are not always taught in the way that apprentices used to be, it is worth reconsidering the nature of how materials are used in design education, e.g. making sure that materials are not merely selected because they are close to hand (as noted in Jacucci and

Wagner’s research on architecture students and material events) [17]. Innovative and imaginative selection of materials could focus more on exploration and understanding of haptic qualities.

2.4 The Importance of an Aesthetic Language

Aesthetic sensitivity through use of language (to reference the Greek *aesthetikos*), can also be linked to critique. Bardzell [20] has noted that criticism is valuable in design because it not only heightens perception and allows for alternating between the whole and cultural particulars, but also spurs the critic to worthwhile action. Drawing on cultural and literary theory, he suggests that criticism be categorised in terms of the author (creator), text (artifact), context, and audience. Haptic vocabularies can reflect socio-cultural context, direct perception towards qualities of artifacts, and empower both creators and consumers through critical vocabularies that reveal opportunities, meanings and interpretations. A comprehensive haptic vocabulary would thus extend beyond the qualities of artifacts to cover design intents, audience responses, and relations to broader social and cultural contexts.

2.5 Qualities, Value Theory and Worth Mapping

Cockton [21] provides a basis for relating product and service qualities to usage outcomes (via consumer experiences) as well as to concrete product attributes (features, materials). Qualities are abstract product or service attributes with a specific role with the means-end chains of product and service consumption. Consumption motivators (the ends of means-end chains) result from the cumulative effects of interactive means (the materials, features, and qualities of products and services, and the user experiences of their consumption). Qualities are therefore the interface between the material product or service and the phenomenology of use and consumption.

Means-end chains can be combined into graphical representations as Worth Maps [22]. Each chain is a path through a network (box and arrow diagram) from a product or service’s material attributes, through its features and qualities, via user experiences, to the outcomes of usage and consumption. Such means-ends chains express comprehensiveness and coherence in design reasoning. The extent to which haptic qualities are understood and leveraged in a design is reflected in their explicit roles in means-end chains. Articulate

designers with a strong understanding of haptic qualities can relate these to both the materiality of products and services (features, materials) and phenomenology of usage and goal achievement. For example, as already noted, a material's weight may imply qualities such as trustworthiness [1]. Trustworthiness in turn may lead to confident use of an artifact, leading to valuable outcomes that could not be achieved without confident use. Designers who lack explicit and/or thorough understanding of haptic qualities are less likely to both name and demonstrate haptic qualities, and also less likely to explain how these qualities relate to material causes and phenomenological consequences.

A comprehensive haptic vocabulary would thus be anchored in material qualities, but would associate those with their origins and features on the one hand, and with their consequences for consumer experiences and value realisation on the other. There are structural similarities between Bardzell's [20] aesthetic frameworks and the elements of Cockton's [21] means-end chains. Authored intent [20] relates to intended qualities and actual experiences and outcomes [21]. Audience response [20] relates to perceived qualities and actual experiences and outcomes [21]. Means-end chains as a whole [21] owe their dynamics to the socio-cultural contexts within which they are situated [20]. Such contexts make possible the meanings and motives that transform qualities into outcomes via experiences.

2.6 Literature Summary

The existing literature on haptic qualities in design and their relation to verbal and non-verbal expression provides a range of bases for interpreting designers' accounts of the nature and role of haptic qualities in their design work.

The combined perspectives provided a basis for coding and interpreting graduate designers' accounts of their work during interviews at a UK national design exhibition. By comparing graduate designers' accounts with theoretical potentials for haptic vocabularies, we can reveal opportunities for improving designers' capabilities for exploring haptic qualities during design.

3 Interviews

In order to investigate the levels of fluency that designers have, in both articulating the qualities of their work, and specifically the haptic qualities, the author conducted short interviews with ten design graduates

at the 2011 NewDesigners Exhibition. The students, from schools throughout Britain, were exhibiting work ranging from furniture to product design to jewellery, but were all designer-makers in that they had all designed and fabricated their work. The designers were also chosen on the basis of work that relied extensively on materials and physical form.

The short interviews were carried out alongside their designed products and audiotaped (videotaping was deemed inappropriate due to the spontaneous nature of the talks). Interviewees were asked to describe:

- their products and the process that had guided them to the final product,
- the qualities that they liked about their final product,
- their thoughts about materials and physical form.

The interviews were conducted on the third and final day of the show. This is relevant for two reasons: firstly the students had had time to get used to talking about their work (or 'refine their pitch'), and secondly as they'd also been able to get audience feedback on their work (some noted that they had only just got the work ready in time for the show).

3.1 Results

As in all qualitative research, interview data was coded to reveal emergent themes within it. Initially the analysis focused on specific use of haptic terms, but this proved to be too narrow a focus, due to the broader extent of graduate designers' accounts of their work.

Interview data was primarily coded through a phenomenological set of codes that generalized over designers' foci on, and subjective understandings of, their work. Theoretical analyses were secondary, and were focused on themes and evidence within the primary coding.

Once a broader view was taken, the following primary codes emerged from analysis of the data:

- *intent*: what the designers intended to achieve; the intended outcome;
- *evaluation*: allowing for reflection, also taking into account the feedback they'd been able to pick up during the show;
- *references*: notes of specific trade and physical terms related to touch (taken from Lawson's observation of design language as being compact and full of references) [5];
- *qualities*: language usages which specifically related to aesthetics and haptics.

While many of the designers initially protested that they weren't able to discuss their products, this did not prove to be the case. The only problematic case came from a student with English as a second language, and even in this situation, the particular student proved to be more nuanced than might be expected. This is in accordance with Krippendorff's [23] and Lawson's [5] assertions that designers are in fact highly articulate and speak in a highly evocative and compact language. However, haptic qualities played only a limited role in the graduate designers' accounts of their work.

Through basic coding of the interviews, two themes emerged:

- Challenging Materials, and
- Limited Recognition of Haptic Qualities.

Key observations and evidence for each of the themes is now presented.

Challenging Materials. The graduate designers talked more about materials in general than about the qualities that resulted from both materials and features (form). The designers who were interviewed had played with materiality in some respect, and so their work often included some sense of challenging expectations in regards to a material:

Y (wooden steam bent table): I've had a lot of people think that the underneath [the wooden table] is all was really soft and flowing, and they've had to come along and like, touch it, and make sure it's all solid. But yeah, everyone loves it and making sure like, feeling all the curves and everything.

A (metal necklace): I've actually had someone come from up there [the top floor of the exhibition] and go, "is it [the metal necklace] rubber? It looks like rubber". and lots of people have said, what is it actually made of? It's not plastic, but it's usually the sound it creates, you can tell it's metal.

K (acrylic jewellery): If people have knowledge already about the material and the processes, they come in and question more, where's the join, or how it is worked? If it's people who don't and have no idea, they come and approach and question: is it glass?

In Bardzell's [20] terms, the graduate designers' intentions sought to disrupt existing audience expectations about specific materials. However not all

consequences of materials and forms were intentional. One student found that he had created an "accidental illusion" with a stool and table that looked as if both were made of the same materials but were not:

M (stool with metal strap): It wasn't really intentional to bring the strapping through and keep it the same aesthetic, it just sort of ended up that way, without me realizing ... I was er, surprised at the number of people saying, "I thought it was fabric, how is it standing up?" which I kinda like really.

These comments emphasise the element of verification prevalent in haptics [24], and are a reminder that the "seeing is believing" is short for "seeing is believing, but feeling's the truth" [1]. Designers' intentions may not be realised until constructed artefacts are critiqued or used, but more importantly, physical realisations and human encounters may reveal unintended consequences. In Bardzell's [20] terms, the designer here extended his understanding of his work through an audience's encounters with it. Within Cockton's [21] means-end chains for design, this graduate designer was mostly focused on relations between materials, features (form) and qualities. There was little focus on experiences, and none on outcomes, which in Bardzell's terms, indicated a limited contextualisation of the design work [20].

Haptic Qualities: Recognition, to an Extent. Several students identified materials and their handling during making as a key influence what they did, through their process of making and/or use:

Y I let the wood talk to me, to let it bend the way it wanted to, and then I just wanted to force it a bit more.

E (glass bowl): I'm just so happy that I've found a product, a technique, which really suits me... I've found, my language as it were, with the glass.

K My work doesn't necessarily have some in-depth deep concept; it's all about the material and the handling of it.

Once again, graduate designers were focused on the initial elements of Cockton's [21] means-end chains, but some could articulate qualities and even outcomes. Interestingly (but perhaps to be expected) the most interesting comparisons in terms of the value of specific materials emerged when designers justified why they'd

chosen one material or process over another (Table 1). One designer who had created a laser cut clock in both acrylic and wood, attempted to describe why the former was more popular:

Acrylic	Wood
Weighty, solid, finished (outcome: sold better), lego-like	Lighter, more flimsy (outcome: not as popular)

Table 1. Terms comparing wood to acrylic in a laser clock and related success.

Another graduate designer had tried a number of materials before setting on glass, noting the following properties of all of them (Table 2):

Glass	Metal	Plastic
“water-like, touchable”	harsh, “though beautiful polished”, didn’t flow	“not a material I enjoy working with, it’s all wrong” [see below]

Table 2. Material comparison for selection.

The contrasts here were mostly in terms of material qualities, including the way in which glass invited touch. One response was visceral (which is how Aristotle considered touch, i.e. as animalistic): this designer simply did not like working with plastic.

Another graduate designer contrasted the two different materials that met in his work. While the haptic and visual qualities of wood and pewter were directly referenced, form dominated his account of their jointing (Table 3):

Pewter (cast)	Two Meeting	Wood
“soft, metal”	Controlling the wood, joints being snug or not strong enough	warm, nice qualities

Table 3. Pewter and wood chair.

Several students had worked with metals (Table 4):

Metal (vs glass)	Aluminium	Pewter
“Harsh, didn’t flow”	“cool ... not warm, but comfortable”	Soft when in thin sheets ... but difficult to compress when in large blocks [meant as positive]

Table 4. Comparison of terms and materials.

Several haptic qualities were in evidence here, with the occasional reference to experiential qualities (‘comfortable’).

Even within single products, they were aware that the value of a haptic quality could change: a necklace was wonderfully ‘fragile’ and ‘delicate’, but not so good when ‘broken’.

When asked about material qualities most felt that they had made successful choices (sometimes rationalised through why they had not worked with various other materials), there were some terms that attempted to capture haptic aesthetic qualities.

- *Flow* “it just didn’t have flow” (E). This was used in a way similar to the concept of harmony in graphic design, in that it represented everything working together (or in this case, not). It could be speculated that this has come from interior or landscape design, as Lehrer [19] notes in wine tasting language that terms can easily move from one domain to another (she relates the concept of a wine having body to the 80s popularity of bodybuilding).
- *Finish*: this was noted by six of the graduate designers as being something they were proud of. This was generally described as sheen, but in one case as patina. These are standard words used in product design language, so it is not surprising to see them used.
- *Comfort* was noted, but used in different ways from furniture to jewellery: in the former, an uncomfortable chair was too angular (M), whereas in jewellery weight, softness, and (to some degree) temperature played a part.
- *Thrown* was used by Y “it’s all very organic and thrown” to describe her hand/steam bent wooden table. This was one of the few times a word was clearly taken from another field (here clay working) and shifted into another.

However, it is telling that many other accounts had to rely purely on material and feature (form) references without exploring their consequences, and mostly viscerally, for qualities or experiences:

E plastic was just, was just for me, it’s all wrong... not a material I enjoy working with.

J too angular... soft wood, which is really warm and has some nice qualities about it ... fluid qualities that were left in it as well, like you can actually see the process

going on, like a little snapshot of what was going on... process, it like, held within the metal.

Other popular terms that came up when explaining design decisions were:

- *Tactility*: “you want to touch and feel it” (E), a rare articulation of an explicit experiential consequence.
- *What it did not have*: “no joins”, “no glue” was also common, focused on features.
- *Natural*: there were a number of mentions of this, through the use of both terracotta and wood. In contrast to some graduate designers’ challenges to existing contexts of audience interpretations, here others were articulating established semiotic associations and their consumer valuations.

3.2 Comparisons with a Previous Study

In a previous study by the authors of an experienced fashion expert’s understanding of textiles’ haptic qualities, video recordings revealed how swatches were manipulated to ascertain and demonstrate their tactile qualities. The use of audio recording alone in the current study reported above highlighted the combination of ostension (pointing at), manipulation, and verbal descriptions and interpretations when communicating haptic qualities. When transcribing the recorded interviews, memories of graduates’ specific manipulations and ostensions had to be recalled to make sense of some of their language use.

A key insight here is that improved understandings of haptic qualities require more than a simple vocabulary, Ostension and manipulation are integral aspects of haptic understandings. This is also seen in areas such as wine tasting where the glass has to be manipulated in a specific way to reveal the ‘legs’ or ‘tears’ of a wine, which indicate its alcohol content.

4 Discussion

The primary aim of this research is to help tease out the verbal and non-verbal language that designers use to help make meanings out of forming, and be able to present it back to them in a way that they can both be made aware of it, and also be able to improve on it. Such improved vocabularies have to be productive, relating both to the assumed material causes of qualities and also to their expected effects e.g. through situating haptic qualities in means-end chains [21].

Given the broad range of uses for vocabularies of haptic qualities, the interviewed graduates demonstrated only a limited ability to critique the haptic aspects of their designs. Much of the references to haptic qualities were related to the processes of designing and making, and not to their consequences for human experience and outcomes from ownership and/or use of their designs. Their accounts often related viscerally to materials or focused on features (form), with limited extensions beyond these to qualities and experiential consequences. In these graduates’ accounts of their designs, few existing theoretical understandings showed through.

The importance of language in design, as established by a range of design researchers [4], [5], [6], [7], [8], [9], & [10], is not well reflected in the graduates’ accounts, although most of Lederman and Klatsky’s six ways to approach objects haptically were demonstrated in product interactions [11]. This may indicate that the graduate designers’ vocabularies had largely been picked up through a cognitive apprenticeship that drew little on existing relevant design research. Existing design education may thus not be preparing students well for articulating their intentions for qualities, experiences, and usage outcomes.

What emerged from student discussions was a disconnect between the language they were able to use to describe their thinking process in concrete terms (references) on the one hand, and their aesthetic decisions relating to touch on the other. While they showed awareness of the haptic qualities and their importance, the language that they used to communicate it was far less specific, except where this was related to processes of making. Few theoretical resources were in evidence.

Graduates’ accounts of haptic qualities had a narrow critical range, making limited use of the range of critical possibilities outlined by Bardzell [20]. Similarly, while some graduates occasionally demonstrated an ability to relate haptic qualities to materials or design features, they rarely related qualities to likely or intended experiences or consequences, as made explicit in Cockton’s [21] worth maps.

Making designers more aware of the language that they use and their means of communicating and reflecting through it should make designers more aware and more

successful when it comes to both making decisions in relation to touch and therefore being able to communicate it.

There are other disciplines that do not have a strongly established language for discussing aesthetics, but they are anchored by a useful means of replicability. A prime example of this is cooking: Fine notes that the blue-collar staff have to learn to develop an eye and taste for dishes that they've never eaten before, but do so through repetition and not having to be able to discuss it [24]. However, it is not clear that design can rely exclusively on such tacit non-verbal knowledge.

5 Future Work

There is an opportunity to investigate the language of designers who have a highly developed appreciation of touch and how their language could be used to improve the design work of novice designers, and perhaps experienced designers too.

Beyond this, design education could be reconsidered in relation to both the cognitive apprenticeship model and design criticism in order to encourage more design dialogue in relation to touch. Similar work has been done by Sonneveld [25] in encouraging design sensitivity in relation to touch, but did not investigate the role of expert discourse.

The current apprenticeship elements of design education could be improved. While some of the aspects of the process are already well formed for learning (e.g. dressmaking students having their knowledge staggered), one of the limitations of the current system is that it often works from practicalities rather than ideals. This is noted with architecture students using materials that are to hand to make prototypes, rather than considering their appropriateness [17].

Understandings of visual qualities are well grounded in gestalt psychology as exploited by Paul Klee and others in the Bauhaus. Such imports from other fields are not uncommon. For example, language used for understanding wine was developed by chemists (and interestingly, later extended by a linguist to be more of a nuanced study [19]).

There are clear advantages in developing haptic vocabularies, with accompanying audio-visual demonstrations, augmented where relevant by

interactive capabilities. We need to consider allowing students to find ways to enrich their vocabularies, in particular in relation to touch. The reasons for this include:

- Designers will be empowered to create a wider range of potential meanings through improved ways of critiquing and interrogating their material choices.
- If designers want to be able to create brand or product systems, they similarly need to be given the language to be able to articulate what constitutes the product system. At least one student noted that they were attempting to extend their singular product to a range, but needed to figure out how to do so. Without an understanding of the key ways to manage this, change, any translations risk being diluted in the way that the brown Microsoft Zune changed from a concept model of two-tone brown and green metal to brown plastic described by Gizmodo magazine as “swamp water Jell-O” [26].
- Designers increasingly work in multi-disciplinary team settings, where traditional tacit knowledge must be made explicit to communicate with other team members, and to allow discussions of design options [27]. Designers need to be able to articulate and demonstrate haptic qualities.
- Designers need to be able to reason about the origins and consequences of haptic qualities, drawing on structures such as the means-end chains of Cockton's Worth Maps [21]. Making the connections within design thinking explicit requires confident broad vocabularies for all elements in design's means-end chains.

We plan to further explore expert, graduate and student use of haptic vocabularies in their accounts of design intentions and opportunities. We will pay particular attention to non-verbal behaviours when accounting for haptic qualities, especially the role of ostension and manipulation. We will use relevant design research as a basis for understanding expert behaviours. Examples and understandings will provide content for an interactive tool for developing designers' haptic vocabularies and understandings. The tool will combine physical and digital resources. Use of this tool by designers will support assessment of the relative value of existing bases for understanding haptic language use and critical behaviours from design research.

6 Conclusions

Graduate designers are aware of the importance of touch in their work (both through their work and its importance to their audiences), and are able to point to some decisions that they have made in relation to it, but appear to lack a broad enough lexicon to be able to fully communicate this, and to relate haptic qualities to both their origins and their consequences.

Designers at all stages of development should be empowered by an improved vocabulary, with supporting practices, for the aesthetics of touch. Such a vocabulary is not only key to enable them to communicate, but also to be able to make complex and demanding design decisions such as translating a single product into a product line.

We have identified relevant theoretical perspectives from across a range of design research and have used this to augment bottom-up analyses of graduates' accounts of their design work. Through this, we have identified opportunities for improving the extent, depth and effectiveness of haptic vocabularies and their associated non-verbal resources. We plan to extend the above studies to expand our corpus of examples and understandings. With a suitable corpus in place, we will then transfer examples and understandings into an interactive tool that integrates physical and digital resources we will then evaluate the effectiveness of this tool.

References

- [1] Paterson, M. (2007). *The Senses of Touch: Haptics, Affects and Technologies (Senses and Sensibilities)*. Oxford: Berg Publishers.
- [2] Kepes, G. (1995). *Language of Vision*. New York: Dover Publications.
- [3] Buxton, B. (2007). *Sketching User Experiences: Getting the Design Right and the Right Design (Interactive Technologies)*. Boston: Morgan Kaufmann.
- [4] Hodges, R.M. (1991). Opening the designers' spatial dictionary: The power of a professional vocabulary. *The Journal of Architecture and Planning Research*, 8(1), 39-47.
- [5] Lawson, B. (2005). *How Designers Think, Fourth Edition: The Design Process Demystified (4th ed.)*. Oxford: Architectural Press.
- [6] Krippendorff, K. (2005). *The Semantic Turn: A New Foundation for Design*. CRC Press.
- [7] Cross, N. (2006). *Designerly Ways of Knowing (1st ed.)*. Springer.
- [8] Buchanan, R. (1992). In design thinking wicked problems. *Design Issues*, 8(2), 5-21.
- [9] Winograd, T. (1996). *Reflective Conversation with Materials An interview with Donald Schön by John Bennett. Bringing Design to Software (1st ed.)* Harlow: Addison Wesley, 171-189.
- [10] Verganti, R. (2008) Design, meanings and radical innovation: A meta-model and a research agenda. *Journal of Product Innovation Management*, 25(5), 436-456.
- [11] Lederman, S.J., & Klatzky, R.L. (1987). Hand movements: a window into haptic object recognition. *Cognitive Psychology*, 19(3), 342-68.
- [12] Ackerman, J.M., Nocera, C.C., & Bargh, J.A. (2010). Incidental haptic sensations influence social judgments and decisions. *Science*, (328), 1712-5.
- [13] Dagman, J., Karlsson, M., & Wikström, L. (2010). Investigating the haptic aspects of verbalised product experiences. *Design*, 1-15.
- [14] Hsu, S.H., Chuang, M.C., & Chang, C.C. (2000). A semantic differential study of designers' and users' product form perception. *International Journal of Industrial Ergonomics*, 25, 375-391.
- [15] Dore, R., Pailhes, J., Fischer, X., & Nadeau, J. (2007). Identification of sensory variables towards the integration of user requirements into preliminary design. *International Journal of Industrial Ergonomics*, 37(1), 1-11.
- [16] Schütte, S. (2005). *Engineering Emotional Values in Product Design*. PhD Thesis, Institute of Technology, Linköping, Dissertations No. 951, last accessed 15/5/09 at liu.diva-portal.org/smash/get/diva2:20839/FULLTEXT01
- [17] Jacucci, G., & Wagner, I. (2007). Performative roles of materiality for collective creativity. *Proceedings of the 6th ACM SIGCHI Conference on Creativity and Cognition - C&C '07*, 73-83. New York: ACM Press.
- [18] Seely Brown, J., Collins, A., & Holum, A. (1991). Cognitive apprenticeship: Making thinking visible. *American Educator*, 6, 38-46.
- [19] Lehrer, A. (2009). *Wine and Conversation (2nd ed., p. 336)*. USA: Oxford University Press.
- [20] Bardzell, J. (2011). *Interaction Criticism : An Introduction to the Practice. Interacting with Computers*.
- [21] Cockton, G. (2008). Designing Worth – Connecting Preferred Means to Desired Ends. *Interactions*, (4), 54-57.
- [22] Cockton, G. Kirk, D., Sellen, A. & Banks, R. (2009). Evolving and augmenting worth mapping for family archives. In *Proceedings of HCI 2009 – People and Computers XXIII – Celebrating people and technology*, ed. A.F. Blackwell, 329-338, BCS eWIC, available at http://www.bcs.org/upload/pdf/ewic_hci09_paper42.pdf
- [23] Krippendorff, K. (1995). *Redesigning Design: An Invitation to a Responsible Future University of Pennsylvania*.

- [24] Fine, G.A. (2008). *Kitchens: The Culture of Restaurant Work*, Updated with a New Preface (p. 328). Berkeley: University of California Press.
- [25] Sonneveld, M. (2004), Close encounters of the first kind: Meet the material world. In D. McDonagh, P. Hekkert, van Erp, J., & D. Gyi, (Eds). *Design and Emotion: The Experience of Everyday Things*. (pp. 436-437). London: Taylor & Francis.
- [26] Ashlock, J. (2007). What can brown do for you? I.D. Magazine. Retrieved June 7, 2007, from <http://www.idonline.com/features/feature.asp?id=1575>
- [27] van Halen, C., Vezzoli, C., & Wimmer, R. (2005). *Methodology for Product Service System Innovation*. Assen: Koninklijke van Gorcum.

Vicky Teinaki,
Gilbert Cockton,
Nick Spencer,
Bruce Montgomery
School of Design,
Northumbria
University