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Diffract Me! – Using a Skills-Based Approach in Design Practice

Jeroen Peeters¹, Stoffel Kuenen², Ambra Trotto³, Caroline Hummels⁴

¹ Interactive Institute Swedish ICT and Department of Informatics at Umeå University, Sweden, jeroen@tii.se
² Umeå Institute of Design, Sweden, christoffel.kuenen@dh.umu.se
³ Interactive Institute Swedish ICT and Umeå School of Architecture, Sweden, ambra@tii.se
⁴ Department of Industrial Design at Eindhoven University of Technology, Netherlands, c.c.m.hummels@tue.nl

Abstract: The potential of skills in design is intriguing; as skills open up new perceptions of the world they allow meaning to arise as we engage with the world. Several skills-based techniques that leverage this potential have been developed, and integrated into the Designing in Skills framework. The framework builds on personal engagement of designers in their practice, and promotes them to take a first-person perspective, enabling designs to be enriched with meaning. In this paper, we present the most recent workshop based on this approach, which specifically focuses on employing the Designing in Skills framework as a starting point and catalyst for design practice. We briefly introduce the Designing in Skills framework and present the DiffractMe! project in which we built on this approach to explore its potential for design practice. We conclude with reflections on the process and result by the involved designers. These reflections offer insights into the value of this approach for enriching interactive design with experiential qualities.

Keywords: Interaction Design, Engagement, Skills, First-Person Perspective, Design Process.

1. INTRODUCTION

In recent years, we have developed a number of methods, approaches and tools that leverage skills, embodiment and personal engagement in design, aiming to enrich both the design process and end-result with "richer" meaning. Examples of this work include Rights through Making (Trotto, 2011) and Designing in Skills (Trotto & Hummels, 2013). These approaches hinge on exposing individual sensibilities and unlocking richness on a personal level in relation to others, rather than
to aim for objective and universal qualities.

When looking at skills, sensibilities and richness, our work is part of the field of aesthetics of interaction and pragmatic aesthetics. According to the pragmatic approach, the aesthetics of an artefact emerge from a dynamic interaction between a user and an interactive system resulting in what has been labelled ‘aesthetic interaction’ or ‘resonant interaction’ (Locher et al., 2010). Pragmatic aesthetics is gaining momentum nowadays, as designers move towards the digital and the HCI community moves towards experience and embodiment (e.g. Djajadiningrat et al., 2007; Forlizzi & Batterbee, 2004; Graves Petersen et al., 2004; Hummels & Overbeeke, 2010; Loke and Robertson, 2013; Ross et al., 2008).

In our own endeavours in this field, we are exploring how design can create alternative ways to engage with the world, based on trusting our senses. Exploring how to sculpt a tomorrow where people can access sensitivity and quality, and how to support people to take and value a first-person perspective when interacting with the world. In this work, we take a philosophical stance based on phenomenology, pragmatism, embodied cognition and the like, which explains how we are and live in the world. We aim to synthesise these perspectives by designing towards our preferred, alternative engagement with the world (Hummels and Levy, 2013). For more information on our perspectives, earlier work and theoretical foundation, we refer you to other publications (Hummels, 2012; Hummels & Frens, 2009; Trotto, Hummels & Levy, 2012; Hummels, Trotto & Cruz Restrepo, 2011). With our focus on exploration, through design action, of the richness of meaning that exists in our bodily way of experiencing the world, our approach has clear parallels with the emerging field of Kansei Design (Levy, 2014). The Designing in Skills framework presented in this paper, celebrates the richness of experiential qualities that emerge from trusting and building on designer’s subjective points of view.

In this paper, we focus on a particular part of our earlier work, centering on the consequences of designing for skillful coping and embodiment. These concepts emerge from the abovementioned theories, and can be used as foundations to create designs that elicit rich and meaningful interaction. They allow for designers to be able to tap into, explore, be sensitive to, experience, apply, enlighten, facilitate, share, discuss, reflect upon and communicate towards the richness and subtleties of skillful coping and embodiment.

Over the last years, we developed the Designing in Skills (DiS) framework (Trotto & Hummels, 2013) to facilitate and support exactly these ideals. The DiS framework aims to stimulate designers to use skills-based approaches in their everyday design practice. In this paper we describe a four-week workshop, in which three designers explore the potential and influence of DiS on their capabilities of designing for skillful coping and embodiment.

They do this on three levels. Firstly, they explore the impact DiS has on their sensitivity of their own personal skillful coping and embodiment. Secondly, they explore the influence DiS has on their shared understanding of skillful coping and embodiment. And thirdly, they explore how to open up skillful coping and embodiment for people and sensitise them during interaction with a product. This process results in the installation DiffractMe! which connects all three levels.

We conclude this paper with reflections of the designers on these three levels, which act as inspiration and directions for other designers who are eager to design for skillful coping and embodiment. Before explaining the workshop and the results, let us first briefly introduce the DiS framework.
2. DESIGNING IN SKILLS FRAMEWORK

By empowering designers to become more sensitive in their relation to the world around them, meaningful subjective experiences emerge. For that, designers need new tools and methods to make the subjective become communicable and transferable, and to allow for the creation of new meanings when fused within the design process. With the Designing in Skills framework, we aim at tuning designers towards skill-based designing in their practice, in which they explore new design values and directions, in which their designs include their own skill perspective as well as enable users to open up for developing new skills, and in which they share their skillful points of view in the often multidisciplinary projects.

The Designing in Skills (DiS) framework revolves around five main steps (Figure 1). As the first step, a participant (Person 1) reflects on his own chosen skill. This step promotes in-depth reflection on the qualities of a skill from one’s own point-of-view. In the second step, Person 2 mirrors Person 1’s skill, offering his own point-of-view to sharpen Person 1’s understanding of his own skill. In step 3, the process is moved into a shared, physical conversation by creating a Design Choreography. This step reveals and re-connects between the meaning of the skill and its perceptual motor qualities. In step 4, the insights that participants gained on the experiential qualities of their personal skill is extracted from the context of the original skill by building an experiential prototype, the enabling tool. This allows others to experience a salient quality of the original skill (step 5).

![Figure 1: The five steps in the DiS framework](image)

Each of these five steps in the framework relies on making and doing as core activities, both individual and group based. By placing an emphasis on making and doing, findings are immediately placed within a concrete realm, as opposed to allowing them to linger in abstraction. Moreover, designers are forced this way to trust their senses and intuition, and have a constructive dialogue via reflection-on-action, while minimising the use of language and abstraction, and finding certainty in “objectivity”.

To explore if and how DiS helps designers to find new design values in their practice, as well as the effects of the approach on multidisciplinary teamwork, the approach was explored through a number of workshops (Hummels & Trotto, 2013; Trotto & Hummels, 2013). Some of these past workshops concluded with more general design assignments, in order to explore the opportunities the approach could unlock in design practice. For example, in the Dense Spaces workshops, architecture students were asked to integrate their findings and newly gained insights from a two-week workshop into a broader course assignment that involved the design of a space that integrated their workshop findings with political views.

For a more in-depth explanation of the Designing in Skills framework, please refer to the paper by Trotto and Hummels (2013).
3. GOAL OF THE WORKSHOP

The workshop we discuss in this paper, explores how the DiS framework influences values in a multi-disciplinary design process. We use DiS to initiate and catalyse an in-depth design process, to explore the richness and subtleties when designing for skilful coping and embodiment. In this workshop, we explore

1. How DiS refines the sensitivity of the designer’s own personal skilful coping and embodiment.
2. How DiS helps in allowing designers to share their skilful points of view in a multidisciplinary design process.
3. How DiS allows for newly found design values and directions to be transposed into a design process and the final design, and how this opened up and sensitise people towards skilful coping and embodiment during interaction.

4. SETUP OF THE WORKSHOP

The workshop was organized during 4 weeks in March and April of 2013. Three designers participated (2 PhD students and 1 Master student). All participants were familiar with earlier workshops held around the DiS framework and the techniques used. Venue for the workshop was the studio at the Interactive Institute in Umeå, Sweden.

Based on the setup and goal of the workshops, we can identify three main phases in the four-week workshop we will elaborate below. The first phase, Sensitizing to Skills, involved sensitizing the participants to the qualities inherent in their skills, unlocking their potential through reflection-on-action loops. The second phase moved these insights and understandings into a shared design process, working towards integration through the creation of an Enabling Tools. The third phase revolved around the specific interest for this workshop, to build on the acquired insights by applying them in Design Practice.

Please refer to Figure 2 for the four phases of this workshop and the activities therein within the Designing in Skills Framework.
5. DESCRIPTION OF THE WORKSHOP

5.1. Phase 1: Sensitizing to Skills

The workshop starts with initial explorations of skills and their meaning, using various media. The goal is to acquire a deeper and “un-tacit” understanding of participants’ skills, to unlock their inherent experiential qualities. In the body text, the process is explained in terms of the steps in the DiS framework. The specific results and outcomes of these steps are presented in the captions. It should be noted that the descriptions of the qualities in the captions and graphics are representations of the participants’ richer and deeper understanding during the process, and as such do not do full justice to their experience.

To start, each designer chooses a personal skill to reflect upon (step 1), by making a 1-minute documentary. The documentary used both as a descriptive and generative tool, aims at exploring this skill’s meaning (see Figure 3). After a group presentation and discussion of the mini-documentaries, each designer switched viewpoints to Mirror each other’s skill (step 2): each designer tried out another designer’s skill and created a new 1-minute documentary to present his interpretation of another participant’s skill (see Figure 3). This allowed a designer to gain more insights into his own skill, both by self-reflection and in response to the point-of-view offered by another designer.

Figure 2: Schematic representation of this workshop’s phases in the Designing in Skills framework.
Figure 3: (left) Stoffel’s chosen skill was juggling, and he created a video showing juggling from various perspectives. He reflected on the salient aspect of his skill in how he experienced repetition: starting slow and with significant cognitive and motor-skill effort, but gradually moving into a flowing, resonating rhythm.

Figure 4: (right) In her interpretation of Stoffel’s skill, Philémonne compared this to her experience of starting a running session. She reflected on her own skill, running, from the perspective of Stoffel’s. In the video she made, she referred to her experience of a running session also changing through its course. Starting in a contrived fashion, unsure of her physical rhythm or the route she would take, to slowly running without thought or decision, and reaching a steady cadence of steps.

The next step was for the designers (Person 1) to integrate these two different points-of-view by designing an Enabling Tool that allows the other participants to experience a salient aspect of his skill (see Figure 5). Due to its subjective and individual nature, the other participants cannot have the exact same experience of the initial skill. The Enabling Tool is therefore an experiential prototype, designed to go beyond the boundaries and context of this initial skill by eliciting one salient aspect of the skill’s meaning. This step allows the designers to extract and define subtle experiential qualities that can then be refined and applied as foundational elements in further design iterations.

Figure 5: Stoffel created an enabling tool by stretching a piece of fabric over a hole in an irregular frame, with a weight was attached to the fabric near the middle. By tapping the fabric with one’s fingers and searching for “sweet spots”, the weight starts to bounce up and down. Finding the right place, one of the sweet spots, as well as the right pace of tapping, creates a rapidly increasing, resonant vibration of the weight bouncing up and down.
Experiencing the Enabling Tools together and discussing their experiential qualities in a group setting further cemented the shared and individual understandings of the experiential qualities that emerged from different skills. This phase concluded with the participants jointly creating a 1 minute documentary on each enabling tool’s quality, in order to anchor this new and shared understanding, but also to reflect on it. Furthermore, the group created a mapping that identifies and qualifies each of the three different qualities (see Figure 6). Each quality was identified in more detail by creating clusters of keywords. By adding a number of qualifications to each concept, the inherent abstraction as a result of creating schematics, is somewhat countered by the richness of meaning preserved in descriptive elements.

**Figure 6:** The salient qualities that emerged, clustered around the themes of friction, resonance and guidance. Together, these keywords hint towards describing the experiential qualities that emerged from this phase, and they should be considered as annotations to the experience the team had during the process.

### 5.2. Phase 2: Enabling Tool

The first phase unlocked the subtle qualities of different skills and offered insights into how they can be expressed in simple interactions. The team gained a first, shared understanding of these qualities and how they related to each other. The body text describes this phase on the process level. The work and insights gained are expanded upon in the captions under images. The descriptions of experiential qualities and the way they are materialized into prototypes are condensed representation of the richness of understanding the team experienced during this process.

The second phase built on and expanded this shared understanding through the act of making. The team entered a quick and iterative design process creating a series of the same Enabling Tool. These experiential prototypes integrated the shared understanding by incorporating all three different themes (*friction, resonance* and *guidance*). The Enabling Tool was an interactive installation that was placed in public space as part of each individual iteration.
Over the course of a week, the designers built a new version of the Enabling Tool every day. Each iteration involved reflection, through experiencing the prototype together as well as public placement of the prototype to observe the engagement of passers-by. In this high tempo, the designers were forced to expand their understanding by making and doing, as opposed to spending large chunks of time abstracting each quality, running the danger of drifting away from experiential richness.

*Figure 7:* Passers-by playing with an early version of the Enabling Tool, placed in a University cafeteria. A number of discs, varying widely in size, weight, surface material and dynamic behaviour are hanging from a frame. Each disc can be touched and spun around its axis. All of the discs have different properties on a micro, haptic level. The discs feature various textured surfaces (rough, smooth, soft, etc.). Some spin freely, others feature a medium or heavy resistance. Others are connected to each other through gearing systems. This creates a set of varying interactions that happen on a very small level, between fingers, hand and disc that reflect on and explore the friction quality. The repetition of this interaction, where there are a large number of discs that can be spun or touched, some of them dynamically linked through gearing systems, elicits an explorative behaviour. It invites to search and find discs with more pleasant experiences, and continued interaction with them. This reflects the qualities identified around the concept of resonance. The spatial dimensions of the Enabling Tool, a 3-meter horizontal post from which the discs were hanging, invited various behaviours in interacting with and exploring the discs. One could walk by and casually touch some discs; return on the other side, or step-by-step carefully explore the whole installation. This explored and built upon the concept of guidance, providing various ways for passers-by to choose their own path in resistance too, or in guidance with, the various physical interactions offered.
Figure 8: The final iteration of the Enabling Tool refined the earlier versions. Most of the discs and their interconnections were hidden using stretched piece of fabric. Hiding the inner workings of the tool made the connections and details of discs less visible, strengthening the focus on tactile experience of friction and stimulating curiosity through interaction rather than observation. Various pieces of material, hanging above the discs on eye level were added. These materials dropped, spun, bounced or otherwise moved through a hidden but noticeable connection to the discs. This created lighting and sound effects that triggered further exploration and manipulation of the discs and their hidden connections. By reflecting on a series of the Enabling Tools that integrated the three themes of friction, resonance and guidance, it became clearer how they related to each other. Where they were initially identified as individual, separate levels of interaction, the Enabling Tools allowed for insights on how they could exist in the same artefact: Friction, a very intimate, personal haptic interaction takes place on a small scale, between the person’s hand and the object. Resonance happens on a mid-scale level: it is experienced between the person’s actions and the system that particular objects form. Guidance emerges on an even larger level, as it is about the experience of someone engaging with the system as a whole.

5.3. Phase 3: Design Practice

The third and final phase of this workshop revolved around transposing the understanding and insights on experiential qualities gained in the first two weeks, into a design process of an engaging public installation for the Civic Forges: Weaving Neighbourhoods project. This joined project between Interactive Institute Swedish ICT Umeå and the Eindhoven University of Technology, aims at realising platforms in European cities that dynamically engage citizens, as catalysts of innovation, in creating self-empowered and sustainable communities. A general brief for this installation, detailing the most basic requirements, had been established before the start of the workshop: The aim of this public installation was to socially connect and engage visitors through rich interaction based on skills, allowing them to manipulate natural light through an interactive façade.

The qualities mapping and shared understanding that the designers had gained from the earlier phases formed the basis on which the group found a new design direction. Reflecting critically on the strengths and weaknesses of the Enabling Tools, the group was able to establish a first design direction.

Focussing on the newly introduced constraint (designing an interactive lighting façade), the team first aimed at exploring a design direction for the lighting aspect of the final installation. Ideas were
rooted in the qualities that emerged from the previous phase. Ideas that emerged for the façade revolved around resonant dynamic patterns.

As making had been a central activity in the previous weeks, this direction was explored through a series of prototypes, in which the (opportunities for) lighting effects created were continuously reflected on with the lenses of the three experiential qualities.

Figure 9: The design direction around dynamic patterns was immediately explored through various iterations of mock-ups and working prototypes. The search here was to find ways in which a collection of physical elements that affected natural light in the environment, could acquire dynamics that reflected the qualities that emerged from the earlier phases. Experiments were conducted on various scales, working with subtle, small mirror surfaces and bigger prisms.

Having explored and established a clear design direction for the façade, the next step was the design of the actual interaction. Building upon the rocking, subtle movements that were explored in the façade prototypes, the interaction mechanism was inspired on the same grounds to establish a clear connection between input and output.

The interaction revolved around visitors rocking one of two interactive surfaces back and forth with their hand. Developing an interaction mechanism based on small, subtle movement reflected the subtle, micro-scale quality of friction. The movement of the interactive surface is electronically transferred to an actuator that influences the dynamic pattern of light objects. The movement of this actuator is slowly but surely transferred to the whole matrix, creating a resonating effect. To reflect the guidance theme, the two interactive surfaces are interconnected: the movement of one is transferred to the other, allowing two people to feel and see each other’s manipulations of the surface, inviting them to shape the movement together as they let each other guide one another.

6. FINAL PROTOTYPE: DIFFRACT ME!

The third phase explored, through an iterative process of making, a concept for an interactive and dynamic façade formed by a matrix of prisms. The final result of this phase were a number of prototypes and a detailed design for both the dynamic façade and the way in which visitors could interact with it.

In the weeks after the workshop, part of the workshop’s team continued with this concept to create a full-scale working prototype to be placed in public space. This process required a substantial amount of engineering to create a fully functional installation that accurately transposed the experiential qualities that were present in the final concept that emerged from the workshop.
6.1. Description of Diffract Me!

The final installation consists of a large frame that houses a matrix of transparent prisms, mounted on horizontal axis. Each prism can move independently, rocking on its axis. Sunlight is diffracted and reflected by the prisms, projecting a shimmering pattern onto and into the environment. Visitors control a row of trigger prisms by manipulating a surface with their hands. All of the prisms are mechanically coupled, allowing the movement to transfer from one prism and be slowly but surely distributed to all the others in a ripple-like, resonating effect.

Spectators are immersed in a shimmering, responsive space of coloured light. As they come closer, they are enticed to engage with the installation. By placing their hand on mobile surfaces and rocking them back and forth, they create a subtle, resonant effect that moves through the lighting pattern. This has a directly perceived, and profound, effect on the surrounding environment. As they interact with the installation, they tactually and visually perceive others doing the same.

![Image of Diffract Me!]()

Figure 10: The final DiffractMe! Installation, showing the matrix of prisms in the centre, and the two interaction columns left and right.

6.2. Experiential Qualities in the Final Design

The qualities that emerged from the first week of the workshop as defined in the mapping were friction, resonance and guidance. The qualities were integrated and reflected in the interaction of the final design, Diffract Me!
Visitors feel the subtle and tactile experience of friction, as they rock the movable surface back and forward. Small motors create a slight feeling of resistance as they mimic the movement created by another visitor on the adjacent column. As visitors feel each other’s movements, they start to let each other guide, rather than obstruct their movements in an intimate dialogue experienced haptically. The result is a continuous, resonating series of movements, in which the visitors move the surface back and forward in harmony with each other. This results in a resonating, ever increasing ripple-like effect that moves throughout the matrix of prisms.

7. REFLECTIONS

Reflecting on the workshop and its different results, there are a number of points of interest that emerge and shed some light onto the opportunities and pitfalls that this approach presented in this context. Below we present a number of reflections around the process on different levels, responding to the three goals of the workshop.

7.1. Understanding of Experiential Qualities

One of the most salient aspects in our reflections relates to all three of the phases during the workshop. By extracting a salient aspect of our skills and immediately applying this aspect in lo-fidelity experiential prototypes, we increased our grip on this experiential quality. General notions of concepts such as friction or resonance seem straightforward, but by exploring their meaning through continuous prototyping and discussion, their richness becomes apparent. This allows these concepts to become more and more a tool to work with when designing interactions. For example, friction has very different meanings, with many different experiences than one would think of at first glance; E.g. it can relate to the unpleasant experience of a grinding gear that is misaligned, or be a way of sensing traction with one’s eyes closed.

We clearly noticed an increased sense of awareness for the complexity or richness that sometimes hides behind the deceptively simple sounding concepts such as “friction” or “resonance”. Sketching in hardware and reflecting through various different media, we were able to explore the meaning and subtlety involved in materializing these experiences. It is important to note here, that this increased understanding relates to both individual perceptions of these notions, and a mutual, shared understanding. In the explorations we were sensitized to the experiential qualities from our own perspective, but were also able to communicate, and build on, a shared understanding of these qualities that developed between us.

7.2. Reflecting on Artefacts

From our experience, it is imperative to reflect on the experiential qualities in direct relation to artefacts. The full richness of the qualities becomes apparent through reflections on, and discussions of, our experience with prototypes. This creates a physical, experiential dimension to the explorations, and discourages discussions moving into abstractions.

The first phase of the workshop, building directly onto the steps of the DiS framework, made this an explicit point. Reflecting upon the later part of the workshop, where the gained understanding was transferred into the design process of an entirely new interactive installation, it became clear that this element is important in sustaining the richness of these qualities. When artefacts that enabled direct reflection were absent, it was difficult to share each other’s understanding of how a certain quality would become evident in an idea. It required us to resort to drawings or elaborate oral examples to refer back to the shared understanding of these qualities and communicate them.
With the lack of concrete physical examples to base discussions on, ideas often drifted back to the abstract, and became removed from experience. This suggests that despite having a shared understanding of the qualities, physical prototypes or other techniques could benefit the process of moving from this shared understanding into the formation of a clear design direction.

The requirement for reflections on these qualities to be rooted in physical prototypes remains relevant throughout the design and prototyping process. In later stages, a high-fidelity installation was created and activities shifted from exploration to engineering. We needed to “shift gears”, and jump back and forward between two different ways of thinking: imaginative in terms of the qualities embedded in the prototypes, and problem-solving in terms of creating complex, working materializations of these prototypes. This requires a subtle, but profound shift in approach towards design-led engineering. When moving through various, increasingly complex, mechanical iterations, the objective is not just to make an element move, but to make an element move in a certain, specific way, so that it best reflects the sought after experiential qualities.

Reflecting on the design process, it is also clear that experiential qualities need to be strongly evident in the first design directions, in terms of being experiencable in consistent prototypes. The qualities can easily be mis-expressed between one iteration and the next, and it becomes difficult and time-consuming to repair such mis-expression, especially in later stages.

7.3. Our Relation to the World

Expanding upon this increased sensitization towards the many, often very subtle, experiential qualities that exist in the ways we interact with the world, there is also a clearly discernable influence of this process on our relation to the world. Exploring these three particular concepts in depth and through continuous iterations of making, clearly expands our perceptive abilities in day-to-day life. Understanding a little bit more of the depth of experience in our interactions with the world, seems to last beyond the specific timeframe and scope of the design process. We feel we have become more aware of the qualities that exist even in the most mundane of interactions with the world, and how these can be further explored and leveraged within our own design practice.

For example, the theme of friction emerged from the skill of rolling a cigarette. Through the workshop, it was explored and materialized as a subtle, small-scale, haptic interaction that felt pleasant and irresistible. Months after the workshop, one of the authors picked up a hand-powered flashlight during a holiday. Playing with the crank that is used to wind-up and power the flashlight, certain richness in this interaction revealed itself. The resistance felt when turning the crank, was reminiscent of the explorations around friction: a subtly captivating rotating motion, irresistible through its haptic qualities. However, upon further reflection, it also revealed very different qualities than those explored during the workshop. Small, ticking steps were felt through one’s fingertips, rather than a continuous, smooth rotation. Also, the momentum of hidden mechanical parts provided a subtly forceful feedback when one stopped manipulating the crank, pushing back and providing an echo of the rotation.

This is just one of the examples in which we can express how this approach, starting from our own skills and increasing our sensitivity, has provided us with an increased awareness of the richness that exists in our interactions with the world. Moreover, through experience, we developed a cross-medial vocabulary to communicate and transfer these findings, as well as the tools to implement them into our design work.
8. CONCLUSIVE REMARKS

In this paper we have presented the Designing in Skills framework, and have described how we have applied this skills-based approach in a workshop to explore its potential for design practice. In our reflections, a number of key points emerge that shed light on the opportunities and potential difficulties of this approach on different levels.

On an individual level, we have acquired an increased awareness of experiential qualities, and have acquired insights and techniques in order to communicate and leverage this potential in our designs. On a shared level, we have found the workshop to facilitate the development of a deeper, mutual understanding of these qualities, allowing for the integration of our points-of-view.

In addition to our own experiences of this approach and its effect on our design process, another point of interest is to reflect on how the experiential qualities we have explored and materialized are perceived by the outside world. The next step within this research is therefor to evaluate, through making the DiffractMe! installation publicly available, in what sense these explored qualities are evident and valuable for the general public.

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BIOGRAPHY

Jeroen Peeters studied Industrial Design at RMIT in Melbourne (Australia) and the Eindhoven University of Technology in the Netherlands, receiving his Master’s degree (Cum Laude) in 2012. In his graduate work, Jeroen was involved in the design of an interactive exhibition aiming to sensitise visitors towards contemporary issues of Human Rights in Siena, Italy. In 2010, he co-founded the interactive lighting design studio De Bende. In 2012, Jeroen joined Interactive Institute Swedish ICT, and started a PhD project at Umeå University, Sweden. In his current work, he explores how to design for profoundly engaging and meaningful aesthetic interactions in various domains.

Stoffel Kuenen studied Industrial Design Engineering at the Technical University of Delft, graduating in 2002 on a wearable, tangible social interaction product. Stoffel has worked as a strategic, conceptual and technical designer, and has led design and development projects for various interaction and communication products for the consumer market. In October 2010 he joined the design research group at Umeå Institute of Design. His PhD research focuses on the physical side of social interactions. Through designing tools for people to get a grip on their social context he is researching how to create products that result in complex systems and the emergent behavior of groups of people that use them.

Ambra Trotto is currently a senior researcher at Interactive Institute Swedish ICT and a senior lecturer at the Umeå School of Architecture, Sweden. She closely collaborates with the Designing Quality in Interaction group of the Eindhoven University of Technology. Graduated with honors in
Architecture at the University of Florence (Italy), she defended her doctoral thesis in December 2011 at the Eindhoven University of Technology. In her research she explores the field of ethics in design for intelligent products and systems, applying processes that focus on the sharing of making and skills in multicultural and trans-disciplinary environments.

Caroline Hummels has a background in Industrial Design Engineering, is full professor Design Theory of Intelligent Systems at the department of Industrial Design (ID) and heading the Designing Quality in Interaction group at the Eindhoven University of Technology. She is co-founder and member of the steering committee of TEI, and has run numerous workshops on designing and skills at TEI-like venues, and for industry and academia. Her activities concentrate on developing theories, frameworks and tools to support designing towards transformation. Her activities address e.g. aesthetic interaction, craftsmanship, phenomenology, research-through-design, multi-stakeholder design processes, new educational approaches, and disruptive innovation.
Message in a Bottle

The use of intermediary objects to convey future emotional intentions during a multi-disciplinary design project

G.A. Verhoeven ¹, C.M. Eckert ²

¹ School of Design/ECA, University of Edinburgh, UK. a.verhoeven@ed.ac.uk
² Design Group, Open University, UK. c.m.eckert@open.ac.uk

Abstract: In this paper we describe a recent design research investigation, highlighting ways in which a designer attempts to communicate to others their intentions regarding users’ emotional responses to future artefacts through the use of intermediary objects during design activity. We follow the interactions of a jewellery designer engaged in a project in partnership with an electrical engineer, a software developer, and museum curators. The overall design goal is to create an aesthetically desirable electronic object for use in a specific museum context, allowing the generation of personalized labels. This paper embraces an ethnomethodological approach to uncover ways the jewellery designer attempts to translate an intended emotional state (appeal and desire) towards the designed artefact in the future context, through intermediary objects, which are interpreted differently by different people across the trajectory of design activity. The use of intermediary objects during sociotechnical interactions in engineering design activity is well documented (Vinck and Jeantet, 1995, Boujut and Blanco, 2003, Eckert and Boujut, 2003) but our research suggests more work is required to understand the role that these types of devices play in intending and interpreting future emotional content, which is seen as a significant goal within product design disciplines. We discuss the concept of difference, and how it is managed during design activity involving various actors and actants, leading towards a better understanding of intention and interpretation during design.

Keywords: design activity, design process, affective design, design intention, designer interaction

1. INTRODUCTION

This paper provides an account of a group of creative professionals involved in a design project aimed at developing and prototyping an ornamental technical device for a museum context. The technical device is part of a system that enables the custom generation of exhibit labels as visitors walk through a museum exhibition visiting different artifacts on display. The aim of this research paper is to build a better understanding of how a designer makes use of physical prototypes to share her intentions and interpretations regarding
overall affective and emotional attachments to a final artifact intention, which is yet to be
developed, in partnership with a wider creative team. The researchers observed the
interactions between the group directly involved in the design assignment to determine how
boundary objects are deployed, used and interpreted in different ways amongst different
team members.

All project partners observed, to varying degrees, considered themselves designers: the
academic Co-Investigator, responsible for project management of product design
development; the jewellery designer, with responsibility for the design and plan of the circuit
casing; the electrical engineer, responsible for the design and delivery of the technical
circuit; a software developer responsible for development of a mobile application which
connects to the server side application responsible for generating the customized labels
throughout the museum exhibit; and finally, the ethnographic design researcher who is
involved in field testing of the system in the wild in various museum contexts. Outside of this
core group are the museum curators and directors who have been invited to participate in a
focus group towards the end of the project to provide feedback on the robustness of the
technical platform, the value of custom labeling to their relevant museums, and their overall
aesthetic appeal the artifact presents as a museum souvenir structured around the
interactive gallery experience.

The majority of the team has not worked together before. There is no significant history of
this group being collectively engaged in design activity together. This suggests that there are
no preconceptions, or shared experiences with team members, and thereby no prior
knowledge or understanding of each other’s intentions, or approaches to working.
Assembled in this way, the team is required to explain or detail decisions to the rest of the
team early in the design processes, in order to ensure a common approach can be found.
This scenario is ideal for the research observation, since it is not clear how any particular
member of the team will respond to the set brief, and explicating personal understanding will
be required.

The co-investigator responsible for product design development is also the lead author of
this paper. It was established early in the project that product design activities would be
delegated to the jewellery designer, but it remained the responsibility of the co-investigator
to retain project management in partnership with the lead project team. All design project
partners were made aware of the research focus of the co-investigator as a design observer.
Project partners were also enlisted as observation participants at the early stages of the
design project, to solicit their responses to the product design intentions of the jewellery
designer in response to the overall project brief established by the Principal Investigator prior
starting the design activities. The design brief does not contain any explicit suggestions
about product design development, and the jewellery designer was asked to provide
prototype samples that addressed colour, material and finish (CMF) as she understood
would be relevant to the project intentions.

1.1. Boundary objects in the design process

The prototypes and samples presented by the jewellery designer are considered here to be
boundary objects (Star and Griesemer, 1989) within the overall process of design activity,
where the prototype possess a clear identity for individual actors, but remains flexible and
ambiguous enough in their identity to accommodate a variety of interpretations across
multiple actors working together across networks. We refer to two types of boundary objects
observed in this project. Conscription devices (Henderson, 1991) are seen as artifacts used
during design activity which enlist participants to think and work towards a common goal in a
participatory environment. Intermediary objects (Vinck and Jeantet, 1995) are artifacts which
work as representations of final, absent object at an intermediate state. They are understood
as objects used to communicate and exchange ideas and intentions between partners
involved in design activity about future states, as well as foster co-operation within design
teams working on common goals concerning future states (Eckert and Boujut, 2003, Boujut
and Blanco, 2003).

Conscription devices and intermediary objects can take a variety of forms, including
drawings, sketches, models and prototypes. We argue that physical artifacts, when
presented as prototypes, can be understood as boundary objects of both types described
above, but are unique from other forms of boundary objects in that they are simultaneously representational artifacts concerning future intentions, while also being non-representational by virtue of their presence during design activity. This dual nature of physical prototypes is also related to their intended (and presented) social, technical and material affordances. It remains unclear in what ways a physical prototype, when operating as a boundary object regarding a future intention, is able to represent intentional future affective attachment, in relation to an object that is not yet realized.

1.2. Project overview: Talisman

Talisman is the name of the design project under observation. The overall intention of the Talisman project is to enhance the visitor experience to a non-specific museum exhibition through the generation of custom digital labels at artifact displays.

Talisman is a small wearable device that contains an integrated circuit that utilizes Near Field Communication (NFC) through a Bluetooth protocol, to enable communication and notifications with devices using Apple’s iOS7 operating system. As the visitor approaches an artifact in the exhibition context, the Talisman device notifies an iOS device of its presence, and the iOS device communicates with a server side application that generates descriptive label text using an algorithm based on natural language processing. Descriptive labels are returned to the iOS device for presentation, and are customized according to the route each visitor takes in engaging or visiting various artifacts, creating the impression of a degree of personalization. The experience is intended to work automatically without the use of buttons or other physically interactive media.

The overall intention of the Talisman is to be both a passive technical device, interacting with computer hardware behind the scenes, while also being an aesthetically pleasing and a positive reminder of the visitor's experience engaged in the museum exhibition. As a result, the project was structured into three key areas: hardware development, responsible for the Talisman circuit design; software development, responsible for the technical code for information exchange between Talisman, the iOS device and the server side application, and; product design development, responsible for the hardware casing and the overall aesthetic of the Talisman device.

It was clear that any smartphone would be capable of fulfilling all functional and technical requirements outlined in the design brief. A secondary design intention was to create a “heads up” experience, preventing the need for visitors to make use of their own phones, but rather to immerse themselves fully in the museum experience. In early project discussions, it was believed that the affective experience of the museum visit might be enhanced if the Talisman device were described as a wearable item, which might also serve as a souvenir, a memory of the event that had created some sense of value through the experience. For this reason, it was decided to invite a jewellery designer to participate as a member of the overall design team, since it was anticipated that a jewellery designer might possess a degree of expertise regarding wearable objects that held value.

The structure of the project suggests that two key indicators of Talisman’s performance will require assessment during overall development; namely, the technical performance of the hardware and software during use, and the affective, aesthetic performance of the Talisman device when engaged by the user, ensuring it remains an object that creates a positive and pleasing means to deliver the technical functions.

There is a degree of overlap of team members across these three areas of activity; for instance, one member of the software team works closely with the electrical engineer involved in the circuit design to ensure signals from the circuit correctly interface with the server software, while the electrical engineer also works closely with the jewellery designer to discuss dimensions, technical restrictions, and other necessary knowledge impacting development of the casing structure. All team members are involved in weekly meetings to update the full project team on the respective progress of their activities.

1.3. Affective Design, multiple views

This paper is intent on describing how the project team involved in the various design activities intends to share their understanding regarding a positive affective experience for each museum visitor using the final designed product through physical prototypes as boundary objects during intermediary stages of design activity.
Norman (Norman, 2005) describes three levels of affective design responses that people normally exhibit when interacting with objects. At a rational level, people are able to discuss the concepts behind the artifact, to describe their understanding of the intentions that the designers were attempting to address in the overall product design and development. At a behavioural level, people generally respond to the overall performance or utility of the object, describing how well an object serves its suggested purpose. At the visceral level, responses are generally pre-cognitive, and people display a more emotional response to the overall form and shapes, exhibiting their personal preferences or tastes prior reflective analysis of their understanding of the object.

The author engaged participants in the early phases of project work, in an attempt to uncover how each team member, each with different backgrounds and experiences, would understand the proposed product direction when engaged with the early prototypes at the rational, behavioural and visceral level of interaction. The research observations form part of a separate research project outside the scope of Talisman, reported here as a case study. Capturing initial thoughts from all team members before any significant interactions occurred between them was considered advantageous in understanding individuals’ initial understandings of the project, prior input from other team members, while also capturing how each individual participant interpreted the overall design trajectory in regards to its affective intentions through presented prototypical artifacts.

The jewellery designer was asked to interpret the design brief and provide some prototypes and samples that would start to communicate her design intentions surrounding the final design specifications. The jewellery designer was informed that she was able to interpret the brief as she felt necessary, and given creative control and direction of the aesthetic decisions. She was trained in a programme that has a strong emphasis on materiality, and her area of expertise involves technical processes of casting simple materials, such as resins, polymers, epoxies. For this particular project, a new material called Jesmonite® was selected for use.

2. RESEARCH METHODOLOGY

Typically, an affective design methodology requires a large sample size in order to construct a meaningful understanding of the affect participants describe concerning an artifact (Nagamachi and Lokman, 2011). The use of large sample sizes is to ensure that any deviation, or individual differences, might be minimized or made irrelevant. Collecting data in such a way is most relevant to very large design projects, such as automotive or consumer electronics. Many design projects, particularly those involving small and medium enterprise, rely on small design teams to deliver results quickly, and often the affective dimension is interpreted through the experience of the designers involved. Deadlines for production are short, volumes for production are small, and access to the final target group can be difficult.

As a design project, Talisman fits the latter description, involving a small design team that has limited access to the final end user and limited time in order to develop the final product. However, the aim of the research observation described in this paper was not whether the designer captured the affective dimension intended in the final product delivered; rather, how a designers’ intentions during design activity are conveyed to others in the network through the use of physical objects and prototypes. With respect to Talisman, it remains unclear how a designer can successfully convey a positive affective experience regarding a future state through an ambiguous boundary object.

The design research observations were structured around methods involving participant observation and semi-structured interviews. All interactions were recorded using standard video recording equipment, and a stand-alone audio recorder was also employed for backup purposes. Each discussion with relevant team members lasted approximately 15 minutes in total. All audio recordings were transcribed and analyzed in textual format.

Rather than constructing Likert scales for understanding the semantic differential space (Snider and Osgood, 1969), each participant was encouraged to speak freely about their experiences with the artifacts presented to them. A corpus was created and analyzed structured on ethnomethodological techniques associated with conversation analysis.
using an appropriately constructed and validated coding scheme in order to identify key themes emerging from each participant’s individual account, and compare any commonalities or differences in perception and interpretation. Our research observations began with the jewellery designer presenting her intermediary prototypes. She described what she believed was an appropriate response to the design direction set in the brief. She was asked to describe the objects presented, to outline her intentions regarding the final design specifications, and how she understood these artifacts to be representative of jewellery objects. The objects presented to each of the participants are captured in Figure 1.

The objects presented were of various dimensions, but all could be described as being hand held, or wearable, each no more than approximately 100 cm³.

Following the designers descriptions and rationale for presenting the collection of objects, individual team members were asked to interact with the same series of intermediary prototypes created by the jewellery designer, prior any meetings with other team members. Three questions were asked of the remaining team members while interacting with the intermediary prototypes:

- Could you describe the objects in front of you?
- Could you describe the designer’s intention regarding these objects?
- Would you describe these objects as pieces of jewellery?

2.1. Results

The jewellery designer described her intermediary prototypes as studies in material. She outlined her design intention was to generate an artifact that resembled a pebble or stone, which had the circuit design embedded into the Jesmonite® material which has a tactile quality similar to stone. In her description, she outlined that she had interpreted the design brief into the pebble artifact because of the affective experience that she perceived most people had with pebbles, particularly found during walks on beaches. She believed that the affective quality of “finding the right stone”, feeling it, and holding it in the hand were affective elements she wanted to capture which maintained the “heads-up” approach to the project. She also outlined that in attempting to understand what affective elements were related to desirable souvenirs, she felt that pebbles, once found, were often kept and collected for their affective quality and value, rather than their economic or functional value.

At a later date, the same intermediary prototypes were presented to the electrical engineer. The total discussion time was over 17 minutes. The research observation team asked the three questions outlined in the research methodology above. In response to the first question, the engineer immediately began to discuss perceived functions associated with the objects: "…that feels like something you use, to keep something in your wrist, like a remote kind of thing … " (0:00:38/0:17:20). Continuing with the various objects presented, the engineer continues to describe the artifacts relating to perceived function, rather than material or mode of construction: "…I’d have to say pencil holder, I dunno, that’s just what
comes to my mind when I see this.” (0:00:57/0:17:20); “…I’m sorry, I’m thinking of common objects again and this reminds me of a chopstick holder…” (0:02:11/0:17:20); “…this kind of reminds me of a tea cozy…” (0:02:36/0:17:20). When asked if the objects presented to him could be described as jewellery, the participant responded: “…well I don’t see why not. Uhm, though they are kind of, they feel a little bit on the boundary of … so like, some of these are not obvious how they would be used as jewellery. So they don’t have the kind mode of attachment, if you like…” (0:09:29/0:17:20). When asked about the designer’s intentions regarding the artifacts, the participant noted: “… in some sense it seems like an exploration of the boundaries of the traditional concepts of jewellery…” (0:15:57/0:17:20), and continuing: “…it’s not obvious how these would be used as jewellery. Though with this ones, uhm, I mean they have this kind of similarities to something, like, a lot of people like having a stone that they’ve picked up at the beach…” (0:16:15/0:17:20).

The same artifacts were presented to the lead software developer, and the same three questions were asked as outlined above in the research methodology. Total length of this discussion was just over 8 minutes. In this instance, the participant in question was quick to identify the material as a strong salient feature, but only after mentioning the lack of technical functionality present in the artifacts: “…Iguess I see a collection of different objects, shaped objects. They all seem to be, uh, inert. Don’t seem to be any kind of electronics or anything. Some of them seem to be made of stone-like material…” (0:00:33/0:08:38). While physically engaging with a number of the artifacts, some other elements are discovered which clearly generate a positive affect with the participant: “…oh, look, that’s actually – oh hey, magnets. That’s Obviously trying to do something functional, but I can’t quite work out what it is though…” (0:01:43/0:08:38). Eventually, the participant decides to cluster the artifacts into categories that allow him to build a deeper understanding of the task he’s involved with: “…they certainly look like, I guess these look like stones. That one looks like a bit of worked stone…” (0:02:05/0:08:38). When asked if the objects presented to him could be described as jewellery, the participant immediately responded: “…uh, I wouldn’t. But then my view of jewellery is very narrow.” (0:03:49/0:08:38). When asked to speculate on the designer’s intention of the prototypes presented, the software developer replied: “…I find it easy to speculate on the intention of these. These seem to be trying to, uhm, take qualities that you associate with a natural stone …” (0:05:37/0:08:38).

The ethnographic design researcher was also asked to participate in the study, since she would be involved in field trials with the artifacts at identified testing gallery sites at a later date on the project. Total discussion time was approximately 9 minutes. In attempting to describe the objects, her immediate response was: “…a mixture of pebbles, and black artifacts …” (0:00:29/0:08:52). Slightly later, prior being asked the third question, she also states “…they also slightly remind me of jewellery.” (0:01:48/0:08:52). At a later time, the researcher asked the participant to expand on this statement, and describe why she felt the intermediary prototypes reminded her of jewellery. She states: “…ehm, I think cause they’re all kinda like pretty, in a way…I guess it’s like the smoothness of them, that makes me think they’d be quite good as wearables. But I think it’s cause I like jewellery and I sort of see everything as ‘Oh, I could wear that’…” (0:04:46/0:08:52).

When asked to describe what she understood the designer’s intention to be, the design researcher states: “…it looks the ultimate aim is to make something that you can hold in your hand and is quite tactile…they don’t really look as if they are just meant to be looked at…they look as if they are supposed to be held …” (0:06:15/0:08:52).

3. DISCUSSION

Though our research findings make evident that the rational intentions associated with the pebble concept initially outlined by the jewellery designer was clear to all participants, the transcriptions suggest that there are other considerations that need to be taken into account when working with boundary objects during design development that are intended to represent ambiguous future states. We discuss below four particular issues relevant to an affective design project involving inter-disciplinary teams. Notably, all four issues involve the role of difference across various elements within the interactions between participants and prototypes.
3.1. Differences among participants
In the interdisciplinary team we describe in our project, the differences between participants, both in their personal world views and their individual biographies is significantly accentuated, due to the small sample size of the group. One key difference is that the jewellery designer and the design ethnographer are women; our two engineers are men. The descriptions provided suggest that a difference in understanding and interpretation is evident between the women and the men. We suggest that this difference is amplified by the presence of the intermediary object, but the intermediary objects presented also enable participants to manage difference since clarification of interpretation and intention is made readily possible through concrete means.

3.2. Ambiguity of intermediaries: differences in interpretation
The traditional approach involved in an affective design methodology is to engage a large sample size with artifacts and objects that are fully formed. The objects normally presented are precedent objects, already in fully formed existence on the consumer market. Design researchers involved in affective design methodologies will normally place restrictions upon the survey target they are addressing in determining the affect in order avoid unnecessary confusion in their analysis (Nagamachi and Lokman, 2011). Such an approach may provide insight into how a target audience of consumers necessarily feels about an existing product, which is clearly defined, categorized, and not ambiguous. Intermediary prototypes used across design teams are not full manifestations of the final design intention, but an incremental representation between the precedent state and the final design intention (Boujut and Blanco, 2003, Vinck and Jeantet, 1995). Intermediary objects are highly ambiguous, open to differences in individual interpretation, as the intermediary object reveals and implicates particular information relevant to the interpreter (Eckert and Boujut, 2003). Our analysis reveals that the ambiguity would appear to emerge as a result of variety of interpretations possible in the presence of the objects and other designers. In attempting to ascertain the designer’s intentions, our three participants were clear on the rational intentions that the prototypes were trying to convey (stones and pebbles), but less clear on the behavioural intentions (how does one interact with or use the pebble as an electronic device?). It is not clear how the visceral responses reported by all participants are related to the artifact presented, or anticipated concerning the future manifestations which are intended to emerge later in the design trajectory.

3.3. Semantics and meanings – differences in understanding
Across the Talisman project, a standard definition of jewellery was not provided in relation to the final design decision regarding final artifact development. In early briefing meetings, it was suggested that the final device should be considered a souvenir, create a sense of “value” and also be “wearable”. This was collectively interpreted to fit within a scope of jewellery, in its widest sense, and to this end, an expert designer of jewellery was invited to participate. What appears in our reports is difference in collective understanding of what “jewellery” is. The designer interpreted the brief to be about value of experience, and attempted to parallel the gallery experience to the act of collecting pebbles on the beach. From that, the designer suggested that “wearable” could be also understood as “handheld”, and interpreted jewellery not as a brooch, pendant or bracelet, but rather a handheld device, which addressed the designer’s understanding of facilitating a “heads up” experience in the museum context.

The electrical engineer, and the software programmer reported having difficulties in understanding the intermediary objects presented as subscribing to a definition of jewellery for different reasons. The engineer made extensive use of analogy in describing the intermediary objects, none of which were related to jewellery. The software programmer was not able to categorize the intermediary objects as electronic devices, outlining that they seemed too “inert”, while also professing that his view of jewellery was “very narrow”. In the conversations with the design ethnographer, her early response of viewing the intermediary objects as jewellery was predicated on her view that she interprets many things as potential types of jewellery.
3.4. Shared affective experience – differences in connections and relations

All participants were quick to understand the metaphorical connotation of pebbles through the intermediary objects presented by the designer. The rational understanding of the experience of walking along a beach and collecting stones considered aesthetically pleasing to both eye and hand, was mutually agreed. However, this analogy was not necessarily transferred to the intended activity of the end user in the final design intention; that is, no participants were able to articulate an understanding of the desired transference of visceral experiences from one activity (walking along the beach and collecting precious stones as souvenirs) to the intended activity (walking through a museum with a precious electronic stone, which is a souvenir). Thought the boundary object was able to operate effectively at a rational level, it remains unclear whether it does so equally well at a visceral level.

4. CONCLUSIONS

This paper highlights that communicating affective intentions presents challenges in small, interdisciplinary design projects, because difference plays a prominent role across the project team, both at the individual level and the level of understanding and interpreting intentions of other group members. Intermediary objects, shown to facilitate communication and cooperation across design teams, are ambiguous by nature, and we suggest that their ambiguity is a result of differences in interpretation by individual actors. Difference occurs on three distinct levels, following from Norman (Norman, 2005): difference at the visceral level (the object’s affect); difference at the behavioural level (the object’s performance); and difference at the rational level (the concepts relating to the object). However, difference also occurs when participants are not clear on which level (visceral, behavioural, rational) other team members are interpreting the intermediary prototypes, since affective responses can occur across all three, and individuals place differing levels of importance on each of these levels.

REFERENCES


