The Material Relation

Anna Vallgårda
The IT University of Copenhagen
Rued Langaards Vej 7
DK-2300 Copenhagen S
akav@itu.dk

CHI 2009, April 4 – April 9, 2009, Boston, MA, USA
ACM 978-1-60558-247-4/08/04.

Abstract
In this paper, I argue for the strength of a material perspective on computers and a subsequent endeavor to develop a new layer of computational materials. I argue that this perspective empowers designers to design functions as they design forms and *vice versa* instead of separating the two and ending up fitting form somewhere in-between function and use.

Keywords
Computational composites, design, interface, material

ACM Classification Keywords
H5.m. Information interfaces and presentation: Miscellaneous.

Problem statement
The interface is the focus of interaction designers. Whether it is tangible user interfaces (TUI), organic user interfaces (OUI), or graphical user interfaces (GUI) the designer's attention tends to be the border between the user and the technology. Through the form of the artifact, we seek to pilot the user's interactions with the technology. We exercise our understanding of affordances [3], skills, rules, and knowledge [7] and we realize that there are more to appealing interfaces than efficiency and effectiveness [6]. Still, we are stuck on the surface trying to make sense of the whole.

When forming the surface of an artifact, the interaction design will be limited to the process of packaging. Whether it is the GUI of computer programs and databases, or the buttons, and plastic wrapping of a digital radio, the task is confined to adding another layer on top of the functions trying to convey the meaning of the functionality to the user. While packaging is a noble discipline—the Japanese culture have even made packaging into an art form [8]—the entirety of the design risk being lost when dividing the form from the function—the surface from the substance. The relation between the technology and the user is more than the interface.

Although some (cf. [4]) argues that the separation of form and function has proven necessary because of the complexity of computers it is quite possible that the computer is far less complex than we have come to believe and that the mystique surrounding the computer is merely resulting from a misconception of the computer comprising abstractions and representations. What if we instead understood the computer in the light of its physicality, of its design of energy flows? Would we not then be able to engage with it as a material for design, as the substance from which we can build both forms and functions?

The computer as material for design

In a paper [9] from 2007 Redström and I proposed to understand computers as a material. This physical perspective clarifies the computer as a material that has little value in and by itself. Resulting from the matter of energy flows the computations can only come to (a humanly perceivable) expression through a composition with other materials (see [9] for elaboration).

The computational composite in its principal structure is simple. The computer controls events in the other materials through switching on or off the electrical output. The other materials react on these changing electrical charges possible through activating a transformation of one form of energy into another (through a transducer). Thus, the resulting composite can change color, form, opacity, light, strength, etc. Furthermore, the input to the computer can be used to change its behavior dynamically—likewise this needs to be done through some sensitive material composition (i.e., a sensor). Indeed, by keeping a focus on the computer's physical existence and its relations to other materials it ought not cause problems for designers with no specific computer skills to understand how the computer works and what potential they hold, at least no more than that of understanding, for instance, glass-fiber, or plain glass. Some understanding of the materials we work with is always necessary in order to engage with them and use them for design [5]. The type of knowledge, however, is not the same whether you are a designer, or a material scientist—a designer, or a computer scientist. Take textiles as an example: the scientists, or the specialized engineer, research and develop fibers, materials, and production techniques. Textile designers then utilize these when designing new textiles. Fashion or industrial designers in turn use the new textiles to design clothes, furniture, or art. Through this process of textile design and product design the goals and methods are not the same, and therefore the knowledge and the language are not the same either. The fashion designer, however, knows enough about fibers and production methods to be sure that what he creates suits the purpose of the garment—that the function suits the form.

Proposition

What if we began a new strand of computer design, which corresponded to textile design? What if we sat out to design a repository of computational composites ready for designers to use or moderate and use? This would become a layer of design between that of (computer) science and (interaction) design.

In a couple of projects, we are investigating the potential of computational composites. One example is a wooden plank with the ability to bend outwards as the volume of sound in its vicinity rises above a certain threshold (see Figure 1, [10]). The PLANKS, as we call them, are the result of an aesthetic exploration of the computers ability to control changes between states in other materials. The PLANKS are meant as a parafunctional proposal (cf. [2]), as a proposal to spark imagination of other computational composites. Hence, they have no intended practical purpose. To apply them, for instance, as a wall panel would diminish the volume of the room if the sonic activity rose above a certain threshold. Such application would change the experience of the room, and especially the relation between the sound and the space. In another project [11], we explore the computers' material properties through the means of a copper composite in which the computer controls the thermodynamic behavior. In one instance we investigate the computers ability to alter any normal material causality. Through the means of temperature sensors, we let the copper cool down when it is exposed to heat and *vice versa*. In another instance we explore the computers ability to form networks, by letting two samples of the copper composite behave thermodynamically as if they were but one material entity. When one is cooled down both adjust their temperature to achieve a new equilibrium.

Figure 1 PLANKS: a computational composite by Henrik Menné and Anna Vallgårda, 2008

Figure 2 Daniel Weil's Bag Radio, 1983

I argue that approaching the computer as a material would enable the designer to go beyond or beneath the surface—to design the artifact as a whole—to master both function and form. The designer could even turn the process upside down and explore forms as a way to discover new functionality (cf. [4]).

The designer was first liberated from mechanical/ material constrains when the computer entered the scene [1]. The freedom, however, had a backside as the suspension of the relation between form and function left the designers dangling at the surface or buried in the substance and only seldom mastering both. The gap between the technology and the user's interactions seemed only to grow wider as the technology evolved, until every connection between them finally evaporated in pure semantics and abstractions (see Figure 2). Hence, (re)introducing a physical link between substance and surface may actually set the designer free again but on an opposite account. By establishing again a material relation between form and function we would be able to engage with the technology similar to how we engage with less sophisticated materials. We will be able to physically explore both functions and forms and through that possibly discover (and develop) a whole new space of opportunities.

Acknowledgements

The PLANKS were made in collaboration with artist Henrik Menné and the copper samples are made together with Tomas Sokoler.

References

[1] Abrams, R. *Adventures in Tangible Computing: The Work of Interaction Designer, Durell Bishop, In Context.* London, UK: MA thesis, Royal Collage of Art (RCA) (2000)

[2] Dunne, A. *Hertzian Tales - electronic products, aesthetic experience, and critical design* (2nd ed.). London, UK: MIT Press (2005)

[3] Gibson, J. J. The Theory of Affordances. In *The Ecological Approach to Visual Perception*. Boston, MA: Houghton Mifflen (1979) 129-143

[4] Hallnäs, L. & Redström, J. *Interaction Design: Foundations, Experiments.* Borås, Sweden: The Swedish School of Textiles University College of Borås and Interactive Institute (2006)

[5] Manzini, E. *The Material of Invention - Materials and Design.* Cambridge, MA: MIT Press (1989)

[6] Norman, D. A. *Emotional Design - We Love (or Hate) everyday things.* New York, NY: Basic Books (2004)

[7] Rasmussen, J. Skills, Rules, and Knowledge; Signals, Signs, and Symbols, and other Distinctions in Human Performance Models In *System Design for Human Interaction*. Piscataway, NJ, USA: IEEE Press (1987) 291-300

[8] Saito, Y. Japanese Aesthetics of Packaging. *The Journal of Aesthetics and Art Criticism: Aesthetics and Popular Culture*, *57(2)*, (1999), 257-265.

[9] Vallgårda, A. & Redström, J. Computational Composites. *In proc. CHI'07*, San José, CA (2007), 513-522

[10] Vallgårda, A. PLANKS: A Computational Composite. *In proc. NordiCHI*, Lund, Sweden (2008)

[11] Vallgårda, A. & Sokoler, T. A Material Focus – Exploring Properties of Computational Composites" *Adjunct Proc. CHI'09*, Boston, MA (2009)