Material beliefs - designing speculatively with biotechnology for public engagement

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Introduction

Material Beliefs was a two-year interdisciplinary project funded by the Engineering and Physical Science Research Council[1]. It aimed to take 'emerging biomedical and cybernetic technology out of labs and into public spaces'[2]. The project provided access to technologies that will offer new configurations of bodies and materials: How can design stimulate a discussion about the value of these new forms of hybridity?

Rather than focusing on the *outcomes* of bioengineering research, Material Beliefs approached research as an unfinished and ongoing set of practices, happening in laboratories and separate from public spaces. The aim is to make labs permeable, so that non-specialists could consider the research. With this in mind, labs were opened up as sites for collaboration between scientists and engineers, designers, and members of the public.

Alongside the everyday business of the lab, which might include submitting funding proposals, conducting experiments and gathering data, and then writing and publishing academic papers, the collaborations produced a parallel set of proceedings captured through drawings, photographs, films and discussions. This led to the design of speculative prototypes, which transformed the parallel activity into something tangible. These prototypes were exhibited, reconfiguring emerging laboratory research into a platform that encouraged a debate about the relationship between science and society.

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[1] EPSRC grant details of Material Beliefs are online at http://gow.epsrc.ac.uk/ViewGrant.aspx?GrantRef=EP/E035051/1
[2] See http://www.materialbeliefs.com for a full description of the project

This paper opens with some description of the lab as a site for collaboration between design and engineering, then moves onto some examples of outcomes, and finally expands upon some strategies for opening up these activities to the public.

Designing in labs

Material Imaginations was a proposal for funding to the ESRC by Robert Doubleday, Mark Welland, James Wilsdon and Brian Wynne. Their proposal followed on from a project described in a DEMOS report, 'See Through Science'[3]. Here Doubleday set up an ethnographic project in Welland's Nanotechnology lab, the aim being to work with scientists to imagine the social outcomes of their nanotechnology research. Doubleday describes, 'My role is to help imagine what the social dimensions might be, even though the eventual applications of the science aren't yet clear[4]. Material Beliefs echoes the title of this proposal, and considers the role for *design* as a set of speculative tools for working with scientists and engineers.

Design practice is not exclusively about making products out of technology. There is room for interrogation of its methods and aims, and an examination of the social relations that are intrinsically linked to the use of the material outcomes of design. The Interaction Research Studio at Goldsmiths emphasises that designed artefacts are subject to interpretation[5] and discusses the use of ambiguity rather than usability as a resource for design[6]. The Design Interactions course at the Royal College of Art supports pedagogy and research that develops a range of practices described as critical design[7].

These activities represent an extended role for design, and before discussing how this type of design might make links with laboratory research, it is important to mention creative practices that have established relationships with labs. SymbioticA in Perth hosts and trains researchers and practitioners, equipping artists with the skills to develop 'wet biology practices in a biological science department'[8].

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[3] Wilsdon, J. and Willis, R. *See-through science : why public engagement needs to move upstream*. London, Demos, 2004.
[4] Ibid.
[5] Phoebe, S. and Bill, G. "Staying open to interpretation: engaging multiple meanings in design and evaluation." *Proceedings of the 6th conference on Designing Interactive systems*. University Park, PA, USA, ACM. 2006.
[6] William, W. G., B. Jacob, et al. (2003). "Ambiguity as a resource for design." *Proceedings of the SIGCHI conference on Human factors in computing systems*. Ft. Lauderdale, Florida, USA, ACM.
[7] Dunne, A. *Hertzian tales : electronic products, aesthetic experience, and critical design*. Cambridge, Mass. ; London, MIT, 2005.
[8] Quote from SymbioticA site at http://www.symbiotica.uwa.edu.au/welcome/about_us

SymbioticA has developed a range of activities that include residencies, an MA programme and postgraduate research, all emphasising artistic enquiry. Also of note is Critical Art Ensemble, a collective of artists who work in partnership with local venues to provide programmes including workshops and seminars, providing resources for participants to work directly with biotechnology[9]. A third example here is Arts Catalyst, a UK organisation, again offering access for artists to participate in science and technology processes, including biotechnology[10].

Developing these contexts, the Material Beliefs projects had their home in the lab, and lead to speculative designs that were not intended for manufacture. Design processes were employed, and led to the fabrication of prototypes. The prototypes adopted the formal qualities of a product, yet were not products. Designing a product has different demands, including time spent specifying materials (because unit cost is important), exploiting intellectual property opportunities, and talking to distributors. Rather than deploying prototypes as a halfway point leading to product innovation, the projects described here emphasise interplay between the prototypes and statements about social life.

Figure 1. Testing a blood pressure implant at the Institute of Biomedical Engineering

Figure 2. A discussion about prototype designs at Reading University, from a film by Steve Jackman

In order to set up an instrument that allows this to happen, there was an attempt to make speculative design's association with science and technology more embedded.

[9] Critical Art Ensemble are participating in the forthcoming ” Interactivos?'09: Garage Science” in partnership with Milan based Medialab-Prado

[10] Arts Catalyst’s curatorial programme started in 1993, a full list is available at the Arts Catylst website - http://www.artscatalyst.org/projects/archive/archive_events.html

The project takes influence from Doubleday's[11] - and previously Bruno Latour's and Steve Woolgars[12]- encampment in labs. While these sociological associations with labs provide accounts of science in the making, Material Beliefs is characterised by an attempt to have an impact on the lab environment and produce material outcomes. When speculative design and science and technology get located at the site of laboratory research a contingent and overlapping practice develops.

Examples of speculative design

Material Beliefs was scattered across different sites. It was administered at Goldsmiths, University of London, and supported at that site by the Interaction Research Studio and a design workshop. At the Royal College of Art, RapidForm is a rapid prototyping shop and the Design Interactions provides a studio. Key laboratory sites include the Institute of Biomedical Engineering at Imperial College, Cybernetics and Pharmacy at Reading University, and the Institute of Ophthalmology at University Collage London. Project activities are based at the most appropriate site, and in some cases need to be run across multiple sites at the same time.

Neuroscope

Noteworthy here is Neuroscope. Responding to research at the University of Reading[13], Neuroscope provides an interface for a user to interact with a culture of brain cells, which are cared for in a distant laboratory. An interface allows the virtual cells to be ‘touched’, resulting in electrical signals sent to the actual neurons in the laboratory. The cells then respond with changes in activity that may result in the formation of new connections. The user experiences this visually in real time, enabling interaction between the user and cell culture as part of a closed loop of interaction.

At a key stage in the development of Neuroscope, Elio Caccavale was designing the artifact and producing CAD models which were then fabricated using an Object rapid prototyping machine, while David Muth was writing a visual client application to link

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[11] Wilsdon, J. and R. Willis, R. *See-through science : why public engagement needs to move upstream.* London, Demos, 2004.
[12] Latour, B. and Woolgar, S. *Laboratory life : the social construction of scientific facts.* Beverly Hills; London, Sage Publications, 1979.
[13] D. Xydas, D. Norcott, K. Warwick, B. Whalley, S. Nasuto, V. Becerra, M. Hammond, J. Downes, and S. Marshall, "Architecture for Neuronal Cell Control of a Mobile Robot", *Springer Tracts in Advanced Robotics*, vol. 44, 2008: 23-31.

the prototype to server software coded by Julia Downes, which communicated with an array of electrodes that linked to a neural cell culture maintained by Mark Hammond.

Figure 3. Neuroscope prototype

Figure 4. Vital Signs prototypes

Vital Signs

Elsewhere, less defined and smaller scale activities have led to larger projects. *Mind the Loop*[14] was an event at the Institute of Biomedical Engineering (IBE) that had no clear design outcome. The silicon beta cell[15] is biomedical device developed at IBE that behaves like an artificial pancreas. It senses blood sugar levels in the body and applies this data to an algorithm that controls an insulin pump to regulate blood sugar levels. The loop is a biological system, made discrete and rendered in silicon. Arranged around this technology are different actors, including the bioengineer who builds the technology, the patient who might use the silicon beta cell, and the doctor who negotiates and implements use. Mind the Loop was a conversation between these three people, documented and edited into a short film by Steve Jackman, that depicted how the description of a piece of technology is unstable, as it is subject to divergent values and expectations.

While the silicon beta cell is an example of a biometric sensor for a local, body scale control loop, other technologies at IBE link to larger networks. In the case of an

[14] Steve Jackman's film and supporting documentation are online at http://www.materialbeliefs.com/events/loop.php
[15] Georgiou, P. T. C. "A Silicon Pancreatic Beta Cell for Diabetes." *IEEE Transactions on Biomedical Circuits and Systems* **1**(1): (March 2007): 10.

application for monitoring patients with chronic conditions, biometric data is passed over a mobile phone to a remote server at a health care centre[16]. As this research was being discussed at public events, including an evening debate at the Dana Centre[17], there was a discussion about the potential abuse of data provided by biometric monitoring services. Additionally, in the UK there is a discussion about the effects of parents' anxiety about risk upon the rights and liberty of children[18]. Cotton Wool Kids is a documentary commissioned by Cutting Edge, in which the issues of monitoring bodies, and the effects of perceived risk upon childhood, collide. In one sequence an anxious mother seeks advice from an engineer about implantable GPS transponders to track her daughter[19].

Vital Signs aimed to locate these issues in a product that monitors a child's biometrics. The prototypes are a physical display for the output of the digital plaster[20], a platform for remote biometric monitoring. The plaster incorporates miniature sensors into a skin worn patch, and transmits this data about the body across a mobile phone network. This live data feed encodes information about respiration, heartbeat and movement. The prototypes then represent biometric data as movement. Vital Signs demonstrates how absent bodies are transformed into data and broadcast across networks to become expressed as behaviours in products. The aim here is not to be critical of biomedical research, but to ask some questions about how technologies reproduce and materialise social relations.

How design contributes to science and society issues

In the UK there is an ongoing discussion about how to involve the public in science and technology[21]. At a policy level, this is a discussion about democratising access to the research that will have its outcomes in the products and services we use[22]. Public engagement of science previously focused on demonstrating to the public that

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[16] Toumazou, C. and Lee, C. Y. "Ultra-low power UWB for real time biomedical wireless sensing." *Proceedings of the IEEE International Symposium on Circuits and Systems* **1**: (2005): 4.

[17] Documentation from Material Beliefs at the Dana centre is available at http://www.materialbeliefs.com/events/dana.php

[18] Madge, N. and J. Barker "Risk and Childhood." London, RSA, October 2007.

[19] Details of Cotton Wool Kids is available on line at http://www.channel4.com/video/cotton-wool-kids/series-1/

[20] Toumazou, C. and Lee, C. Y. "Ultra-low power UWB for real time biomedical wireless sensing." *Proceedings of the IEEE International Symposium on Circuits and Systems* **1**: (2005): 4.

[21] See government reports and current consultations for Science and Society on The Department for Innovation, Universities and Skills website at http://interactive.dius.gov.uk/scienceandsociety/site/download/

[22] see Public Attitudes to Science 2008 A survey, available at http://www.rcuk.ac.uk/cmsweb/downloads/rcuk/scisoc/pas08.pdf

science produced a range of benefits[23], performing an educative role to address gaps in the public knowledge[24]. Contemporary public engagement is tasked with responding to descriptions of science and the public that are less about cognition, and more about contextual issues, such as the communities through which science and technology are encountered[25]. GM crops are an example of a technology that is understood as much through the agenda of campaigning groups like Greenpeace, as it is through scientific assurances of safety[26]. As a result of these new policy attitudes about what public engagement of science might look like, it is a good time to extend design practices that ask questions about our relationship with technology and science.

Additionally there is some pressure on science and engineering researchers to *do* public engagement[27]. As a researcher, being able to show you have participated in public engagement activity strengthens a funding application. This was something that was appealed to when researchers were initially invited to collaborate. It goes some way to establishing a recognisable context in which to hold the activities that form a collaboration, in a way that makes some sense for everyone.

Responding to these conditions, the Material Beliefs collaborations are open to the public wherever possible. Public events have been curated at The Dana Centre, the V&A, MoMA, the Design Museum in London, The Royal Institution of Great Britain, the National Theatre, LABoral and Selfridges. These events frequently open up a discussion about partial outcomes, and act as a cross between project crits (criticisms) and think-tanks. The public events move between venues associated with arts or science, so that science and engineering is discussed in a design context, and science institutions are opened to design processes, so that both disciplines become challenged by the other's format.

A workshop was held at the Institute of Biomedical Engineering (IBE) for postgraduate design students at the Design Interactions course at the Royal College of Art. The aim of the workshop was to provide students from the RCA with an embedded view upon biomedical technologies, and for researchers based at IBE to

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23 Association of Scientific, W. "Science and the nation." [S.l.], [s.n.]. (1974)
24 A Vision for Science and Society - A consultation on developing a new strategy for the UK, (July 2008), Department for Innovation Universities and Skills
25 Irwin, A. and Michael, M. *Science, social theory and public knowledge.* Buckingham: Open University, 2003. Press.
26 Ibid.
27 Comment from lab director during focus group meeting, 24/11/08, audio transcript available

have a refreshed set of responses to their research.

Figure 5. Design Interaction students isolating DNA at the Institute of Biomedical Engineering

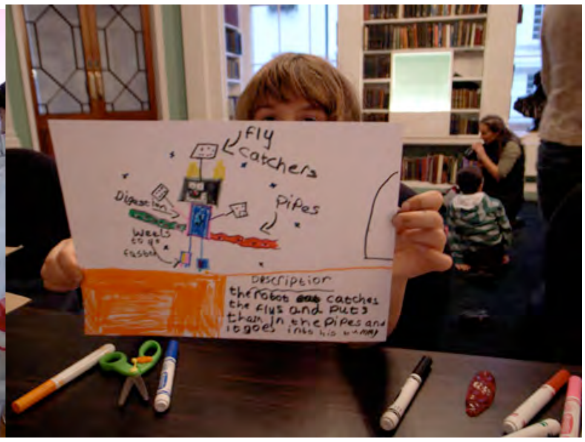

Figure 6. Family day at the Royal Institution of Great Britain

The workshop included an introduction and tour from a director at the institute, with presentations from researchers, and a simple lab experiment, where DNA was isolated from saliva swabs. The lab then became the location where a four-week project brief for the students was set. Researchers from IBE and Reading University took up visiting tutor roles at the RCA, offering tutorial sessions, and providing feedback on the projects. By launching the project at the IBE, the aim was to connect designers' fascination with and trepidation towards biotechnology with a mundane and situated understanding of lab based research, along with an awareness of contemporary science and society agendas, which were presented within the brief.

Conclusion

The projects described here hopefully provide some early descriptions of how designers might become embedded within laboratory spaces, and conversely how engineers might be offered a presence in design studios and exhibition spaces. These mutual incursions are encouraged through loose collaborations that move towards the design of speculative prototypes.

Material Beliefs proposes that by opening up the process of collaboration between bioengineers and designers, non-specialists are able to respond to science in direct ways. Design offers a range of methods for lay members of the public to develop their curiosities with science and technology. Potentially there are opportunities for the public to take an active role within the production of research, or at least to play a role in the discussion of unfinished research, in terms of its social value and ethical implications.

Rather than see science and technology as a set of finished and discreet products and services that have their effects upon us, Latour described how science is complex and unfolding. It is enacted through a relationship between peers and rivals, institutions, markets, funders, politicians and ethics committees[28]. This paper has tried to sketch how is might be possible to situate a creative practice productively somewhere amongst this network.

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[28] Latour, B. *Science in action.* Harvard University Press, 1987.