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

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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

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.
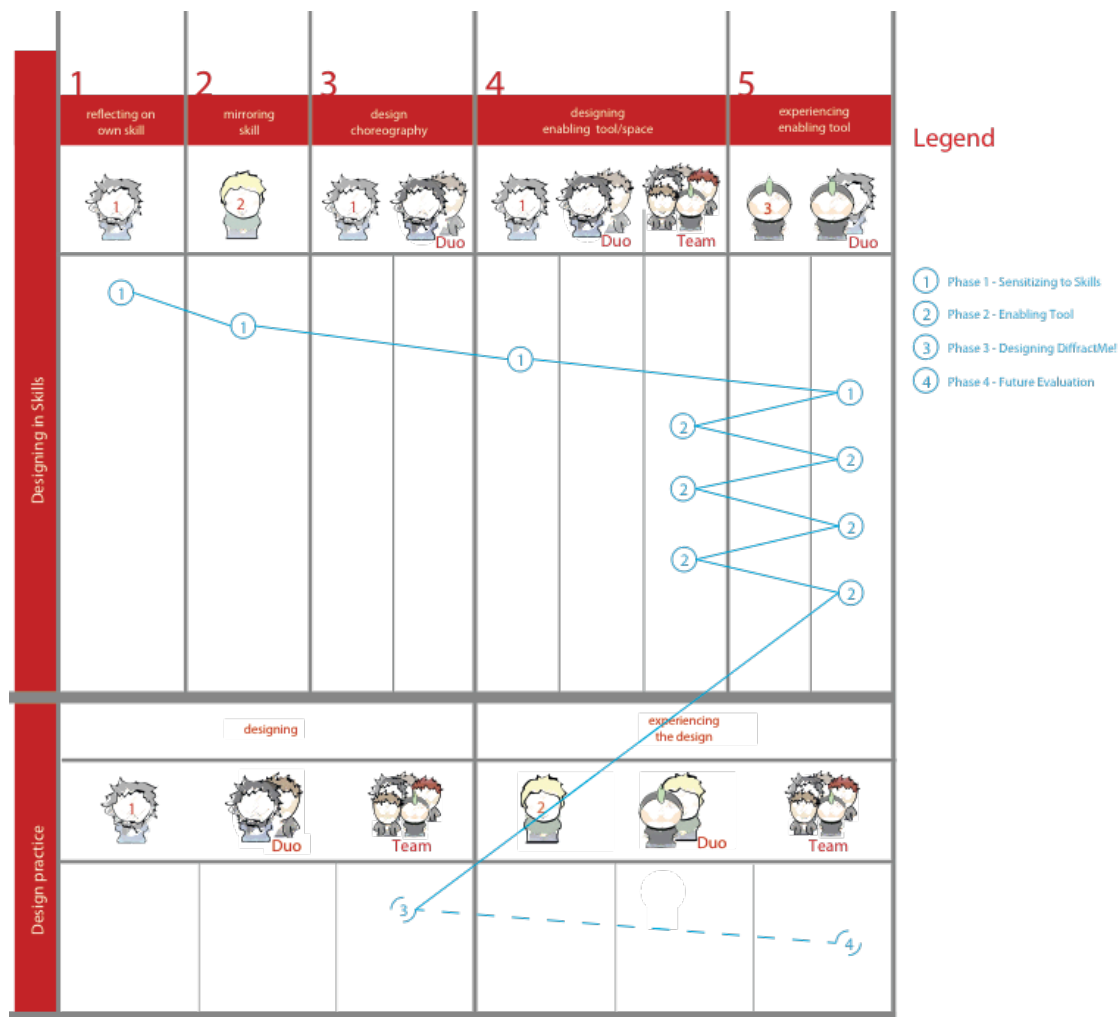
Figure 2: Schematic representation of this workshop's phases in the *Designing in Skills* framework.

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 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.
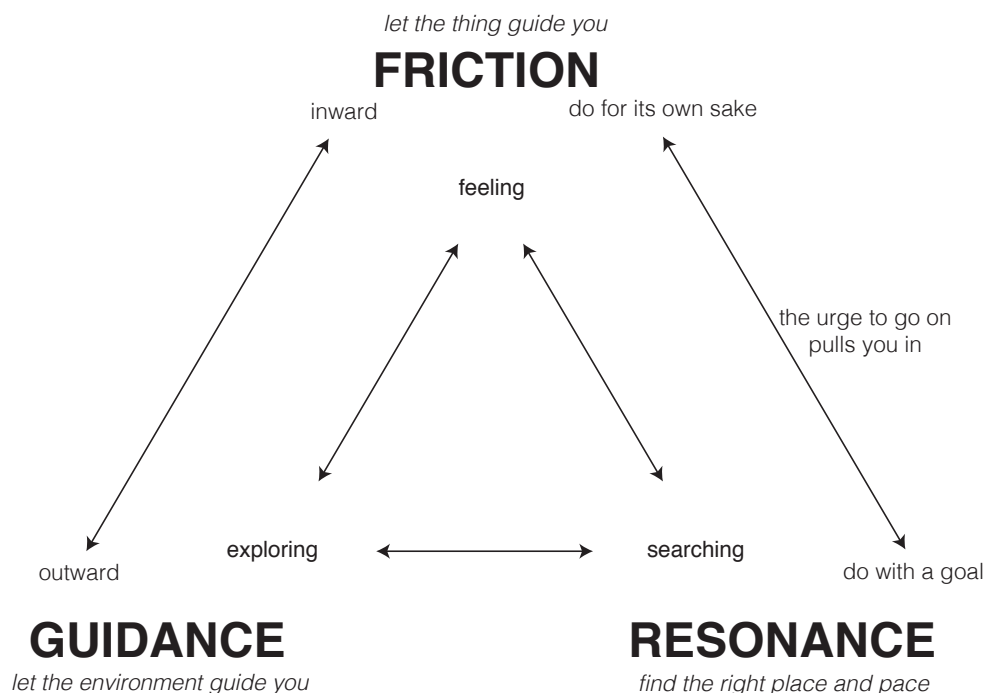
let the thing guide you

FRICTION

inward   do for its own sake

feeling

the urge to go on
pulls you in

outward   exploring ⟷ searching   do with a goal

GUIDANCE   # RESONANCE

let the environment guide you   *find the right place and pace*

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, other 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 catalysers 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.

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 hi-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.