

Bridging Material Science and Interaction Design

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Introduction

Recently different researchers have begun to explore the possibility of developing materials and products, which tightly integrate sensing, actuation and computation, making it possible to change their shape, stiffness, or physical appearance in a fully programmable way. This research perspective holds the possibility to add unprecedented functionality to everyday objects, allowing them to adapt their physical appearance and properties and has been carried out both within material science and interaction design. Although material science and interaction design share the same goals, they approach it from different disciplinary backgrounds, with different motivations, and little references exist to the work carried out together. The aim of this workshop was to bridge these two separate multidisciplinary fields, to gain a better understanding of the impact these materials can have on a personal and societal level, as well as to inspire scientific research that connects more closely to future applications. Therefore, this workshop brought together a diverse group of people, both researchers and professionals, with backgrounds in: chemistry, mechanical engineering, computer science, physics, arts, industrial design and aerospace engineering.



Fig. 1 Participants attending the introductions to the diverse research interests (photo by Marcelo Dias)

Approach

The workshop started with an introduction into the diverse research interests of the participants (fig. 1). This was followed by speed dating sessions to connect material scientists with interaction designers. In these sessions participants generated ideas regarding how new material developments could be applied in novel applications, and how applications could benefit from new material developments. Ideas, cross-domain topics as well as differences between the disciplines were identified. During a workshop in the Fablab of Zoetermeer, interaction designers and material scientists worked together on physicalizing some of the generated ideas (fig. 2) including: mechanical behaviour of complex structures by building mechanical systems into materials; 4D textiles and weave structures with sections composed of responsive properties; organic materials addressing dynamic and

tuneable foods as well as edible displays; new developments in haptics addressing micro-energy harvesting for tactile interfaces and texture-changing haptic tattoos; novel approaches to shape-change and actuation by 4D printing samples embedded with electronics; adaptive wearables with 3D scanned body parts; dynamic sensing of range of motion using e-textiles; and finally novel displays including rewritable electrochromic/photochromic tattoos. After identifying potential application domains, the workshop focused on identifying cross-disciplinary connections and means to bridge the gap through research and education.

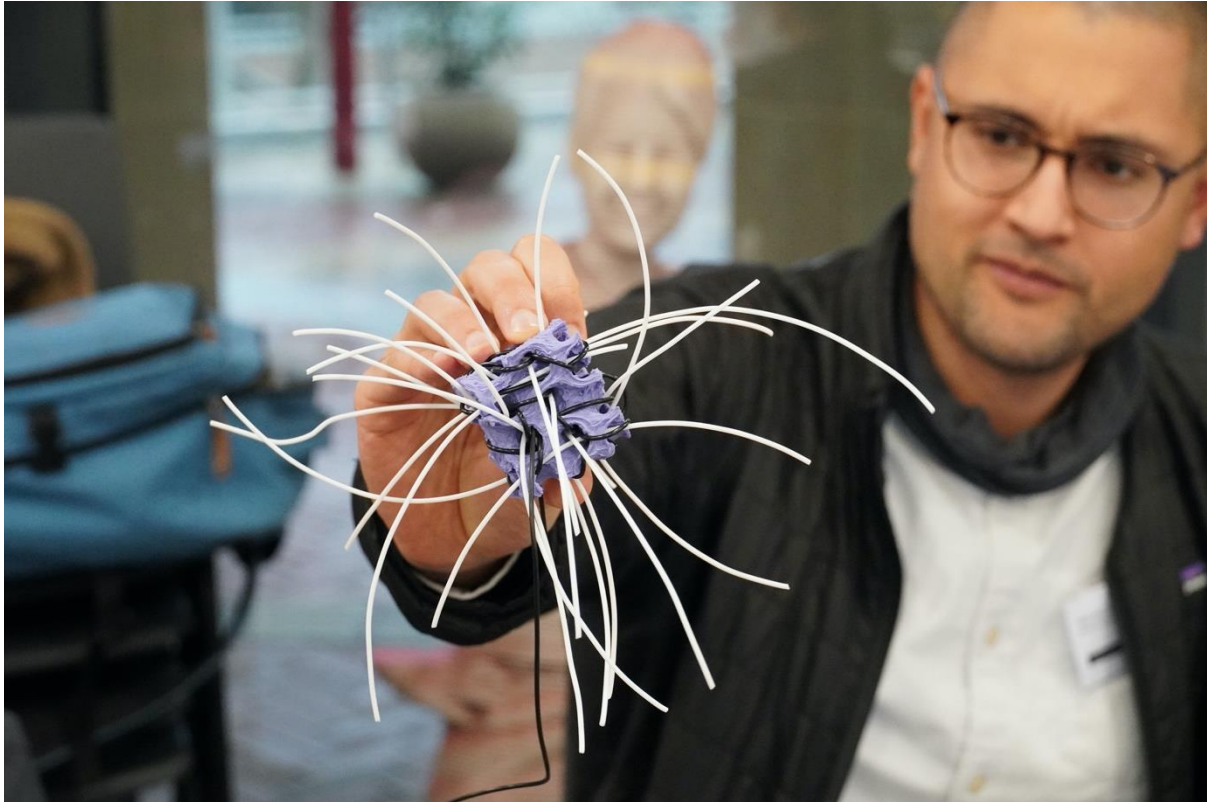


Fig. 2 Outcome of the workshop in the Fablab addressing complex weave structures (photo by Isabel Qamar)

Outcomes

First, connections between the two disciplines were identified (fig. 3) addressing types of materials (polymers and textiles), design approaches (ideation, coding and prototyping), structural properties (auxetics and meta-materials) production techniques (3D/4D printing and weaving), display information (shape-change and haptics) and scale (micro-architecture topology, wearables, displays and architecture). The overarching challenges to bridge the disciplines were identified as transparency regarding the sharing of knowledge, storytelling addressing potential futures, timing and synchronization between developments (e.g. with regards to TRL engagement level yielding a differences in optimal solution vs. early prototyping), and the language barrier between researchers in the two disciplines. Various solutions were discussed such as finding or creating common events; enabling storytelling for all disciplines; experiential prototyping vs. in-depth knowledge of a technology; residencies in each other's departments; mapping of sub-communities to better understand the potential of collaboration and more project based approaches. In addition, the motivations for stronger collaboration between the disciplines were identified as the need for specific skills and knowledge; societal challenges that need to be solved; and the need to create transparency for the different disciplines to enable exchange of knowledge between them. Ideas that resulted on how to bridge the gap included offering trick boxes relating to the different disciplines. Material science would offer their expertise regarding molecules, processes, publications and interaction design would contribute design of applications and discussions with industry.

Conclusion

Through the workshop interaction designers realized that the ideas and future applications which they are thinking of and working on, are actually possible and being researched in material science. They learned about

the science of materials and physical phenomena. On the other hand material scientists obtained a new perspective, and were particularly stimulated by the creativity and different ways of thinking of interaction designers. They appreciated how interaction designers consider the qualities of materials from a user experience perspective rather than a technical perspective, thereby adding context to technology developments. However, there are still many constraints before we can bridge the divide. While interaction design ends at the simulation, material science ends at demonstration of a technology, and it is difficult to find people and industry that see the value or are willing to take the challenge up further. Another challenge was that the more technical people had difficulties in connecting to the more open and subjective design approaches. Finally, user safety and sustainability were identified as aspects that need to be considered for the future. Overall, the workshop offered the start of something which could become a new field. We will continue to identify the structure of this field and clarify what interaction design can offer to the material science community and the other way around.



Fig. 3 Researchers exploring and making connections between the two disciplines (photo by Marcelo Dias)

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