Using Smart Materials as an Inspiration Tool in a User Workshop

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ABSTRACT
In this paper, we investigate how smart materials can act as an inspiration tool in a workshop with users. Whereas materials are often thought into the design of artifacts in the construction stage, we have worked towards discovering the productiveness of exploring materials early in the design process and in collaboration with users. We will discuss how this has influenced our concept, and how this has revealed another set of properties of smart materials. Our findings support the notion that materials can generate ideas and reflection, however we have achieved a more elaborate understanding of how they can do so by being a representative metaphor for interaction. As our participants had another relation to the materials, than within the design group, we experienced that they had another way of approaching them. Hereby we want to purpose the productive role of working with smart materials together with users, along with our reflections on what to consider when doing so.

Categories and Subject Descriptors
D.2.10 Design

General Terms
Design, Experimentation,

Keywords
Smart Materials, Fictional Inquiry, Inspiration Workshop

1. INTRODUCTION
A material move in interaction design challenges the Scandinavian user-centered design tradition [1]. We wonder what the situation will look like in 10 years, and this paper questions whether the ethnographic studies of use and domain will become downgraded in favor of material studies in the design lab. In our recent design process we have attempted to navigate back and forth in the field between domain- and material studies. Through the use of three different materials (virtual video prototype, smart materials and audio hacking) our latest interaction design project has explored, how interaction design can help market a product or a message [2].

In this regard, we chose to design an installation that would assist the organization WWF's efforts in the area of fish welfare. With the final design concept it has been our goal to make consumers more aware of the problems caused by the fishing industry.

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The structure of the design process has been highly influenced by our choice to work with WWF's fish guide [3]. The guide, Hva' for en fisk ("Which fish?"), recommends which fish are best to buy, in relation to the environment and the different fish stocks. As an additional self-imposed constraint, we had chosen Aarhus Food Festival as the location for the installation.

Picture 1. Visualization of the concept Havets Stemme

The result was our design concept Havets Stemme ("Voice of the Ocean"), which is a spacious interactive installation that works with audio and visual feedback. It is a pavilion-sized tunnel in which a video taken under water is projected onto the walls, accompanied by a soundscape of underwater sounds. Squeezable fish figures of a rubbery material are hanging from the ceiling. When squeezing them a big splash will sound, and at some point, when several of fish has been squeezed, the soundscape and video will start to get distorted leaving a more gloomy expression inside the tunnel. The installation is meant to give the participants an aesthetic experience and help trigger a curiosity towards the subject. The participants are thereby encouraged to seek more information at the connected WWF stand at the festival.

In the process of working with the marketing of a message, we have also been equally interested in the exploration of different materials. The design process has therefore been driven by materials studies in the scope of marketing through interactive experience design. Though the perspectives have influenced each other, the research scope of this paper is focused on material studies. We argue that experience design drawing on the aesthetic potential of bodily and haptic interaction might facilitate a closer consumer-product relationship, enabling a greater communication of the message. As we shall explain, using smart materials as inspiration is mainly what engaged us with this bodily and haptic interaction. Using smart materials' as inspiration could be very helpful in other design situations, and so we explain how we have used smart materials, how they influenced the process, and which inherent values we have discovered.

By smart materials we are referring to materials that have one or more properties that can be significantly changed and reversed in a controlled fashion by external (computational) stimuli.

2. RELATED WORK

Our design approach is based on a pragmatic perspective, especially on Donald Schön and his theories within design. According to Schön's theory a reflective design practitioner needs to consider problems as being wicked, and engage in a conversation with the materials in the situation [4]. In user-centered design traditions the ultimate particularity of the social and cultural context have long been the focus of the design process. However design theorists such as Wiberg are starting to encourage designers to focus more actively on the ultimate particularity of the technology [1]. Hence materials have recently become a big topic in design research, and the 'material move' has been coined as a term describing when materials guide the design process. It is a movement from a user-centered to a material-centered design approach [5]. Wiberg describes a framework for material science and culture, where the materials are used as inspirational bits in the process, which in among other ways, can be approached through sketching in hardware [1]. In this article, we concentrate on smart materials, such materials are evidently ideal functioning as computational composites. Computational composites are materials put in connection with a computer [6], and since smart materials can change status for instance when electrified, they are computational. Rethinking ways of connecting materials is growing more important as the computer is becoming more ubiquitous, hence in this regard sketching in hardware is becoming a relevant tool, when exploring new ideas [7]. The smart materials and hardware used in our workshop can therefore be seen as sketches functioning as representations. Kyng stresses the importance of introducing representations early in the process in cooperation with future users [8]. It is especially important that a common praxis and language around the representations is established in the first steps of a design process. Representations can represent both the system being designed, for instance prototypes, mock-ups, drawings etc. but it can also represent use, for instance descriptions of work situations and use scenarios, and as we have already introduced they can stand as a representation for something else, for instance a metaphor of interaction [8].

Picture 2. Table with primitive and smart materials

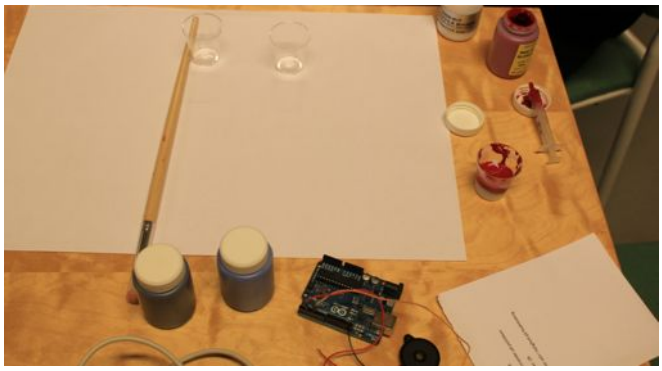
3. IMPLEMENTING SMART MATERIALS

In the beginning of our design process, we quickly came up with a concept. However after some time we saw the need to explore other materials and possibilities. In order to transcend our initial ideas we therefore chose to step back in the process and carry out a workshop with users. Diverging the process, we started to recognize that exploring the smart materials does not necessarily mean including them in a final design product.

Before organizing the workshop we casually explored the materials internally in the design group, and here we experienced their immediate accessibility and playfulness. The fact that the materials can be very easily approached supported our idea of carrying out a workshop based on a material move, where users had a minimum of constraints and no special task to fulfill, other than exploring the materials (in relation to our problem statement).

The smart materials we chose to use in our workshop were thermochromic paint and BioMetal Fiber wire (contractible wire), which could be interacted with through bare hands, electricity or an Arduino. In addition to these materials, we made some primitive materials available, which they could use in combination with the smart materials. None of these materials demanded extensive knowledge to make use of them.

Setting up a framework for the workshop we draw inspiration from the Fictional Inquiry Method, which is a method that sets up a fictional narrative framework for working with the wicked design problems [9]. Through this framework we were able to help the participants transcend their normal patterns of actions, expectations and thoughts. The type of fictional inquiry called future workshop uses anchor points that work as objects of focus from which new meanings can rise. In this perspective the smart materials would act as the anchor points. We chose to combine this with a form of role playing, giving each of the workshop participants a character to play.



Picture 3. Thermochromic Paint

3.1 Structuring the workshop

We invited six participants to take part in a two-hour workshop. Our target audience is families and especially children, but the workshop participants were all students, thus not the intended end-users. However being students living in Aarhus the participants would still be potential visitors at the food festival. Through the roles we gave them, we also intended for them to enter a fictional space, where it would be easier for them to relate to or question our target audience.

When the participants arrived we established an informal common space, and introduced them to the problem statement, as well as the smart- and primitive materials. Hereafter we divided the group in two and assigned the specific fictional roles to the participants. The roles included stereotypical personas as a dietician and a poor student. The two groups were divided so that they had radically different values and personas, hereby we hoped to initiate discussions and conflicting design concepts. They had half an hour to design concepts dealing with the problems of fish welfare, with the only constraint being considering the smart materials at hand. In the meantime we documented the design task, and

encouraged the groups to consider their roles and the materials, and help them use the unfamiliar smart materials.

Hereafter we gathered the groups, and they presented their concepts and their thoughts by presenting the 'reconstructed' smart materials and sketches on paper. The participants stayed in their fictive roles in the presentation and discussion of the concepts, and various potentials in the concepts were deduced. The following section presents our findings, and discusses the potentials of using smart materials in a workshop with users.

Picture 4. The workshop space

4. SMART INSPIRATION

The workshop demanded that the participants would make use of the smart materials. However when sketching their ideas, paper was still the most used material, but as the workshop progressed they started getting more comfortable using all the materials available. We entered the process under the assumption that the materials would inspire the participants and that their concepts would somehow contain the smart materials. However what we did not anticipate was that the materials worked not only in generating concepts but also as means to convey their ideas (through gesticulating with the materials). Most of their concepts was, if build, not meant to be constructed of these smart materials, hence the materials became representations not of the product, but of use situations [8]. Furthermore they also functioned as anchor points guiding the discussions [5].

From our analysis of the workshop we have found the following three essential properties of the materials: 1. They help generate ideas 2. They support a shared focus, and last and most importantly 3. They function as a representative metaphor for interaction modalities. Besides listing the potentials and qualities of materials in the following sections, we will also reflect upon which considerations is useful to have in mind when this approach is transferred onto future design situations.

Picture 5. Experiment with paint, battery, and magnet

Picture 6. User sketching a design concept

4.1 Generating Ideas and Provoke Reflection

All the materials present at the workshop, the smart as well as the primitive materials, worked very well at triggering their imagination. For instance the users started thinking of the materials in relation to the fish guide ("Which Fish?"), and thus concepts working with color codes and categorizations started to emerge. In a workshop context, having physical materials present, have therefore proven to initiate a flow of ideas among the users, which again support the importance of having externalizations to support ideas. Dix and Gongora are pointing out how important external objects are, they describe the externalization method reducing and relating [10]. Fish welfare is a complex problem space, and therefore by this method of reducing and relating the categories of the fish guide to the thermochromic colors, the participants made the complex problem more understandable.

Using materials in a workshop can however also have some implications, for as the materials inspired they also constrained the participants. One outcome in the particular situation was that the participants did not think to implement other materials or technologies that they knew, even though they were free to do so.

Despite the fact that the materials were very accessible, they still made some participants more engaged than others, and the fact that they could play very freely with the materials was ironically maybe also the reason why some was more or less inactive.

4.2 Supporting a Shared Focus in Groups

Even though the participants did not use all of the materials extensively, they did still serve a purpose acting as the aforementioned anchor points. For instance the participants transferred the potentials of some materials and applied them to several of the concepts, thus we detected some common denominators of their ideas. When the conversations around one material seemed to fade, they shifted to a new focus in the group by switching to a new material. Somehow through their free play, the materials also managed to make them systematically talk their ideas through with each other. Internally in the design group, being much more confident with the materials, often we jumped around between ideas, sometimes leaving things unsaid and unexplained. But using the materials as the shared focus in the group of users made them adhere to a subject and thoroughly explain their ideas. Their temporary engagement with the materials and the subject, somehow revealed some insights that we as designers had been too involved to see – we couldn't see the wood for the trees.

4.3 A Representative Metaphor For Interaction

The materials worked as metaphors just as for instance inspiration cards do [10]. An externalization property is for instance activating transformational thinking using materials [10].

Working as inspiration cards do, smart materials can represent the object that they are, but also represent what you can do with that object, how you can transform it, or use it to transform something else. For instance the thermochromic paint can represent changing a surface by colorization, but it can also represent the interaction of grabbing something as you can manipulate thermochromic paint with the heat of your hands.

In the design group, our first concept was a screen-based game, which we developed partially from an inspiration card workshop. Confident with different technologies, we used pictures of such to construct our concept, thus we initiated our thinking in the digital and this guided our ideas towards a traditional kind of interaction.

We believe that it was the participants' lack of experience and confidentiality with the technologies and materials, that led them to literally grab the materials, and think of how to interact with them, rather than thinking too much about the computational aspect. Their approach to the materials is what inspired us to create a concept relying on haptic and bodily interaction, thereby transcending our command and screen based one. The materials in the workshop thus proved to play an important role when generating a more alternative interaction, in this case more than inspiration cards did.

Picture 7. User presenting a concept by rubbing a colored fish

5. CONCLUSION

Our final concept has been based extensively upon the information we gathered during the workshop. We have made an installation that relies on haptic and bodily interaction. As the participants illustrated by rubbing a colored clay fish, the smart material thermochromic paint can change color from the warmth of your hand (see Picture 7). Even though the paint wasn't used in the final concept, we were greatly inspired by the use of touch to change a status. Therefore we created an installation where the distortion of a video signal and of sound happens due to the grip of the hand, as opposed to touching a screen. Hereby we used the analysis of the participants' work with the smart materials as representative metaphors for interaction.

We believe our explorations contributes to a pragmatists perspective on technologies insofar that we have experienced that smart materials are much more than mere building blocks. Instead of approaching the problem through extensive user-studies, we have related to Wiberg's idea of exploring the materials and their properties as a starting point for idea generation [1].

We have explored not only what kind of productivity use of smart materials can unleash, but we have also taken time to reflect upon considerations. What we have found to be very important to consider when working with smart materials, is when and how to implement them. We gained some very helpful information by implementing smart materials early in the process, other materials we worked with such as video material we found to be implemented to early. Hence different materials are suited to different stages of the process also according to costs and time management.

We also found that when working with smart materials it is very important to consider how they constrain the process, and how we constrain the exploration of them. One question left for us to explore is whether the framework of the workshop was too constraining or too open, where in the one end of the continuum we have total free play and in the other controlled experiments.

As an example we have considered whether or not the roles we gave the participants was beneficial for their explorations of the materials, and if they were actually working against a true material move. But as in any design process different approaches often influence and support each other.

6. FURTHER WORK

Studying how smart materials work as inspirations tools when working in a participatory practice such as a workshop needs further exploration. As every design situation is unique, we do not expect that smart materials will always inspire to a haptic and bodily interaction. Our first move in further work would therefore be to explore other smart materials along with different workshop set-ups. Set-up's can change for instance through the use of more strict constraints or more open ones, and experimenting further with these can give us an idea of how different workshop structures affect working with smart materials.

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8. REFERENCES

[1] Wiberg, Mikael. 2013. Methodology for Materiality: Interaction Design Research Through a Material Lens. Personal and Ubiquitous Computing, 1-12.

[2] Spiffy project blog. http://spiffydd.wordpress.com/

[3] WWF Fiskeguiden. http://www.hvaforenfisk.dk/

[4] Schön, D. A. 1983. The Reflective Practitioner: How Professionals Think in Action. Basic Books.

[5] Fernaeus, Y. & Sundström, P. 2012. The Material Move - How Materials Matter in Interaction Design Research. In DIS'12: Proceedings of the designing interactive systems conference, pp. 486-495

[6] Vallgårda, A., & Redström, J. 2007. Computational Composites. In CHI'07: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. pp. 513-522

[7] Holmquist E. L. 2006. Sketching in Hardware. In interactions - The art of prototyping, Volume 13 Issue 1, pp. 47+60

[8] Kyng M. 1995. Making Representations Work. Communications of the ACM, 38(9), pp. 46---55

[9] Iversen, O. & Dindler, C. 2007. Fictional Inquiry – Design Collaboration in a Shared Narrative Space, International Journal of CoDesign, 2007 3 (4), (2007), 213-234

[10] Dix, A. & Gongora, L. 2011. Externalization and Design, In Procedings of the second conference on creativity and innovation in design, pp. 31-42