

The ideology of the future in design fictions

Rodrigo Freese Gonzatto^{a,b}, Frederick
M. C. van Amstel^{a,c}, Luiz Ernesto Merkle^b
and Timo Hartmann^c

^aFaber-Ludens Institute of Interaction Design, Brazil; ^bParaná Federal University of Technology, at Curitiba, Brazil; ^cUniversity of Twente, Netherlands

rodrigo.gonzatto@faberludens.com.br; f.vanamstel@utwente.nl; merkle@utfpr.edu.br;
t.hartmann@utwente.nl

Abstract

The production of fictions within the design field are not disinterested speculations about distant futures, but intentional political actions in the present time. Fictions can entertain as much as cause social friction. This article discusses three sources of design fictions: a global information technology company; an art school in the UK; and a design institute in Brazil. By contrasting the three cases in light of the philosophical work of Álvaro Vieira Pinto, this article deconstructs the ideology of the future—futurology—and proposes acting in the present—handiness—to sketch an ideology of liberation. Instead of supporting the status quo, such ideology could inspire collective action for change. The practices from the three aforementioned sources are discussed to lay the foundations for such ideology of liberation in design fictions.

Keywords: design fiction, critical design, scenarios, ideology, futurology, design livre

1 Introduction

Sticking to reminiscences of the past and predictions about the future, every futurology assumes the shape of a social ideology. (Vieira Pinto 2005, 90)

Design fictions articulate desires for new futures of the everyday life, but their fictional status bring forth desires that bear no accountability in the present. The technology of the future is shown as the product of current desires, as if it would be unlikely to change the desires in the future. In this article, the boundaries between fiction and reality are discussed to reintroduce them as material production with political implications. The future in design fictions, then, could be approached as an open-ended possibility of the present, an ideology of liberation.

This insight is taken from Álvaro Vieira Pinto (1909–1987), a Brazilian philosopher who, between the years 1960 and 1970, developed a criticism of cybernetics that anticipated many issues discussed in recent studies of science, technology and society (STS), human–computer interaction (HCI) and interaction design. Vieira Pinto's work on the concept of technology remained unpublished until 2005, due to the political uneasiness created by the Brazilian dictatorship at the time of his writing. We suggest that Vieira Pinto's criticism on cybernetics retains its currency today and

can potentially help design fictions overcome technological and societal determinism, the main hurdle for an ideology of liberation. ~~We discuss fictions from three sources: a global information technology company; an art school in the UK; and a design institute in Brazil.~~

2 Design fictions

The term ‘design fictions’ is currently being used to discuss a specific format of everyday scenarios about the future, where technology plays a crucial role. The approaches are diverse. For instance, Lukic and Katz (2010) described them as a philosophy of things; Grand and Wiedmer (2010) consider them a research prospect; Milton (2003) proposes it as a methodology; and Bleecker (2009) treats design fictions as a design technique.

Large corporations have used design fiction for advertisement and marketing initiatives, promising future technological solutions for current problems. Microsoft, for instance, reveals its interest in the format on their website: ‘One of the best ways to get people thinking about the future is to show them what it could look like . . . to spark discussion about future scenarios by trying to portray the evolution of key trends’ (Microsoft Office Labs 2012). From a different standpoint, Anthony Dunne (2005), Head of the Design Interactions programme at the Royal College of Art (RCA), United Kingdom, refers to fiction as ‘what if . . .’ scenarios that stimulates questions, a desire for change. The Design Interactions programme develops critical and ‘estranged’ futures to stimulate discussions, under an approach called critical design, with the intent to develop a ‘parallel design activity that questions and challenges industrial agendas’ (Dunne and Raby 2001, 58). The Faber-Ludens Institute, Brazil, approaches design fictions as an opportunity for increasing the cultural density of design work, in as much as it explores hypertextuality, synchronicity, ambiguity, and contradictions.

Despite dealing with the future, what are the origins and consequences of design fictions in the present? In order to explore this question, we turn to Álvaro Vieira Pinto’s perspective.

3 Fiction as real and concrete

Vieira Pinto (1960) departs from the assumption ~~that departs from the assumption~~ that every human production is necessarily concrete. Action and thought are processes that set and interfere with the world. It is not possible to disconnect the imagination from the situation in which it arises, or from the moment when it is shared in communication. Human beings are embedded in reality, transforming it and being transformed by it. According to Vieira Pinto, reality is made available by handling it, a phenomenological concept also explored by Martin Heidegger (1962) as *readiness-to-hand*, but with a historical, situated dimension. Vieira Pinto qualified this characteristics of reality as *amanualidade* (handiness): reality presents itself to man as a space of possible actions, with objects arranged around as something that ‘is at hand’ due to the socio-historical construction of reality. Reality is a process; it is always, by nature, in transition and change. The technical deed—labour—reveals reality while modifying it.

We take this extended materialistic and dialectical dimension of handiness, understood as a situated historical process, to scaffold our approach to design fictions. Some interpretations of design fictions already explored this dimension. Anthony Dunne, in his critical design perspective for design fiction, assumes that:

the challenge is to blur the boundaries between the real and the fictional, so that the visionary becomes more real and the real is seen just as one limited possibility, a product of ideology maintained through the uncritical design of a surfeit of consumer goods. (Dunne 2005, 84).

Nevertheless, Dunne’s position towards ideology differs from Vieira Pinto. While in Dunne ideology is the legitimation of alienation from the means of production, as in the tradition of critical Frankfurt School, in Vieira Pinto it can also be a collective effort towards autonomy and self-consciousness. An ideology of liberation is the projection of human existence to construct the means of production to modify the present reality. But first, to

envision this possibility, it is necessary to dismantle the technological determinism of the future.

4 Futurology

Vieira Pinto lived in an optimistic period of accelerated development and industrialisation—the Brazil of the 1970s—and believed in an ideology of liberation. He saw his role, as a philosopher, to interpret his country and create an ideology of national liberation to support social development. The government relied on a technocratic discourse that equalised social development with technological development, and he considered this a major flaw for an ideology of development. He criticised cybernetics—a major reference used by the technological development discourse of that time—for skipping and hiding social contradictions under naïve ideas such as machine intelligence, self-organisation, the end of work—and others. These ideas were spread:

to make the man live in an imaginative upcoming happy life, as if he could find right now what he will become in the future. Actually, they intend that the man, an actual worker, do not get disturbed with current injustices, inasmuch as he is convinced that the defects in the present world are the result of technological imperfections not yet corrected by intelligent action. (Vieira Pinto 2005, vol. 2, 689)

Despite trying to go beyond it, Cybernetics was tied to a formal perspective over human existence, where history lies in the past as a given, reality is restricted to the experiences of the present, and future is left to fictional speculations (Figure 1). When past determines the present, changes in the status quo can only happen in the future, as a hope, but never as a fact.



Figure 1. The past determining the future to maintain the status quo.

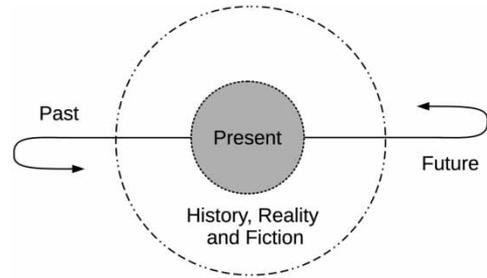


Figure 2. History as the possibility of redefining past and future.

Vieira Pinto had already, in his proposed concept of technology, deeply criticised the limitations of cybernetics formalist approach (Vieira Pinto 2005). He understood both past and future as shaped by the present, a present open and creative due to constant change (Figure 2). Each moment offers men and women the opportunity to design the future that they imagine and the past that they believe has happened. Everyone projects herself into the unknown future, and not only in the context of proposing long term scenarios, but also in simple actions such as hammering a nail. A sense of purpose is necessary and always present, though not necessarily acknowledged. The cybernetic endeavour needs to be rooted into the concrete reality to close the loop.

Vieira Pinto named *futurology* the visions that do not close the loop, visions that imagine the future without considering changes in social structures. Futurology relies on scientific findings to legitimate its predictions, but explicitly leaves out the questions posed by the scientific community. It is in fact ‘the inclusion of a future dimension in examining a contemporary problem’ (Vieira Pinto 2005, vol. 2, 86).

5 From futurology to critical design

Several global corporations, such as General Electric, Sun, Nokia and Microsoft, make use of future technological scenarios that could be considered futurology. Using design fictions, they reinforce brand identity with innovation and leadership, assuring consumers that their futures are in good hands. Although not restricted to it,

video is the most successful format of futurology in terms of audience, currently attracting millions of viewers on video-sharing websites such as [YouTube](#). These videos make use of montages and visual effects to give realistic renderings of equipment and interfaces, suggesting viable uses of augmented reality, immersive environments, tangible interfaces and nanotechnology. Consumer news media representatives and corporation shareholders are constantly questioning the capacity of corporations to fulfil upcoming needs and desires, especially regarding digital technology products. Corporate design fictions are meant to nurture consumers into consumption habits and convince investors of their capacity to fulfil those same ‘demands’.

An example of this kind is the Microsoft Office Labs future vision for the year 2019 (Figure 3). Their first video with the theme of productivity features people manipulating a whole range of

complex devices with simple smooth gestures, as if all their complexity had been tamed to their fingertips. Apart from appealing interfaces, the situations in which these devices are shown astonishingly maintain current social paradigms—classroom education, work in offices, and palliative sustainability efforts—as if none of these paradigms would change until 2019. The social contradictions that could stimulate change are quickly anticipated and solved by technology, like in the scene where an English-speaking girl tells an Indian boy that she has a cat throughout a teleconference system and the system warns her that in India cats are considered bad luck.

Such design fictions typically avoid the negative facets of their proposals with seductive imagery, borrowing from science fiction language. The aestheticisation of technology works to naturalise them, resembling a known genre and



Figure 3. Stills from the ‘Microsoft 2019’ movie.
Source: Microsoft Office Labs.

lowering cultural barriers to its adoption. Vieira Pinto characterises futurology with the use of a pseudo-scientific discourse and the tendency to pose fictions as mere speculation. They are effectively proposing the end of history, where technology advances make human contradictions obsolete.

Design fictions, thus, are not just an uncommitted exercise of creativity; they come from the interest of someone who acts on the present social order. Design fiction, whence futurology, presents itself as a solution to the problems of the past and present, as if it had never been possible to deal with them, and not even now. But there is an alternative perspective on design fictions that questions rather than maintains the status quo, problematising the future and raising more doubts than certainties: critical design (Dunne 2005). Mónica Mallol (2012) uses the word ‘friction’ to discuss critical design intentions and effects: polemicalising delicate social issues in a sort of activism through design. Frictions ‘deconstruct the dominant, hegemonic landscape of things and attitudes’ (Mallol 2012, 1). We take as an example the Placebo project from Dunne and Raby (2001) in the UK. This project encompasses a set of electromagnetic-aware products like the Electricity Drain, a stool covered with a rounded metal surface that pretends to electronically ‘ground’ or ‘earth’ the body (Figure 4).

The project was motivated by the designers’ intention to stimulate a debate around the electro-



Figure 4. Portrait of the Electricity Drain (centre), an artefact of the Placebo project.

magnetic field and the curiosity as to how strange products would be appropriated by users. The designers wondered if people would use the stool to ‘clean’ their bodies of static electricity, like a shower. Instead of the expected personal hygienic use, it was used in the living room, where it got some sceptical comments from home visitors. In that context, it triggered a sense of displacement, effectively tracked by the designers through follow-up interviews. Despite not being used in the way designers intended, both users and designers were happy with the product, since it posed a reflection about the topic of their concern: the electromagnetic field.

6 Handling critical design in a different place

Critical design, by addressing cultural issues in interaction design, served as a major reference to Faber-Ludens Institute for Interaction Design, Brazil. Since 2007, Faber-Ludens has offered an interaction design programme that focuses on the social dimensions of interaction design, as a tactic to compensate for the technological disadvantage of Brazilian industry. In one of the classes of the programme, the Placebo Project was introduced. At first, students could not understand the critical dimension intended by the placebos. For them, it seemed like a kind of joke or irony. They could not really grasp the critique behind it. Dunne (2005) acknowledges this phenomenon: if an artefact is too strange to be understood, it can be dismissed rather than serving to estrange reality. In Faber-Ludens case, strangeness arose from cultural differences between the two places. One student observed that the Placebo Project’s artefactual strangeness and concern over electromagnetic fields was a European ‘thing’, and not a Brazilian issue. Brazil is still developing its own infrastructure, while the UK has ‘too much’ of it. Brazilians seem to worry more about rising energy bills than with possibly harmful effects of electromagnetic radiation.

One issue that is relevant to Brazil is religion. Brazil is currently experiencing an economic boom, seemingly followed by the spread of a ‘pro-

testant' work ethic as well as its churches. As it is consistent with the protestant morality (Sansi-Roca 2007), profit and development is encouraged. Because there is no central protestant authority in the country, new churches appear every week, each with their own evangelion. To discuss the role of design in this economic boom, Faber-Ludens proposed The Church of the Divine Design (Figure 5), a design fiction that encouraged everyone to become a designer. The project was developed on a public website using wiki documents and a discussion forum that any visitor could access to join the debate. It was announced in an interaction design mail list, where it got angry and playful responses, like: 'What is this? Another dogma? We should focus our attention on real topics and not blasphemy', or 'We've got projects, but the design comes from God.' In the end, 10 volunteers—mostly Faber-Ludens students—contributed to the project.

Under a humoristic rubric, the project discussed the role of the designer in society, the design discourse and the cult of design. Some outcomes of the project: a selection of sacred design works (Wassily Chair, iPod, Lego bricks, and others); a list of 18 commandments (e.g. 'Less is more'); a hall of saints (Walter Gropius, Oscar Niemeyer, Hans Donner and others); a rank of the biggest problems of humanity ('ugliness' ranked first); and a design process for liturgical

work. The project clearly challenged the uprising protestant work ethic and corporativism in the Brazilian design practice through the same play ethic that they deny. Fortunately, this play ethic, well described by Pat Kane (2003), is still dominant in Brazilian design studios. The Church of the Divine Design was an important relief between the many techno- and methodological-oriented projects done by Faber-Ludens.

Excited with the discussions sparked by the Church project, Faber-Ludens proposed another design fiction project to the public, but this time it didn't succeed in gathering participation. The Consumption Agency (Figure 6) is a mixture of an advertising agency and a credit card company. Currently, there is a gap between these two companies, although they intervene in the same flow of goods. The proposal is to join them together to create consumption desires and the means to fulfil them in a single business operation. The agency would offer expensive products such as sports cars, mobile phones and branded clothes as rental services, but the consumer has to choose wisely what to use with what, since he is rated by other affiliated members. If the combination does not fit the social situation, the consumer can get negative ratings and lose consumption opportunities. The agency effectively transforms style within economic indicators (Figure 6).



Figure 5. Playful illustration of the altar of The Church of the Divine Design, featuring a Wassily Chair, iPod, Ball Chair and Lego blocks.



Figure 6. Consumption dashboard offered by the Consumption Agency. A parody of Google Analytics, a web navigation statistics software.

Source: Google Inc.

The project’s website included wikis for the business plan and the ‘Peopleing Manifest’, a document that stated the company’s vision to work with people and not with markets. The business plan describes how the company aimed to invert the flow of goods—starting from consumption instead of production—by transforming products into services and services into products. The Consumption Agency is, in fact, a consumption club, an extrapolated version of the group buying websites that proliferate in Brazil at the time the project went public. The project didn’t attract comment from website visitors (1,407 hits at the time of this writing), and thus was not taken further by Faber-Ludens, but it is possible that some of its ideas have at least been taken up elsewhere in cannibalistic practices. Such cannibalistic

practice is difficult to track due to the conventional morality that denigrates plagiarism, but it is argued to be the goal of Faber-Ludens’s open projects:

Although projects were published under a Creative Commons License, some ideas were copied without giving any credit. Instead of trying to regulate that cannibal practice, Faber-Ludens stimulated even more its students to publish their projects, document the design process step-by-step, and build on top of ideas from other students. Faber-Ludens had the hard task of pioneering Interaction Design in Brazil, so its founders believed that spreading the practice was more important than being credited. (Van Amstel, Vassão, and Ferraz 2012, 449).

Since Oswald de Andrade's *Cannibal Manifesto* (1928), cannibalism has been used as a metaphor for handling the cultural influence of more developed countries in Brazilian culture. The metaphor says that Brazilians should eat the imported concepts and digest them, returning a more appropriate version to the local condition. Like the indigenous people that ate captured enemies in honour of their strength, and in hope they will become part of the tribe, modern Brazilians should, similarly, dare to blend the global and the local, the mass production and the crafts, the erudite and the popular culture, and so on.

The attempt to localise critical design in a different place cannibalised it into a different approach, what is being called 'Design Livre' (Instituto Faber-Ludens 2012). Design Livre tries to build an ideology of design freedom, where everybody can act as designers of their own conditions of living. Projects developed under this approach release their source code, open the design process for indiscriminated participation, and focus on local issues.

7 Discussion

Faber-Ludens's fictions differ in some senses from the British counterparts mentioned above. While the work of the RCA makes use of the academy as a privileged locus to perform provocative design proposals without the risk of being '(Un)Popular' (Dunne and Raby 2001, 59), Faber-Ludens explicitly seeks popularity, developing themes of popular interest and offering mechanisms for visibility and participation. Corporate fictions like those created by the Microsoft Office Labs take the popular for granted—as a source of already known desires—and Faber-Ludens questions this: why is this popular or not popular? Sometimes it fails miserably in posing irrelevant questions.

The future is depicted as the continuity of the present by Microsoft Office Labs, with the exception of the technology they develop, capable of making the utopia of peaceful social relationships works. The RCA seems sceptical about such utopias, so it put technology in conflictual scen-

arios, dystopias about the possible effects of using technology. They try not to embed any judgement of whether these effects are positive or negative, but their scenarios cry for an opinion from the viewer. Technology is still considered as a driving factor of change, obligating people to adapt their behaviour or question it. An underlying message among many of their design fictions is that the issue highlighted can't be just ignored. Faber-Ludens, inspired by Gilberto Gil's notion of *usopy*—the future that is already in use (Savazoni and Cohn 2009)—tries to develop design fictions that are constructed at the same time they are used, relying on participation to keep the future open-ended. The project is collective and open, but comes to an end when the participants lose interest on it.

In all three cases, the resulting fiction manifested the handiness of each actor trying to interfere within a particular reality. Each fiction was constructed from the resources each actor had available and transformed according to its own approach (the concept) towards technology: Microsoft Office Labs put technology as a requirement for new actions; the RCA find the controversies around new technologies; while Faber-Ludens strives for new appropriation of current technologies. The handiness property, thus, helps us to understand how the concept of technology is embedded in action, in this case, the action of posing design fictions to the public.

The concept design fiction itself has both *naïve* and critical interpretations. As a fictional genre, each design deed recognised as design fiction embodies a multiplicity of values and interests. Each moment in the design or use of design fictions, for each participant, is a blended whole. When the voices heralded tend towards orthodoxy, representing only a class of persons, calling for deterministic solutions, skipping disempowered stakeholders, we can consider them naïve. Otherwise, when heterodoxy is present, respect for participants, and open discussions, we can consider fictions as critical. In Bakhtinian terms, these poles could be compared to monologised heteroglossia and dialogised heteroglossia (Bakhtin 1981). In the cases analysed, there is a

mixture of represented interests at different degrees.

8 Conclusions

We expect to have shown, with the aid of the concepts of handiness and ideology, that what is designed-for-the-hand is ideological, but this can be alienating or liberating, depending on the collective intentions that make it relevant for society. Vieira Pinto does not exclude the possibility of a legitimate futurology, but specifies that it needs to acknowledge the uncertain unfolding of history. Also, it should include—or explicitly exclude—the things that are predicted to disappear in the current state, leaving space for new ones. Technology should not be the protagonist but the resource from which the reflection departs: the practical relationship of the man with his surrounding contradictions, in a word, handiness.

When design fiction is problematised and taken in a cultural perspective, it is possible to observe an interplay between domination and resistance. Such an interplay stretches fictions beyond their material conditions, touching the borders of imagination and actual life. It is paramount for a non-deterministic ideology to recognise the friction between present and future, or between fact and fiction. If the future depends on people, there is no need to wait for it; people can start making it real right now.

As Álvaro Vieira Pinto reminds us, people are not interested in knowing with which machines they will live by, but with which persons and relationships they will live by. The hope is not for a future with better machines, but for a better society. To this end, prospects for the future should also include social transformation. The future, therefore, corresponds to the capability of society to recreate itself today, not tomorrow.

References

- Bakhtin, M. M. 1981. "Discourse in the novel." In *The Dialogic Imagination*, edited by M. Holquist and V. Liapunov. Austin, TX: University of Texas Press.
- Bleecker, J. 2009. "Design Fiction: A Short Essay on Design, Science, Fact and Fiction". <http://nearfuturelaboratory.com/2009/03/17/design-fiction-a-short-essay-on-design-science-fact-and-fiction/> (accessed 2 May 2012).
- de Andrade, O. 1928. "Manifesto Antropofágico." *Revista de Antropofagia* 1: 3–7.
- Dunne, A. 2005. *Hertzian Tales: Electronic Products, Aesthetic Experience, and Critical Design*. London: MIT Press.
- Dunne, A., and F. Raby. 2001. *Design Noir: The Secret Life of Electronic Objects*. Basel, Boston, Berlin: Birkhäuser.
- Grand, S., and M. Wiedmer. 2010. "Design Fiction: A Method Toolbox for Design Research in a Complex World." In *Proceedings of the Design Research Society Conference*, Montreal. Available at <http://www.designresearchsociety.org/docs-procs/DRS2010/PDF/047.pdf> (accessed 11 March 2013).
- Heidegger, M. 1962. *Being and Time*. Oxford: Basil Blackwell.
- Instituto Faber-Ludens. 2012. *Design Livre*. São Paulo: Clube dos Autores. Available at <http://designlivre.faberludens.com.br/>.
- Kane, P. 2003. *The Play Ethic: A Manifesto for a Different Way of Living*. London: Macmillan.
- Lukic, B., and B. Katz. 2010. *Nonobject*. Cambridge, MA: MIT Press.
- Mallol, G.M. 2012. "(F)rictions. Design as Cultural Form of Dissent." Design History Society Annual Conference, Barcelona, 7–10 September 2011. <http://www.historiadeldisseny.org/congres/pdf/38%20Gaspar%20Mallol,%20Monica%20FRICIONS%20DESIGN%20AS%20CULTURAL%20FORM%20OF%20DISSENT.pdf>.
- Microsoft Office Labs. 2012. Website. Available at <http://www.microsoft.com/office/labs/index.html> (accessed 9 May 2012).
- Milton, A. 2003. "Filmic Design – A Hitchcockian Design Narrative". Proceedings of the 5th European Academy of Design, Barcelona. Available at <http://www.ub.es/5ead/PDF/8/Milton.pdf> (accessed 2 May 2012).
- Sansi-Roca, R. 2007. "Dinheiro Vivo: Money and Religion in Brazil." *Critique of Anthropology* 27 (3): 319–339. Available at <http://coa.sagepub.com/content/27/3/319.short>.
- Savazoni, I. R., and S. Cohn, eds. 2009. *Cultura digital.br*. Rio de Janeiro: Beco do Azougue.

van Amstel, F. M. C., C. A. Vassão, and G. B. Ferraz. 2012. "Design Livre: Cannibalistic Interaction Design." In *Innovation in Design Education: Proceedings of the Third International Forum of Design as a Process*. Turin, Italy: Allemandi. Available at http://www.allemandi.com/university/Innovation_in_Design_Education.pdf (accessed 11 Mar 2013).

Vieira Pinto Á. 1960. *Consciência e realidade nacional*. Vol. 2, Rio de Janeiro: ISEB.

Vieira Pinto Á. 2005. *O Conceito de Tecnologia*. Vol. 2, Rio de Janeiro: Contraponto.

Rodrigo Freese Gonzatto is a masters student at the Technology and Society Programme at the Paraná Federal University of Technology (UTFPR), Brazil. He is a guest lecturer at Pontifical Catholic University of Paraná (PUCPR) and Faber-Ludens Institute for Interaction Design. He holds an interaction design degree from Faber-Ludens and a Bachelor of Media Studies from South Brazil Faculties (FASUL).

Frederick M. C. van Amstel is a PhD candidate from the University of Twente, The Netherlands. His research at the Centre for Visualisation and Simulation in Construction (VISICO) focuses on envisioning the future use of healthcare facilities. He has a masters degree in technology and society

from Paraná Federal University of Technology (UTFPR) and a Bachelor of Media Studies from Paraná Federal University (UFPR). He is co-founder of Faber-Ludens Institute for Interaction Design.

Luiz Ernesto Merkle works at the Paraná Federal University of Technology, Curitiba, Paraná, Brazil, at the Department of Informatics and the graduate programme on technology and society. His interests encompass the social studies of technology, the foundations of interaction design, computing curricula and free and open technology. He holds a PhD in computer science from the Western University, Ontario, Canada.

Timo Hartmann is Associate Professor at the University of Twente, Construction Management and Engineering Department, where he leads the Centre for Visualisation and Simulation in Construction (VISICO). His research focuses on the social challenges of integrating visualisation and simulation technologies in construction management processes. He holds a PhD in civil engineering from Stanford University, United States, and a masters in computational mechanics from Technical University Munich.