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## Editorial: Philosophical Tools in Design Research: from empirical turn to practical turn

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Collaboration between Design Research and Philosophy of Technology seems very promising. The reflective, philosophical perspective brings the societal implications of design to the fore and this is an interesting focus for reinforcing research approaches for design. Since the philosophy of technology in the current of the 'empirical turn' aims to study concrete technologies and contexts, contributions from philosophy to design have become all the more feasible. Design Research can use the frameworks of philosophers to theorize the findings from practice, to make sense of the past, and for ethical reflection on the impacts of design and the moral responsibilities of designers. Or, still more practical, philosophical insights in the relationships between humans and technology can contribute to design for usability and design for behaviour change. On the other hand, the practice of designing actual things provides a laboratory for putting philosophical frameworks to the test and to use in the real world.

Following the 'empirical turn' before, the present search for collaboration with design can be termed a 'practical turn' in the philosophy of technology (as will be further elaborated in the first paper, by Eggink and Dorrestijn). Under this notion of a practical turn in the philosophy of technology this track brings together papers which are in one way or another about 'philosophical tools in design research'. All research projects apply insights from philosophy of technology to real world problems and design solutions; or the other way around, they use insights from philosophy of technology to reflect on designs that were actually made.

We will now give an overview of the papers in which we mention the tools and philosophical backgrounds used in each paper. So diverse as the philosophical tools are, so are the design contexts: from service design to infant healthcare, and from the physical to the digital, the emotional and the political. The order of the papers is from the more practical to the more reflective papers, with a more general perspective in the first and the last paper.

The first paper *Philosophy of Technology x Design: The Practical Turn* (Wouter Eggink & Steven Dorrestijn) – apart from elaborating on the theme of the track – reports on applying the approach of technical mediation (Peter-Paul Verbeek, Don Ihde, Bruno Latour) to design projects by way of the Product Impact Tool.



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In *Service Fictions through Actant Switching* Sarah Marie Foley and Dan Lockton present and show the combined use of two tools called Actant Switching and Service Fictions. Foley and Lockton refer to the work by philosopher and anthropologist Bruno Latour on what is known as Actor-Network Theory.

Next follows *The Use of Philosophy of Technology in Design: A Research-Through-Design Case of Treatment Compliance* (about the treatment of infants with clubfoot) by Jonne van Belle, Bob Giesberts and Wouter Eggink. Their main reference in the philosophy of technology is Mediation Theory (Verbeek) and the Product Impact Tool (Dorrestijn).

*Turning Philosophy with a Speculative Lathe: Object Oriented Ontology, Carpentry, and Design Fiction* by Joseph Lindley, Paul Coulton and Haider Akmal introduces another philosophical strain: Object Oriented Ontology (Graham Harman, Ian Bogost). Their application domain is the Internet of Things.

Then, *Aestheticising Change: Simulations of Progress* by Chad Story and Jocelyn Bailey extends our endeavour to the political domain. With reference to concepts by the philosopher Jacques Rancière they explore how design practice becomes part of the way public sector actors negotiate, envision and catalyse change in relation to public ‘problems’.

Also more reflective in nature is *Using the Product Impact Tool for Prospective Thinking* (Thomas Raub, Steven Dorrestijn & Wouter Eggink), which explores the wider application of philosophical tools in prospective studies. The paper shows some of the potential of this direction by a case study on the future of automated driving.

Second-to-last paper *Using Heterotopias to Characterise Interactions in Physical/Digital Spaces* by Haider Ali Akmal and Paul Coulton addresses the complexity of designing interactions in hybrid digital/physical spaces, using the notion of heterotopia as a philosophical lens ‘borrowed’ from Michel Foucault.

The last paper *DRS Conferences: barometer and mirror of theoretical reflection of design discipline* by Alejandra Poblete provides an overview of theoretical concepts in design research by looking at the DRS conferences over the years. One of the aims that this track wanted to bring to the fore with the collaboration of the two disciplines was not only making philosophy of technology more practical, but also making design research more reflective. Therefore, this contribution nicely suits as a conclusion to the track, not by elaborating yet another philosophical design tool, but by showing the presence of “reflection in design” in a context of design research history.

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# Philosophy of Technology x Design: the practical turn

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In this paper we explore how the collaboration between Design Research and Philosophy of technology can be profitable for both disciplines. From three case studies where Philosophy of Technology theories and methods were applied in a design context we show how these projects profited from a more reflexive perspective. Then we analyse the three cases again to show how these design projects also lead to a better understanding from a Philosophy of Technology perspective. In putting the in principle rather abstract theories in design practice, the consequences become clearer and designing actual things thus provides a laboratory to test philosophical frameworks in real life. One can say that the Philosophy of Technology, besides thinking and talking, proceeds to action. Not only Philosophy of Technology with the head, but also Philosophy of Technology with the hands. Therefore, in analogy with the empirical turn in Philosophy of Technology before, we present this collaboration with design as the 'Practical Turn in Philosophy of Technology'.

*ethics of technology; practical turn; design for behaviour change; mediation theory*

## 1 Introduction

Research in the Philosophy of Technology has led to a variety of theories and reflections about the impacts of technology and innovations on our culture and our daily lives. Bringing such philosophical and critical insights about the impact of technology to the practice of design of technology, where the purpose is to actually change things, holds the promise of developing critical and responsible approaches to the design of our future world and way of living.

This implies that philosophy of technology besides thinking and discussing concepts starts to engage more closely with practical probing. Design thinking in a most literal sense: philosophical thinking about life by way of design, by making and testing products and possible ways of doing. In philosophy of technology there has been an empirical turn, towards the study of concrete technologies in society. Our proposal is to further develop this into a practical turn, with a change from 'study and description' to 'interventions by design', with the redesign of technologies and correlated ways of doing.



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We start this paper with an overview of stadia in the philosophy of technology up to the empirical and practical turn. Next, we present three different design cases where philosophy of technology tools and theories were explicitly applied. From these three cases we will argue how the philosophy of technology perspective can improve design results. After that we will show how these design projects also led to results for philosophy of technology. We conclude with discussions and a positioning of our proposal for a practical turn in the philosophy of technology.

## **2 Philosophy of Technology Turn by Turn**

Technology is becoming an ever more important topic of philosophical reflection. This is however a relatively recent development. There are good reasons to define the human being by the use of tools, from stone tools and the control of fire in the prehistoric beginnings of human history up to today's smart phones and genetically modified crops. Still, the conscious reflection on the technical conditions of our lives long remained a marginal topic in philosophy. During the past centuries a divide has existed between the human sciences and the exact sciences, what C.P. Snow has called the "two cultures". Technology and engineering knowledge belonged to the exact sciences and philosophical contemplation had not so much to contribute there. It is of course basic knowledge in the human sciences that the Scientific and Industrial Revolutions have shaped modern Western culture. Still technology did not receive much attention, because it was only the applied form of science making progress tangible.

### **2.1 Early, classical, and empirical philosophy of technology**

Early philosophy of technology views technology mostly in this utopian spirit of progress that leads human life from a precarious state towards completeness. In this framing technology could easily escape from attention because it appeared itself unproblematic and therefore neutral. The idea of technology as neutral instruments is still widespread in common thought, but philosophical reflection has always explored the deeper significance of technology for society. Ernst Kapp (1877) was the first to use the phrase "philosophy of technology" in the title of a book in which a theory was elaborated of how technologies are projections of capacities of their human inventors. In his view the hammer was a projection of the fist and the saw a projection of the teeth. The telegraph system could be seen as a projection of the neural network. Technology also figured in the theory of a spiritual super-structure which is determined by the material-economic base of a society by Marx and Engels. Their concern was however that most people do not profit from the advancements in production. Technology appears in early philosophy of technology as the means for the completion of human life, while the challenge remained to make everybody share in the advancements.

With the spread of technology during the twentieth century also the dangerous impacts of technology on humans, society and the environment became more manifest. This became a major topic in the work of prominent philosophers, such as Martin Heidegger, Herbert Marcuse, Jacques Ellul, and Lewis Mumford. In this period of "classical philosophy of technology" the tone reversed from utopian to dystopian. What if social inequality was a problem inherent to technology itself? In the twentieth century the Marxist struggle was no longer between classes of people, but between humanity on the one side and all the technology accumulated into a system gone out of control on the other side. The most emblematic event was the explosion of the two nuclear bombs in Japan. An awareness suddenly struck that a humanly construed thing was so dangerous and powerful that it could even annihilate humanity. Classical philosophy of technology analysed the threat of technology dominating humanity and called for limits to the rush of technology.

From the 1970s onwards new approaches were developed with more detailed, differentiated and ambivalent views on technology. This new wave is characterized by a reevaluation of the concrete adventures of humans and technology as opposed to the abstract and generalising claims of the classicists. This concreteness was then reflected in the term "empirical turn" (Achterhuis, 2001; Verbeek, 2005). To break out of the framework of technology as a massive and dangerous system philosophers of technology began to incorporate more case studies and collaboration with

historians, sociologists, and anthropologists (in the new field of Science and Technology Studies). Don Ihde (1990, 1993) analysed the variety of relations between humans, technology and world. Bruno Latour (1992) began to describe how technical products give a twist to our way of living, under the general assumption that humans and technology cannot be separated but co-shape each other. Donna Haraway (1991) thought that our merger with technology has long made us cyborgs and that this puts us in need of new ideas about the human being, concerning gender for example. Contemporary philosophy of technology now acknowledges the fusion and interdependency of technology and human life, and concedes that any technology will always have both good and negative consequences.

An advantage of the empirical style of philosophical analysis is the focus on concrete products in everyday life, which appeared refreshing compared to the generalizing and abstract analysis of before. The debunking of abstract and essentialist ideas about technology, meant a kind of liberation from the dystopian fatalistic sentiment in classical philosophy of technology. It also opened the way for Technology Assessment approaches for the government of technology in society.

A disadvantage was that the ethical seriousness of before was largely lost, regretted for example by Langdon Winner (1993). The approaches of empirical description taken by Latour, Ihde, or Haraway were explicitly directed against generalising philosophical and normative claims. However, other proponents of the empirical turn aimed to renew rather than to oppose the classical studies. Albert Borgmann (1984) built upon Heidegger's work, but with more concrete suggestions for meaningful engagement with modern technology. And the critical theory of technology by Andrew Feenberg (2002) explored the possibility of alternative technology and structural change of society, better tuned to social values.

## **2.2 Beyond the empirical turn**

Currently we see a variety of initiatives to explore and develop again the deeper critical and ethical potential of philosophy of technology after the empirical turn. Robert Scharff (2012) questioned if empirical philosophy of technology does not suffer from "too much concreteness" and promotes a reappraisal of the work of Comte and Heidegger (early and classical philosophy of technology). Others plea for a stronger political dimension with a reevaluation of resistance and societal change (e.g. Rao et al., 2015). There has been an increase in engineering ethics studies, and recently an appeal for an axiological turn (Kroes & Meijers, 2016). Even Latour who so strongly promoted the empirical orientation has recently been expanding his approach by a profound philosophical framework with a prominent place for the notion of values (Latour, 2013). All in all there is a reconsideration of more critical stances: an "ethical turn" (Brey, 2010; Verbeek, 2010).

At this point we want to bring to the fore a "practical turn", which we see as a different branch for further development of contemporary empirical philosophy of technology. Although the empirical turn led to instant practical success with Technology Assessment and governance of innovation, the collaboration of philosophy and design seems another obvious way to make philosophy of technology practical. This is in line with Peter-Paul Verbeek's (2010) proposal that philosophers "accompany" technology development. Verbeek suggests an approach where philosophers do not act as ethical border guards who say yes or no to new innovations, but where instead they collaborate in the design process, adding philosophical and ethical reflection, and aim to contribute to better designs.

A practical turn suits the contemporary view of ambivalent technology in which there are no predefined and overarching answers to what is good and what is not (utopian and dystopian views). Reflection by ourselves on our own situation and circumstances must lead to a self-defined ethical vision on how to live with technology. In this respect, of determining future ways of living, the design and ethics of technology merge. The reluctance to give a hard yes or no, may be unsatisfactory from the side of the "ethical turn". From a normative ethical viewpoint, the idea of co-evolution of technology and morality, as is assumed in the accompaniment framework, might lead to a sort of

accommodation and justification of shifts of moral values in any direction. From a practical viewpoint however, the advantage of actual influence in the real world contrary to firm but ineffective theoretical moral standpoints is deemed more relevant.

Such considerations about the (ethical) justification in theory of the philosophical accompaniment of technology are important, but what does it actually mean in practice? What are good examples and what are good approaches for bringing philosophy of technology and design together? In the following we will discuss examples of how design may improve by the use of philosophical tools. Afterwards we will also reflect on the question what the philosophy of technology gains by a practical turn.

### 3 Philosophy of Technology in Design Practice

In the following paragraphs we present three design cases where Philosophy of Technology theories and methods were explicitly used in an attempt to improve the design outcomes. In particular mediation theory by Verbeek (2005, 2015) and the Product Impact Tool by Dorrestijn (2012, 2017; Dorrestijn & Eggink, 2014). Verbeek’s mediation theory offers a structured account of human-technology relations in order bring to the fore how technologies mediate human perceptions of the world and actions in the world (figure 1, left). Dorrestijn’s Product Impact Tool is a more practical implementation of theories like Verbeek’s into a model intended to be helpful in the design process. It offers a repertoire of exemplary types of impact of technology on humans, presented in a model with different sides or levels of affection (figure 1, right).

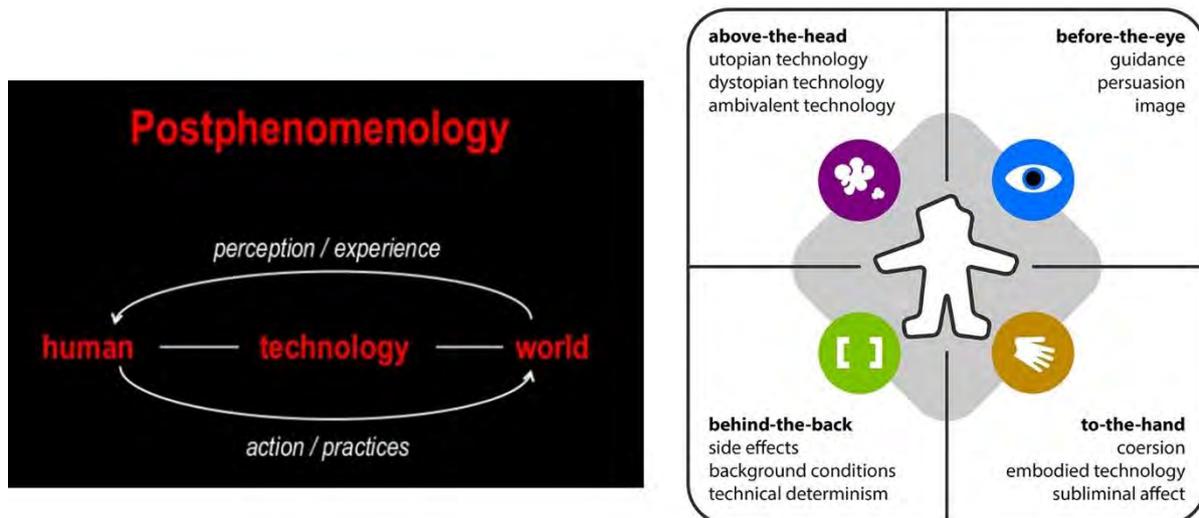


Figure 1 (left) Schematic depiction of Mediation Theory (after Verbeek, 2014) and visual model of the Product Impact Tool (Dorrestijn & Eggink, 2014). See also: <http://stevendorrestijn.nl/tool/english.html>

#### 3.1 Design Case – eBike interface

In 2008-2009 the Dutch design agency Indes worked on the (re)design of a Dutch bicycle with hybrid traction – as it was at that time called. Specifically it concerned the design of the electrical kit of the bicycle. The electric kit would contain battery, motor and a user interface to control the several functions such as the amount of support of the electric motor. One of us authors collaborated as a researcher in philosophy and technology and usability with the design agency, in fact much like the “accompanying technology” approach, as proposed by Verbeek later (Verbeek, 2010). Because of the focus on usability and interaction design the researcher was assumed to advise on the design of the user interface: the amount, characteristics and functionality of the buttons and display of the user interface. However, analysing the hybrid bicycle from a perspective of mediation theory (and the Product Impact Tool in development), the advice turned out differently (Dorrestijn, 2011).

A display with buttons is particularly an example of a human product relation in the cognitive realm. The user experiences the product through interpretation of the information that is provided to him

or her through the user interface. The user interface thus mediates between the bicycle and the cyclist. However, cycling in itself is exemplary for a direct physical relation. The act of cycling becomes part of our physical routines by practice and is, once learned something one does unconsciously. In this embodiment relation (Verbeek, 2015) the user becomes one with the technology and experiences the world together, so to speak.

The hybrid bicycle concept by Indes stood out with a patented drive train that provided for a fluent adaptation of the electrical support to the movements of the cyclist. The better this works, the better the bicycle will be perceived as a part of the cyclist's own body. In the best case the electric motor support would not be noticeable as a device that reacts on the input of the user, but the cyclist would rather have the experience of miraculously extra strength coming out of his or her own legs.

On the basis of these considerations the concept of the "perfectly embodied eBike" was formulated, where the display was completely left out and the interaction with the bicycle stayed purely physical, based on electronically sensing the force of the user. A consequence is that the bike can have less electric functions, however the concept is attractive because of its natural interaction. This could serve ease of use. And while the reduction of functions could harm a high tech image, it could add to an image of pureness and sportive strength and fitness.

### **3.2 Design Case – Solving a littering problem at a secondary school**

A second design project concerned an attempt to influence user behaviour, in particular the waste disposal behaviour of students at a secondary school in Deventer, the Netherlands. Central problem for the school was the large amount of litter that remained every day after lunchtime in the central canteen. The school had already experimented with an installation that should encourage the students to throw away their waste by making it more attractive and playful. The installation that mimicked a basketball ring however led to an even bigger mess (figure 2, left). Industrial design student Paul de Waard proposed several alternative solutions from which the converted lunch table with a trash bowl directly in the middle was the most successful (figure 2, right).



*Figure 2 (left) Playful design of a waste bin didn't work (right) Mock-up of the alternative solution with a waste bowl integrated in the middle of the lunch table (de Waard, 2012).*

Although this reduces the effort of throwing away your waste to a minimum, one would say intuitively that having your lunch directly around a waste bin in front of you is not very desirable. A user test however showed that the students had no problem with this solution whatsoever and moreover, it indeed showed that it solved the problem of waste throwing on the ground (figure 3).

On a sidestep it is interesting to mention that a simplified pre-test with waste bowls that were not integrated in the table but just placed on top of it was not so successful. The waste bowls ended up thrown away on the ground themselves (see also figure 3; here the green bowl is visible surrounded by waste on the ground just left of the middle). This shows that it is very important with these kind of intended influence of user behaviour to be precise in testing the designed solutions in context.



Figure 3. Image of the lunch area of the secondary school after one of the tests. The area around the converted table (in the front, with the bowl in the middle full of waste) is free from litter on the ground (de Waard, 2012).

Having seen this big difference in results from just slight differences in design solutions, de Waard chose to analyse the effects of his intervention with the Product Impact Tool. This tool presents the possible effects and affects in the interaction between users and technology, divided in four quadrants. These quadrants represent the physical “to-the-hand”, the cognitive “before-the-eye”, the environment “behind-the-back” and the abstract “above-the-head”.

The analysis showed that the proposed solutions were mainly to be found in the before-the-eye quadrant, with persuasion and suggestion as the most important influencers. The waste bowl seduces the user to dispose waste because it is right in front of his or her eyes. This led to a whole new strand of possible behaviour influencing measures targeting at changing the attitude of the students towards waste disposal.

Based on the views on technology in the above-the-head quadrant de Waard developed teaching materials for classes in Social Science and Society, and a Facebook Application (figure 4). The teaching materials were in the first place targeted at learning about more sustainable alternatives for the target group, like for instance using a bicycle instead of a scooter. This is based on the view of “utopian technology” from the above-the-head quadrant of the Product Impact Tool, meaning a positive view on the use of technology as the way to better the future. On the other hand, the teaching materials showed the consequences of littering behaviour like in the example of a deformed tortoise due to plastic waste (figure 4, mid). This is related to the idea of “dystopian technology” of the above-the-head quadrant, that reflects on the negative aspects of technology. The Facebook Application was targeted at directly influencing the opinion about littering by promoting likes and dislikes for desirable and undesirable behaviour (figure 4, right).



Figure 4, Examples of alternatives for influencing littering behaviour; Scooter vs. bicycle teaches students about sustainable choices; image of distorted tortoise shows consequences of littering; facebook post influences opinion about littering.

In a questionnaire evaluation, a large proportion of the target group responded that they would change their littering behaviour, influenced by the concepts. Especially more than half of the 100 respondents indicated that they would change their behaviour after having seen the images of the negative consequences. In this way, the teaching materials can strengthen the effect of the before-the-eye based integrated waste-bowl concept.

### 3.3 Design Case – Digital Camera evolution

The third design case concerns the design of a next generation digital camera. In this project students Sven Deinum and Tom Feij investigated the evolution of the photo camera in order to come to an improved future design concept (Deinum & Feij, 2017). The analysis of the historical development of the photo camera showed that since the introduction of the first commercially successful rangefinder camera, the Leica II from 1932, the appearance of the photo camera hardly changed until the present day. The students then applied a mediation theory analysis to a set of typical cameras derived from the historical analysis, in order to find out more detailed differences and developments. This analysis revealed that the introduction of the digital camera, although not very visible on the outside of the camera design, had a huge impact on the human-product relation with cameras.

Formerly, with the analogue rangefinder camera the user would look through the camera objective onto the subject of the photograph. This is a pure example of an embodiment relation, where the user is not focused on the technology, but perceives the world through the technology. As Verbeek puts it: “In embodiment relations, technologies form a unity with a human being, and this unity is directed at the world: We speak with other people *through* the phone, rather than speaking to the phone itself, and we look through a microscope rather than *at* it.” (Verbeek, 2015, p. 29).

With the introduction of the digital compact camera, with a large screen display at the back showing a preview of the photograph to be taken, this completely changed. When busy taking a photograph, the user watches the screen of the camera where one sees a preview of the picture to be taken, rather than the subject out there which one wants to make a picture of. The direct embodiment relation is changed into an indirect alterity relation, where the user interacts with the technology while the real world is a sort of hidden behind the technology in the background. With the attention of the user confined to the camera display, the user is also shut off from the environment, which is in particularly influential when taking pictures in the company of other people, or taking portraits.

Based on this analysis, two major use aspects were included in the requirements for the future camera concept: “If possible, the camera should communicate openness to people around the user”, and “While using the camera, the attention of the user should not lie with the camera, but with the subject.” (Deinum & Feij, 2017, p. 47). The students solved this by introducing a cleverly redesigned range finder, which serves as a window to the world (figure 5).



Figure 5. Future digital compact camera concept with two possible views through the new rangefinder; an overview when the camera is held close to the eye and a detailed cut-out of the scene when the camera is held far off (Deinum & Feij, 2017)

The rangefinder is a simple glass rectangle on top of the camera through which the user directly looks at the subject of the photograph. The camera would at the same time measure the distance and position of the eye with respect to the camera. When the camera is held close to one’s eye the rangefinder shows the whole scene and when held with stretched arms the rectangle encompasses only a tiny detail of the environment (figure 5, right). The photographer in this way uses the glass rectangle to literally *frame* the subject, while at the same time still overseeing the whole scene. In this way the embodiment relation is restored. At the same time, while the user is no longer focussed on the camera, it also enables an openness to the world. This aspect is even stronger than with

conventional analogue cameras, because the open frame of the new rangefinder allows the user to see the whole environment. And from the perspective of the subject, the photographer is also more visible because the camera is held more at a distance (figure 6).



Figure 6. User interface of the future camera concept and a typical use situation holding the camera at a distance (Deinum & Feij, 2017).

#### 4 Better Design by Use of Philosophy of Technology?

In all three design cases the incorporation of Philosophy of Technology theories and tools had informed the design outcomes. It is difficult to decide if these outcomes were better than without the influence of the Philosophy of Technology perspective, but at least one can say that there were new and different ideas.

In the case of the eBike interface the mediation analysis showed that the addition of a traditional cognitive interface would compromise the embodiment relation that is natural to the bicycle. Without this analysis the designers would have simply placed a display and knobs on the bicycle steer. Resulting in a more indirect interface, that could even distract users from their primary task of cycling. Especially in heavy traffic this can be potentially dangerous. The concept of the perfectly embodied eBike means a retrieval of natural interaction with possible gains for usability and safety in traffic and a different positioning qua image. The philosophical reflection enabled the designers to take distance and to rethink what an eBike can be on a conceptual level.

In the case of influencing the littering behavior, the influence is not so much visible in the proposed solution itself. The Product Impact Tool analysis of the converted lunch table provided the designer with more insight in the working of his concept, but it did not change the concept so obviously. The added value of the use of the Product Impact framework in the project lay more in the additional options that were explored to influence the target group. The four quadrants showed the potential to influence in different ways on different levels. In this way the behavior change is potentially strengthened because it impacts the user from multiple sides. And if the user is not so vulnerable for a particular type of influence, he or she can still be affected on another level.

In the case of the camera redesign the mediation theory analysis revealed the 'problem' of the interaction with camera and subject-to-be-photographed, even if there did not seem to be a design problem in the first place. The narrow functionalist idea of a taking a picture of a scene is broadened with details about the photographer's gestures and posture in respect to the camera and the environment or people that make the scene. Moreover, this use of the Philosophy of Technology perspective revealed ways for improvement. Especially when a long product history is limiting innovative solutions because of the image of what a good product should be is influenced by strong archetypes (Eggink & Snippert, 2017).

## 5 Better Philosophy of Technology by Collaboration with Design?

Is the collaboration with design also beneficial for philosophy of technology? We will now concisely review the three cases again to see which kind of philosophical reflection can be evoked through the philosophical accompaniment of design practice.

In the case of the eBike it appeared that the old phenomenon of embodied technology (e.g. Heidegger 1996 [1927]; Ihde 1990) remains valuable in a high-tech world. In classical philosophy of technology in the wake of the later Heidegger (1977 [1954]) embodied technology is linked to traditional tools and romanticized. Modern machine technology, and contemporary digital and interactive technology would not allow this natural relation of embodiment, and instead cause estrangement of people. The eBike gives practical proof for the claim in empirical philosophy of technology that the estrangement thesis is one-sided, and shows that against a certain trend, embodied technology can be retrieved in an era of smart technology.

The second case, about litter disposal behaviour changing design, brings out how very important actual testing is. The situation of an environment with technical products and people's behaviour is so complex and full of detail that it seems impossible to forecast exactly what people do and experience. The concepts from the Product Impact Tool helped to structure the search for solutions but also raised awareness about the occurrence of unexpected impacts. There is an alternation between conceptual thinking and practical testing which makes this a case of philosophical research with the hands as much as with thought.

The third case, about the rangefinder for digital cameras, shows the persistence of the phenomenon of the embodiment of technology again, much like the first case. What was also present in the first case, but stands out here, is how philosophical reflection helps to take distance for a reconceptualization of how pictures are made. The mediation analysis helped to become aware of the differences between cameras one looks through or looks on for the making of pictures (engagement with the whole actual scene against focus on the preview of the picture on the camera screen). Moreover, it appears that customary values and ways of doing which appeared to be affected by new cameras can still be saved or retrieved by a thoughtful redesign. This is a case for the feasibility of the idea of "alternative technology" (after Marcuse, see Feenberg, 2002) which philosophy could never make so tangible without the practical turn of collaboration with design.

## 6 The Practical Turn

Philosophy of technology made an empirical turn in recent decades, from abstract theories to more detailed description of concrete technologies, situations and use practices. Today there is a renewed wish to bring back a more critical perspective: an ethical turn. It would be a pity however if this would renew the gap between philosophy and practice. A feasible compromise can be to continue with philosophical reflection on questions about deeper principles and structures while simultaneously continuing with more practical and applied work in collaboration with designers. The two types of work need not be mutually exclusive. Characteristic of our proposal of a practical turn is the application of philosophical insights in actual design. This should not at all mean however that only philosophical work that can directly be put to practice is valuable.

What is then the meaning of the practical turn? The "philosophical accompaniment of technology" is a nice but very general expression for what a practical turn entails. The redesigns and reconceptualization in the three cases we discussed also illustrate Don Ihde's variant of a practical philosophy of technology when he suggested that philosophers of technology can serve in an "R&D role". His proposal is that philosophers contribute to the design process with "deep insight into both technological structure and the history of technologies", and with "a critical take", though "detracted neither by utopian nor dystopian aims" (Ihde, 2002, p. 112).

Such ideas must however be made one step more concrete and operative. There is a need for more translation of work in the philosophy of technology into philosophical tools for design research. The

Product Impact Tool is our version of such a translation. We think our proposal compares to approaches such as Critical Design, Social Design and also Persuasive Design.

Persuasive Technology (Fogg, 2003) and Social Design theories, like Tromp et al. (2011) deal with the same kind of 'user-influencing-for-the-greater good', but they are also limited to this specific focus and come with a smaller, less versatile repertoire than our approach. The classification of Tromp et al. (2011) of the intended user influence, based on the dimensions of force and salience is more or less limited to the physical and cognitive quadrants of the Product Impact Tool that encompass coercion, suggestion and persuasion. Characteristic of the Product Impact Tool is the inclusion of the environment and reflection via the quadrants "behind-the-back" and "above-the-head". Philosophical reflection is also a characteristic of Critical Design (Malpass, 2010). However Critical Design is merely limited to criticizing the status quo by stimulating critical thinking and user reflection (Markussen, 2013), therefore with limited results for everyday practice. In comparison our approach is more practical and focussed on functional and usable results. So, our approach to philosophically accompanied design compares to Critical Design, Social Design and also Persuasive Design, but characteristic and distinctive is the simultaneous orientation towards practical use and critical reflection.

## 7 Conclusion

In three cases presented above concepts and tools from the philosophy of technology were applied in design. This proved to have results in the sense of new, surprising, and perhaps better designs. The other way around philosophy of technology also gained from the collaboration with designers. The effects of technology are ambivalent. Estrangement and domination as may be a threat, but more desirable alternative directions are possible. These are philosophical claims, which however cannot find their ultimate form nor decisive proof in philosophical argumentation, but only in practice. In that sense philosophy of technology has to become practical if it wants to fulfil the task of answering its own questions.

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# Service Fictions Through Actant Switching

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Actor-Network Theory (ANT) and speculative design inspired the creation of Actant Switching and Service Fictions. ANT states that each action is a system made up of human and nonhuman actors. All actors play their set role for the system to move forward. By mapping out the system, ANT can enable exploration of relationships within a context. Actant Switching is a method for speculative scenario creation that interchanges human and nonhuman actors to create counterfactual scenarios exposing tension with the context and technology. Service Fictions is a method for engaging participants in a co-created speculative design around the created Actant Switching scenarios. A case study on sleep practices demonstrates these techniques. Both methods enable insights from allowing participants to confront their relationship with a system, to make explicit the implicit roles in the system and therefore their relationship with technology. These methods are a useful addition to designers' toolboxes, at the intersections of service design, speculative design, and participatory design. Both techniques provide a practical way to apply ANT.

*speculative design; participatory design; actant switching; service fictions*

## 1 Introduction

This paper introduces two related generative methods which enable design researchers to explore questions of people's relationships with a system and the technology internal to that system. Both methods bring to focus the questions around delegations of agency to technology in everyday life. Actant Switching (AS) is a method for speculative scenario creation, based on Actor-Network Theory (Latour, 1992; Verbeek, 2005), which involves switching nonhuman actors to human actors in order to create slightly counterfactual (speculative) scenarios. Service Fictions (SF), evolving from AS, is a method for engaging participants in co-created speculative design based on a slightly counterfactual scenario generated through AS. Both methods enable insights for design, from allowing participants in a user research or design process to confront their relationship with a system, and from defining the implicit relationships between actors in the system or network. AS provokes *designers* to make explicit their relationship to the system; SF enables *participants* to make explicit their own



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relationship to the system, based on a designer's prompts. Both methods use speculative design and Actor-Network Theory (ANT) to explore and understand a context.

These methods grew out of wanting to explore the boundaries of a context; speculative design was chosen as a way to push the boundaries of a context and ANT was chosen as a way to generate slightly counterfactual speculations based on existing systems. Initially, when these speculations were shown to participants, they tended to only react, rather than engage. SF are a way of having participants engage more fully with the generated AS speculations, by having the participants co-create a scenario that makes sense for their lives, based on their preferences and values. The speculative nature of both methods allows researchers to examine their own values, and to open up conversations with participants regarding their values, preferences and ways of thinking, otherwise harder to attain in a first encounter.

### **1.1 Background: Speculation and Probes**

Speculative design can be used to elicit reactions through thought-provoking materializations of counterfactual concepts, its intent can be to initiate reflection and discussion (Dunne & Raby 2001). However, if the scenarios presented are too uncomfortable, too difficult, or too devoid of context, participants may potentially only *react* to the scenario—amplifying gut reasoning—without exploring the reasons why such a reaction is provoked. There is a trend of using speculative design to provoke debate in public discourse through gallery exhibition or promotion. This 'showroom model' (Koskinen et al, 2011) keeps the participant at a distance, where they are perhaps unable to engage fully with the scenario.

One way of rooting this more closely with 'one foot in the present' is to use speculative design methods. This exaggerates elements of what is already present in a familiar situation—making it easier for people to connect the speculation to current reality, so long as they are open to engaging with the prompt. The closer the speculation is to reality, the more the speculation perhaps 'disturbs' the customary conceptions that participants have of a context (Dunne, 2007: 10). There is an effort to remove the 'showroom' model and have participants engage more directly with the speculation. Chris Elsdon et al's 'Speculative Enactment' (2017) uses scripted bodystorming to allow participants to experience speculative scenarios in situation. Other methods that attempt to use speculative design in a participatory way to initiate conversation to inform the design process include speculative design probes (Wallace et al, 2013), *provotypes* (Boer & Donovan, 2012), *prototypes* (Fuez, 2015) and other similar approaches, at various levels of resolution. These methods have been used to explore and gain an understanding of research participants' values, context, and ways of thinking, through collecting responses to a provocation in the form of a "part-made object[...] explicitly awaiting closure" (Wallace et al, 2013), or a presented scenario for "what might be" (Gaver, 2012: 940) which explicitly invites, and makes use of, participants' responses. For example, the evolving approach taken by Bill Gaver and colleagues (the Interaction Research Studio at Goldsmiths) involves giving prototypes of new products and artifacts to participants, to live with over time (e.g. Gaver et al, 2015). These prototypes are used as research probes, where conversations have often started with the designed object but opened up to "encompass the broader and more particular issues, practices and controversies with which our volunteers were living" (Gaver et al, 2015). This use of speculative design as a form of research employs the object as a prompt for rich conversation around, as opposed to simply evaluation of it as a product—similarly to Dunne and Raby's *Placebo project* (2001), examining people's experiences of electromagnetic fields in the home through a series of prototype objects. "We are not interested in whether these stories are true or scientific, but we are interested in [the] narratives people develop to explain and relate to electronic technologies, especially the invisible" (Dunne and Raby, 2001, 75).

Our intention with creating AS and SF were similar; the counterfactual AS scenarios work as research probes meant to spur 'rich conversation' around the context. The aim of co-creating speculative service scenarios is to open up a deeper conversation around participants' reasoning for their decisions—enabling different insights to emerge from the process. SF aim to help pull out the

reasoning behind participants' preferences. With the designer co-creating this scenario with the participant, the context can be explored thoroughly.

Since speculative design is meant to spur conversation, the benefit of SF is capturing engagement through progressive disclosure and recording how participants relate to the scenario that they create. In co-creating the scenario, participants can engage with the scenario in a way that makes sense for them and thus illuminate the reasoning behind their choices. Conversation also allows for slow 'buy-in' allowing participants to explore and engage more with the provocations rather than the encounter ending with the initial reaction (Dorst, 2015).

## **1.2 Background: Actor-Network Theory**

ANT describes an approach to the description of situations, arising from work in science and technology studies (STS), which centres on interactions and relationships between humans and non-human actors—together making up networks which perform actions. In ANT, objects, environments—indeed all entities—are considered to be actors just as humans are. As such, ANT holds some interest for designers, as a sociological approach which recognizes the performative role of designed artefacts in social systems. It has particular relevance in service design, in terms of its focus on relationships and changing interactions between actors, which influence how we as humans and our nonhuman counterparts work together to act, or achieve a goal (Uden & Francis, 2010). In working together, each actor's role can be seen to move the action forward to the next actor that plays its part until the desired action is complete. An action depends on the actor before them for the system to move forward; each actor in the system is as important as the next. These networked systems are flat continuous networks that make up everyday life.

Latour saw systems in need of both technological nonhuman and human actors to allow the system to function and work seamlessly. Systems are not 'either or', but made up of both types of actors, as a system of only nonhuman actors could not exist without a human actor. Each actor's role can be delegated to either a human actor or a nonhuman actor. For example, Latour uses the example of a door being opened and closed: the actor that closes the door can be either a human or nonhuman (mechanical) actor; it does not matter as long as the action is done.

The reason for considering how both humans and artifacts make up a system is that they are dependent on, and co-construct each other. As Yaneva (2009: 284) puts it, "a thing or a design project can modify all the elements that try to contextualize it, triggering contextual mutations. In this sense, a design project or a disputed design resembles more a complex ecology than it does a static object." An artifact is usually designed with the intention that a human interacts with it in a certain way. The actions of the human are designed. Nevertheless, an artifact is nothing if a human does not use it; and use it the way it was designed to be used. Artifacts shape individuals' day-to-day actions. Likewise, much technology is only realized when a human actor uses it. For example, if a human actor picks up a phone to call someone the human is allowing the phone to be a phone, the phone is then allowing the human to talk to someone, thus completing original desire for the action. Both are reliant on each other for the action to work. The way the phone interacts with the human, and the way the human interacts with the phone is predetermined.

ANT does not recognize free will: there is only one interaction a human can have with a nonhuman and vice versa. If a human deviates, there is a notion of an *anti-program*. Anti-programs are designed into nonhuman actors that are meant to reinforce the intended interaction if a human were to stray from their role. In Latour's example of the seatbelt, if the human actor chooses to not buckle up, the car will beep incessantly until the human actor puts on the seatbelt. If a human strays too far, Latour states that 'the technical shifting-out forces the reader to choose between frames of reference' (Latour 1992: 169). This means when anti-programs are not strong enough, one needs to make a choice to abandon the system 'as is' and make a new system by introducing a technology switch. Each time a technology switch occurs and technology is added or subtracted a 'price is paid' (Latour 1992: 174). The system will normalize through an additional need, i.e. the 'price'—precisely the place the designer can examine, and make explicit, otherwise implicit relationships. This offers

an opportunity for designers to explore: playing with these relationships to provoke discussion and reflection.

### 1.3 About/ Background for Actant Switching

AS was born as a way to explore a context through using ANT—specifically, exploring the differences between delegating a role to human and to non-human actors, and the effect this has on the actions of others. If one starts playing with whether an actor is human or nonhuman, the role the actor follows stays the same, but its connotations may change. Switching actants provides an imbalance that allows one to examine the roles and meaning placed upon nonhuman or human actors. In the following case study, the role an object or technology once played became intrusive and awkward when a human did the same action. Participants were more aware of the actions humans performed, rather than an object providing the same action. This highlights questions about the types of relationships we have with our objects and the amount of control we actually hand over to technology (Figure 1).

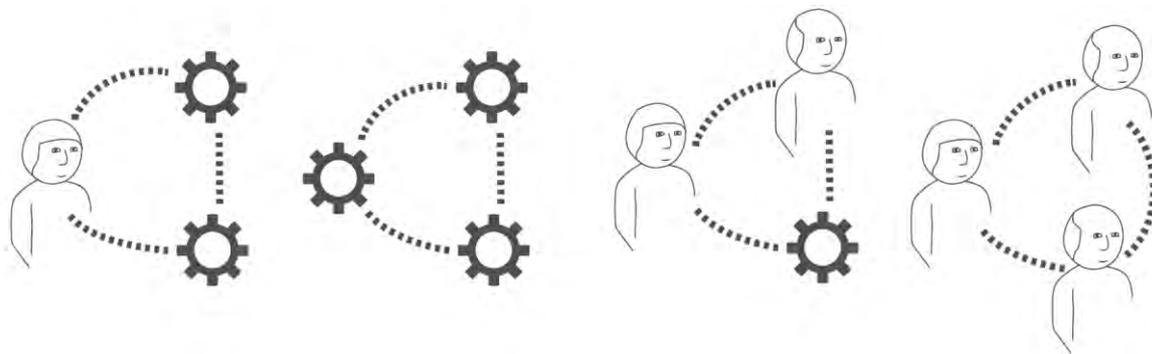


Figure 1. ANT, interchanging actors in a system.

In changing one actor for another, the action stays the same, the role stay the same, but the makeup of the system, and connotations change. This creates a slightly counterfactual scenario that could in fact exist, but doesn't. Different sets of actors lead to different actions, ('the price to pay' (Latour, 1992), allowing for emergent qualities. In changing the connotation, the scenario itself needs to change to rebalance the imbalance that switching actors created. This imbalance creates tension, this tension delineates that this is the boundary of a context. The act of understanding these tensions and attempting to rebalance the system so the scenario becomes plausible, if not preferable, uncovers implicit relationships, underlying contingencies and one's relationship to both the context and its technologies.

This tension allows us to examine our viewpoint and our interpretation of the inherent roles actors hold in a system. AS spurs ideas through the cascading changes in roles and interactions that result from changing a single actor in a system in an effort to find the boundary of what was comfortable for a specific context.

### 1.4 About/ Background for Service Fictions

SF attempt to minimize the 'reaction' to the speculation, by engaging participants in the scenario generated through the AS method. Initially, participants' reaction to the AS scenarios were because they didn't know where to start... SF were created as a way to slowly take them through the scenario by co-creating a scenario that could fit into the participant's life.

SF in the end, are co-created speculative scenarios (the captured SF Scenario, see Figures 6-11) that are reactions to speculative prompts based on scenarios generated from AS. SF attempt to situate the speculative scenario which is centered around an activity or practice, into a participant's life, in a way that makes sense for them based on their values and preferences. It is the participant attempting to rebalance the imbalance AS created. The rebalancing is an act that forces participants

to reflect on their relationship to the system, and thus provides an entry point to talk about the participants values and preferences (or reveal their values to themselves).

This engagement is less about the reaction to, but an exploration of the speculative prompt. In stepping through the speculation, participants are eased into engagement. Starting with reflection of the now, then stepping slowly towards creation of their own scenario with prompts based on their rituals. By stepping through the thought process taken in creating the AS scenario, the resistance to engage in the scenario is less than it was when the scenario was just shown to the participant.

The purpose of these scenarios is for the participant to explore a scenario that is slightly outside of their comfort zone. Service Fictions provided steps for the participant to think through how a speculative scenario fits into their lives. In stepping through a speculative scenario, it becomes fiction and it is no longer about the participant or their life, it is about this world that they are building. Since it is no longer about them or their life, participants feel more free to open up. Their stories, even if based in fiction, are still tied to their lives. The insights are in the participant's comparison between the two, and the why.

## **2 Methods**

### **2.1 Actant Switching Methodology**

AS is meant for the designer to understand their relationship to the context. It is used best in a purely generative way to uncover the possibilities of the new configurations of a network or to explore and understand a network. This allows the designer to understand the system they are designing within, it helps explore the dependencies and assumptions internal to systems.

AS works well in a context where technology has created a need that has not previously been occupied by humans. AS also lends itself well to contexts that are sensitive in nature. The goal of the designer is to find a scenario that sits on the edge of what is acceptable. Slightly sensitive contexts have varying mental models and any slight variation may be normal to one person or be at the boundary for another.

*Procedure:*

1. Choose a system/context.
2. Map actors and their roles in the system.
3. Using the same role, switch out one non-human actor for a human actor.
4. Design the scenario so that it makes sense. (Rebalance the imbalance)
5. (Optional) When returning to the original actors, how has this changed viewing the system?

*Some useful questions to ask when using AS:*

1. When roles/relationships are made explicit, how does the nature of the relationship change between actors?
2. How would making relationships explicit change the world around them?
3. How does having 'x' change the way one interacts with the world around them?
4. Re-balancing the system allows one to ask 'what would fit into my life?'
5. When switching back to the original actor, how does that change the original context?
6. What was displaced before this technology came into being?

## **2.2 Service Fictions Methodology**

SF should be done at the end of the exploratory phase, at the beginning of the generative phase.

To generate the SF, participants were prompted with situations that are slight shifts to conventional practices, and presented speculative service scenarios as provocations. These slightly counterfactual scenarios were the basis for the SF. Instead of presenting the scenario at face value, the interview mirrored the designer's thought process when creating the service scenario. From there, the participants are asked to co-create scenarios to the initial prompts. Making part of the interview a co-creation session allows for the participants to closely relate to the material. Participants are able to talk through and reflect on what the speculative service would look like in order to fit into their individual lives, values around a topic, and rituals.

It was important to lead the participant through the thought process taken to generate the speculative scenario before engaging in co-creation of a script. 'Priming the Participant' was necessary for them to 'arrive at the same frame idea themselves' therefore '[bypassing] the adoption problem' (Dorst, 2015, 65). The participants are asked to think through their rituals around the context first, then with the prompt in mind, how would their rituals for this context change? The co-creation development of the script allowed individuals to react to the prompt, but then situate the service scenario in their own life while remaining emotionally separated. Counterfactual probes allow participants to think about circumstances that are close to reality but are still based in fiction. This gives participants permission to explore the topic in a way they might not normally have considered. SF allow participants to play with a certain idea without having to actually live through it in reality. The participants' insights given in storytelling nevertheless still reflect their individual values and thoughts towards certain issues.

*Possible Procedure:*

1. Development of speculative scenario (AS).
  - a. Since this method was interchanging actors as a way of highlighting tensions in the dependencies of actors, it is important to develop the scenario separately beforehand for the development of the interview.
  - b. Designers should capture their thought processes taken to get to the scenario, break down the core concept and devise steps on how to get the participant to the desired result.
2. Interview/Step users through thought process:
  - a. Breakdown thought process to:
    - i. What happens now, what do you wish was easier, what is challenging?
    - ii. Shifts in convention, and how that would change things.
    - iii. Engagement with scenario prompts.
3. Co-create the scenario.
4. Post-interview:
  - a. Each created scenario was illustrated in storyboard format, using the same character and environment for each scenario.
  - b. Capture script.
  - c. Anonymizes scenarios by having same actors.

### 3 Case Study

#### *SleepGivers*

Sleep is a slightly sensitive and private subject. While everyone sleeps they don't generally talk about it, unless things go wrong. People do not talk about their practices or rituals because it is something that is shared with only a select few, and to talk about nighttime routines is slightly intrusive to some, but not others. Everyone has different mental models of and around sleep, it means something different to everyone even though there is an assumption that these mental models are all the same or similar.

This inconsistency provided a starting point to probe to discover what was acceptable around sleep (thus the boundaries) and to make more transparent the differing mental models and relationships to sleep as a system. AS proved useful in creating scenarios that were not abnormal but were uncomfortable.

Taking the system of going to bed, there is a person and non-human actants that allow for that person to go to bed. If one inserts or switches humans to take over the role of the non-human actants, the system changes as seen in Figure 3.

If a designer contextualizes this system and a human actor takes over for that of an app a human actor uses when going to sleep, a scenario starts to emerge (Figure 4).

Using this context, the following speculative scenario (Figure 5) was generated focusing on switching a sleep app that helps one sleep for a person who helps one sleep.

The scenario was not out of the realm of the possible. Elders often have night nurses, ICU's have a service that aims to help people sleep better, and hotels mimic this to a degree with a turndown service with a mint on one's pillow. Attempting to normalize the scenario revealed that individuals were more comfortable when the scenario was medicalized and this person acted as a medical professional who had medical knowledge of how to make one sleep better.

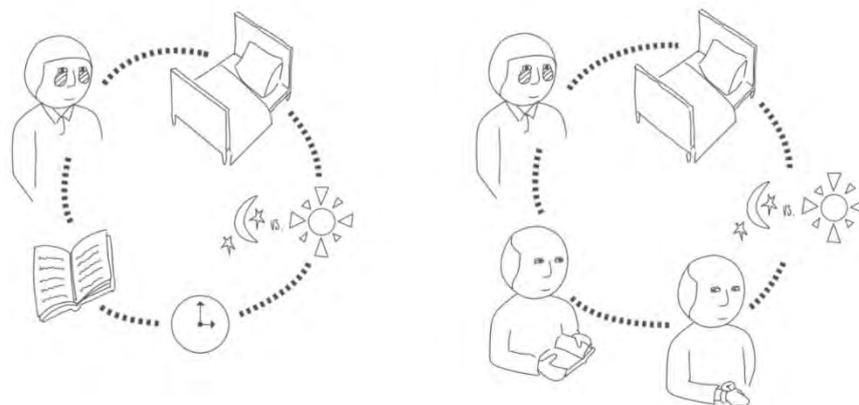


Figure 3. AS Scenario

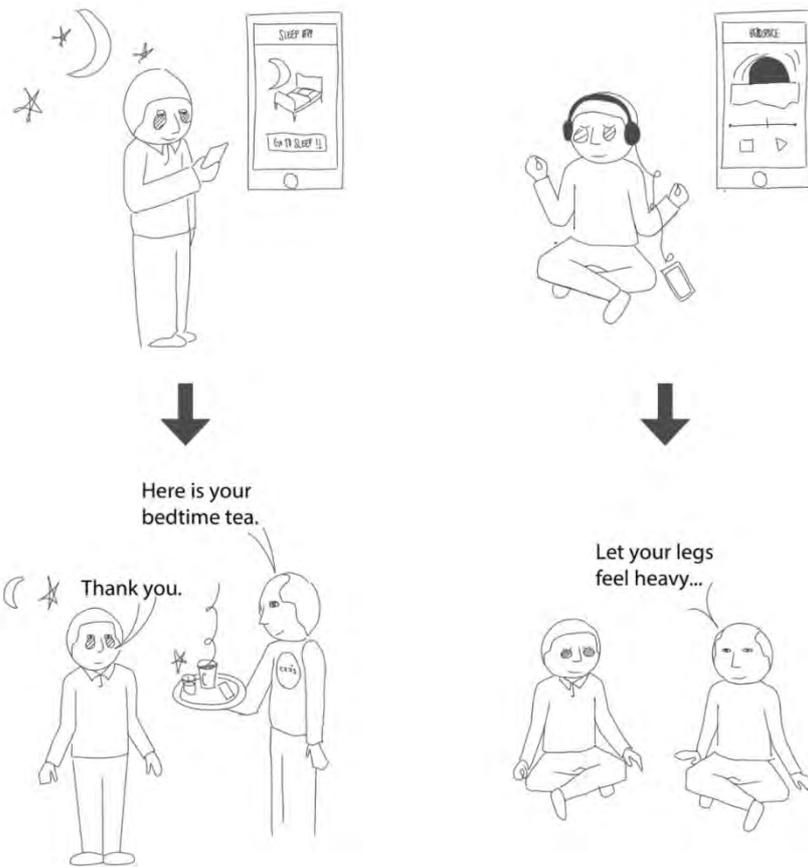


Figure 4. AS Scenario



Figure 5. AS Scenario

An informal call asked for individuals with insomnia who expressed the interest to 'be able to sleep more'. Of the 40 who responded, 12 SF were created illustrating the participant's boundaries around what they were comfortable with related to sleep.

*The questions asked in the interviews:*

1. What are your rituals around sleep.
2. If there was technology associated with an action, what would it be like if someone was facilitating that same action for them?
3. Then we co-created a script for a person who comes in to help the participant sleep.
  - a. When would they come?
  - b. What would your conversation be like?
  - c. What would they do?
  - d. When would they leave?

Below are some of the resulting scenarios from these SF sessions.

*Select Generated scenarios: (Figures 6-11)*

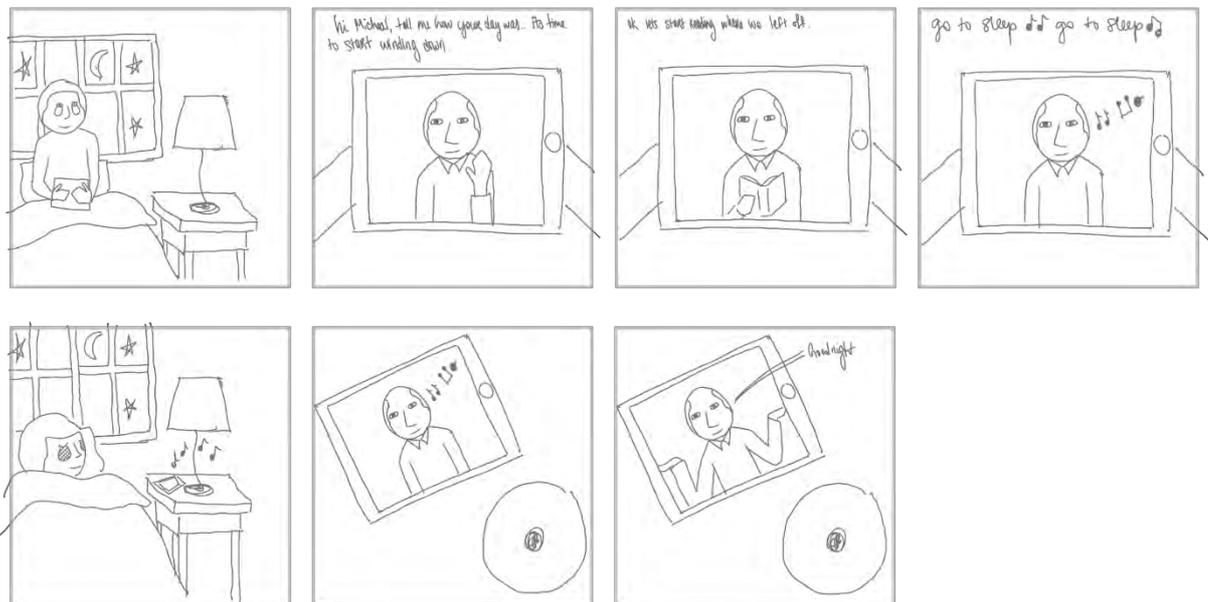


Figure 6. SF where the SleepGiver Sings the participant to sleep remotely.

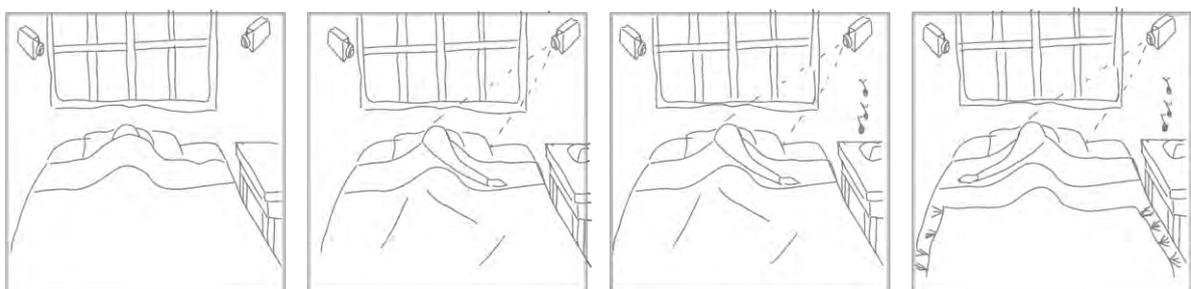


Figure 7. SF where the SleepGiver watches Participant sleep remotely, so that they could give participants tips on how to sleep better.

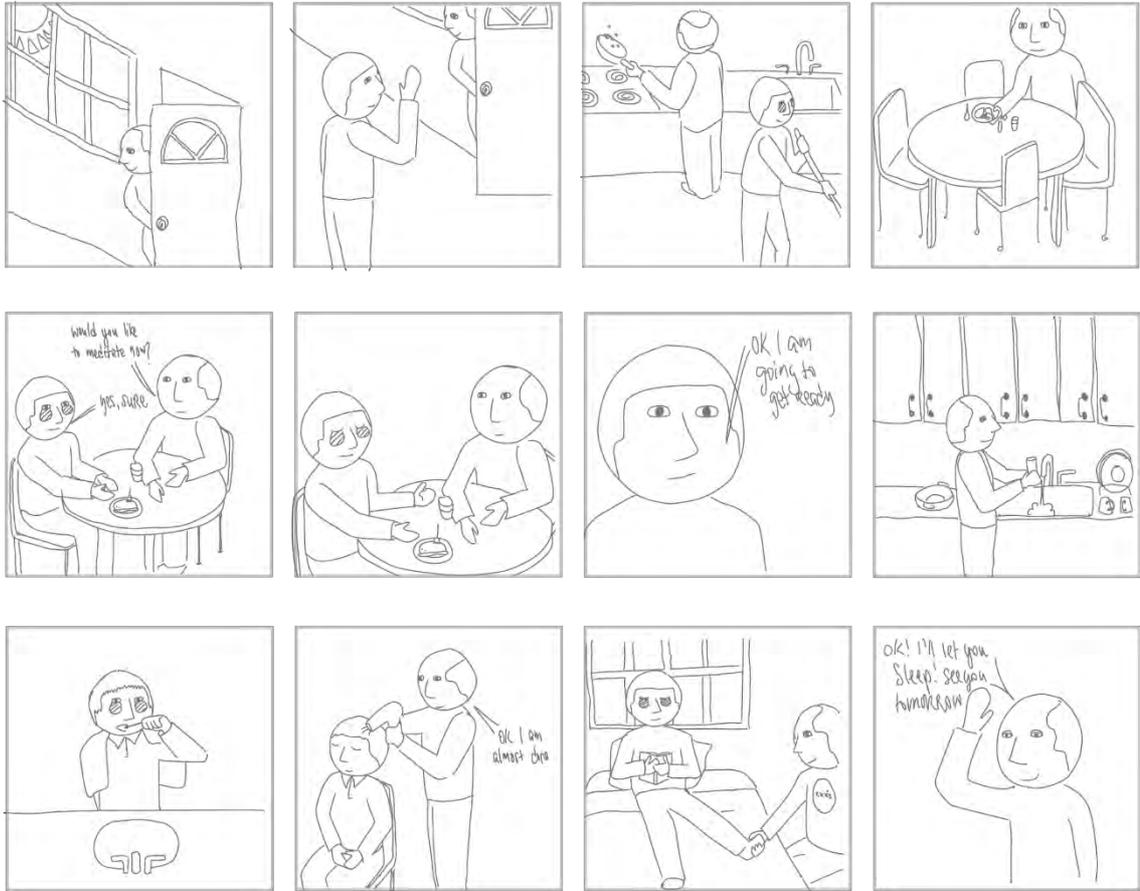


Figure 8. SF where the SleepGiver helps with chores, then blow dries Participants hair dry and rubs feet until they fall asleep.



Figure 9. SF where the SleepGiver hangs out and reads a book, does not interact with Participant. The SleepGiver brings dog, dog falls asleep on bed.

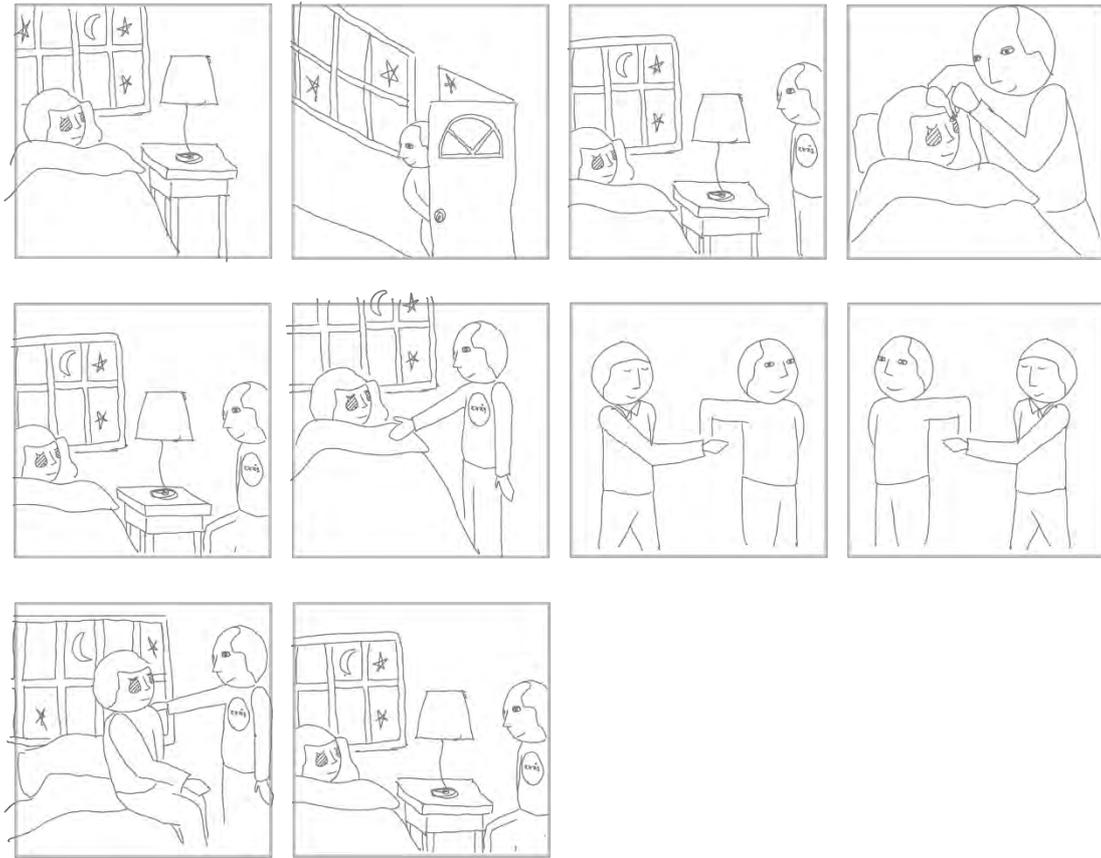


Figure 10. SF where SleepGiver watches Participant sleep, puts eye drops in their eyes so they won't wake, and if they do they walk them to the bathroom and back.

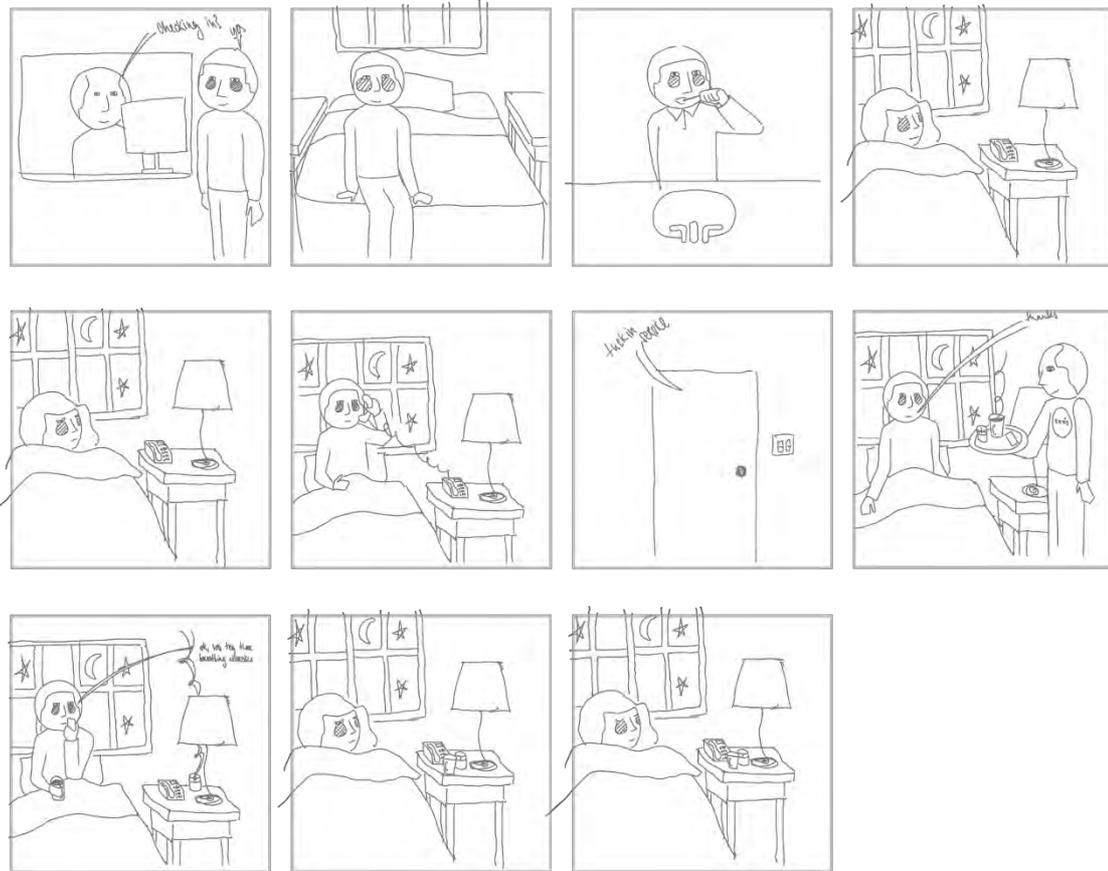


Figure 11. SF where the SleepGiver acts like a hotel Concierge and brings tea so the Participant can fall asleep.

Participants had varying degrees of comfort when creating the SF and normalized the scenario in completely different ways. Some made their scenario far-fetched as a way to bypass the privacy issue, but their reasoning behind their choices gave insight into what sleep meant to them. One participant wanted a person in a rocking chair reading but did not want that person to acknowledge them or speak to them (See Figure 3d). Having a person setting the mood of sleep, the participant felt that sleep would then become much more contagious. Other individuals wanted a person to help them make the dinner and help with chores, but wanted them to hide in a closet when the rest of the family sat down to eat.

Themes that emerged from this method were about when it was appropriate to use humans or technology in the design of services and preconceptions one has of each. For example in some cases, the 'SleepGiver' was stripped of their human qualities and used as a proxy for technology that did not exist. Or a reason people were hesitant about this 'SleepGiver' was that they didn't know their intentions, and it was not a closed but variable feedback loop, as opposed to technology where you 'know' what you are getting. Other themes that came up were the varying degrees of control, privacy and trust.

#### 4 Results

AS is the method utilized in creation of slightly counterfactual speculative scenarios to be used in the creation of SF. If systems are made up of both human and non-human actors, shifting one non-human actor in this system to a human, the balance and relationships in that system changes. The system becomes a service. It creates service scenarios that could exist, but yet are not wanted. This allows one to examine their relationship to the previous non-human actor (technology). These Service scenarios exist at the boundaries of a chosen context. It allows the designer to explore their

individual boundaries, and understand the roles internal to the system making explicit the implicit relationships.

SF are co-created speculative scenarios evolved from AS. AS is the designer exploring their relationship to a system/context through speculative scenarios. In SF, it is the participant exploring the boundaries and understanding their relationship to the prompts and thus the system. These speculative scenarios are meant to allow participants to adapt speculative prompts as related to their life. The end result is a SF, or a co-created scenario that takes place through a semi-structured interview/session. The participant uses the prompts created from AS and creates a service scenario of their own based on their preferences in how they see the prompts fitting into their own life. The purpose is to understand the 'why' behind the reasoning for these choices. These co-created scenarios allow for insight into a participant's preferences, values, and imaginaries while allowing them to define, reflect and explore their relation to specific actors internal to a specific context. SF allow participants to reflect upon and converse about their values and underlying assumptions specific to a context in a non-confrontational manner.

#### **4.1 Validation of Methods**

A workshop at Carnegie Mellon University was held to see if these two methods could be applied to a financial health context in a way that gathered rich insights, and if designers could use these methods without too much guidance.

The workshop took place with second year Master of Design students. The workshop was four parts, the introduction of the topic, AS, Interview script, and SF. The last three parts were done in teams of three, and activities were slightly modified in order to make it group work.

Students worked around a system of withdrawing money from the ATM (Figure 12). Initial concepts resulting from Actant Switching were switching out either currency, the ATM or the receipt.

Students noted that to normalize the scenario, more than one actor needed switching. Normalizing was less about fitting the scenario into their current lives, but about making the scenario make sense in a fictional world.

The participants then voted on one scenario, where the money had been exchanged for a human substitute. The groups then broke the scenario down to a script, and generated SF based on the speculative prompts.

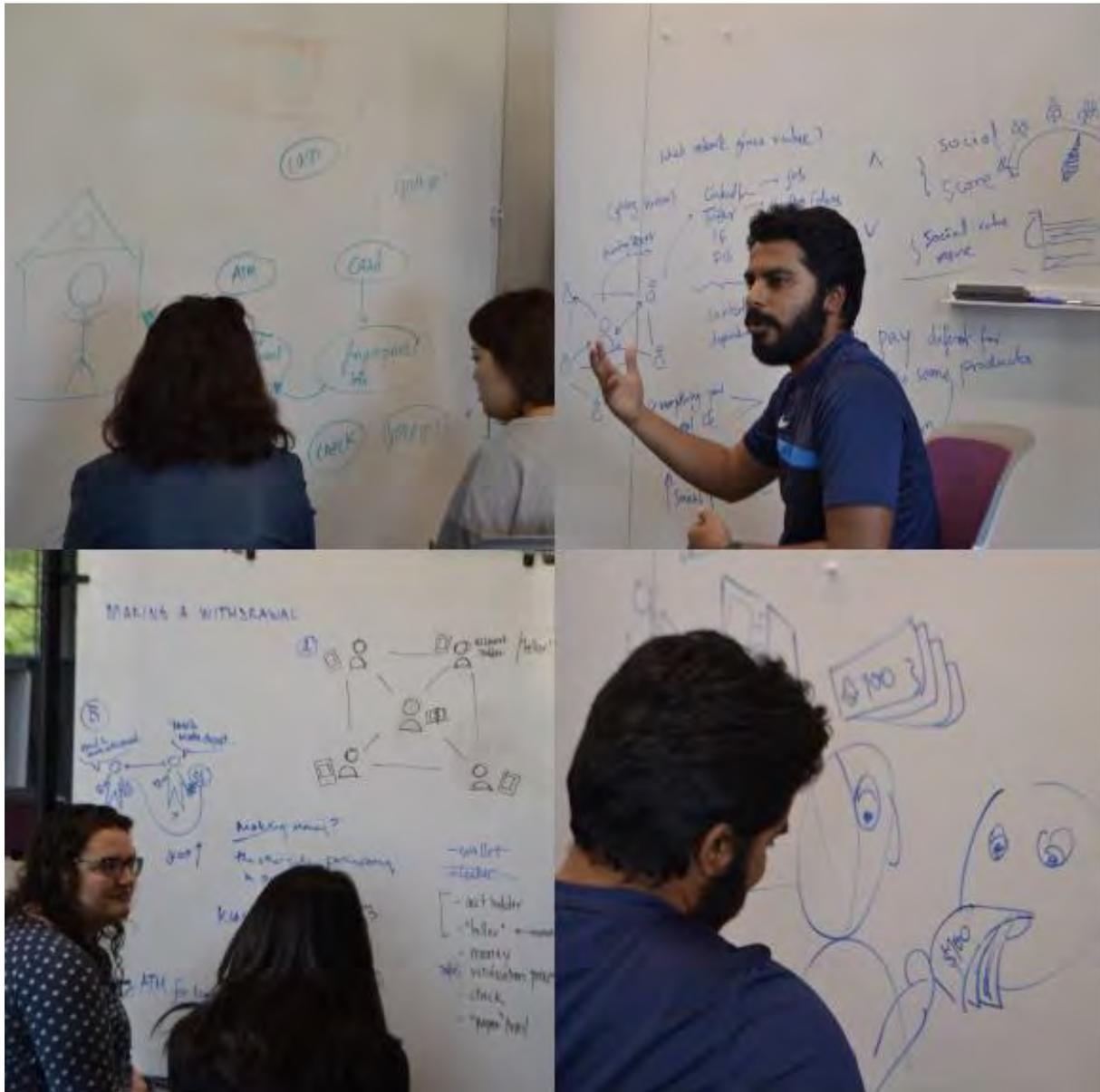


Figure 12. Validation workshop on Financial Health

Conversation that was spurred centered around the script that humans delegated to money and what humans displaced when delegating the script to money. We also noted that most scenarios treated social relations as capital, and if AS also looked at social relations. The workshop participants found that AS was useful in changing the way one thought about a system, specifically what would happen when that system was switched back.

## 5 Discussion

### 5.1 The Benefit of Actant Switching

AS is a useful way of reframing problems/exploring problems as different relations or properties may emerge in its creation process. ANT in this iteration of AS and SF has proved useful when trying to understand social conditioning and constructs as related to one's possessions and the type of care one deems to be acceptable.

Tensions and imbalances resulting from AS allow one to examine their relationship to the context. When one attempts to rebalance the scenario, one is forced to make explicit the implicit relationship between actors. Thus, forcing one to confront what it is that they like or don't like or care about in

relation to particular actors in their life. Since AS focuses on switching non-human actors with human actors, this un-automation primes the conversation to one's relationship with technology.

## **5.2 The Benefit of Service Fictions**

In showing participants a speculative design that sits on the boundaries of a context, participants can relate this slightly counterfactual scenario to their own life, without it being part of their own life. This allows individuals to safely engage in fictional world building that is relative to them. The fact that this created world isn't real and is fictional allows participants to feel that they can engage. How they relate this world to their life is where insights can be and are gained about the context and boundaries. These thoughts towards a provocation can be extrapolated to be one's relationship to provocation itself, and thus their relation to the original context.

SF work well with sensitive contexts and expose insights from participants and stakeholders without broaching the topic head on. Generally, sensitive topics are difficult to ascertain what the participants truly feel about the topic. This may be due to the participants not knowing how they feel and needing to figure out their thoughts towards a prompt. Exploration of this in real time can capture and lead to powerful insights. Alternatively, sensitive topics may be considered private and considered not up for discussion. Speculative scenarios are fictional, are not based in this current world, and thus provide an analogous storytelling element where participants feel that they can engage because it is fictional and thus not about them or their situation.

### *Captured Engagement*

SF are an attempt to allow individuals to engage and react with speculative scenarios in a way that can be captured. Slowly stepping through a scenario, allowed the participants to experience and engage with the SF rather than just reacting to it. By stepping through it, participants could digest smaller bits of information, and acclimate slowly to the scenario prompt. Also giving the participant not the script itself but the prompts to generate the script allowed them to respond to the reasoning behind the scenario, not the scenario itself. This led to the point that the scenarios generated reflected the participants' own personal values and boundaries.

### *Analogous storytelling*

Participants may be reluctant to voice their experiences to a complete stranger. Since the prompt is fictional, it is not about them or their experience, however since it is the participant who is telling the story, aspects and reasoning are not separated. It is about what is acceptable to the participant, and their boundaries. Analogous story lines allow the interviewer to dig deeper without being intrusive to the sensitive aspects of the participant's day to day.

### *Defines boundaries on social norms*

In some slightly sensitive contexts, individuals hold vastly different mental models towards a chosen context. Yet, people are not aware of these differences, and assume their mental models are the same until they are made explicit. This method breached slight social norms, to see where the norms were for different people.

### *Decisions on level of engagement*

Participants accepted creating scenarios, but as soon as they were asked to act it out, they felt as if it was an intrusion to their privacy, or they felt weird, or they felt that was asking too much. This reflected the level which the participant is free to explore the scenario. If it is just talk, it is still fictional, when they are asked to act it out, it becomes more or less real.

## **5.3 The Limitations of Service Fictions**

It is well known that there is a difference in what people say that they want, versus what they do, and therefore what they actually want (Bertrand, Mullainathan, 2001). When participants build their own scenario based on the designers prompts, it is not about what they want but their rationale behind that leads to insights.

Some people were initially reluctant to explore creation of the script because it was still out of their comfort zone. It was only when the designer said "I understand it is weird and I understand you may

not want this, but what would happen if this were the only way you could go to sleep". This was the allowance needed for people to engage in the SF. SF seemed to be the right amount of abstraction for people to engage.

Some participants still found it hard to engage due to the semi-private context and only answered what was specifically asked. This made it more difficult to spur conversations or to go off script, so some scenarios were short and not very detailed. The benefit of the semi-structured-ness of the script creation was to allow people to wander and reflect in the moment. This is still valuable however, because one is able to see and reflect about where their boundary was. In retrospect, it was hard to ask 'why' at the end of the creation of each SF. Instead 'whys' were asked during the conversation or when the participant felt the need to explain.

This method is used to gather insights, it does not attempt to analyse insights. Analysis is a separate event and has been used successfully with clustering.

#### **5.4 Applications to Service Design**

AS interchanges a nonhuman actor with to a human actor. This switching turns a system into a service.

Service design is concerned with designing people's actions within the system that they operate. ANT says that each actor in a system is interchangeable (whether it is a human or technology), so in designing a service- the designed service designs human actions the same way one would design a product. Each actor has a purpose and plays their role.

There is value in using these two methods to make relationships explicit, or understand where the boundaries are particularly when researching sensitive topics. Defining relationships, one starts to see how actors and roles are delegated to each other. In any service or service ecosystem, modelling things in terms of actors allows one to see what part of the system relationship or goals are delegated to human actors and which ones are delegated to nonhumans, and how they delegate to each other.

## **6 Conclusion**

This article describes and details the development of AS and SF. Both help to uncover an individual's relationship in a context/system/or network by making explicit the implicit relationship in a system or network. Both techniques enable design researchers to explore questions of people's relationships with, and delegations of agency to, technology in everyday life.

AS provides an imbalance that through rebalancing allows the designer to reflect on their relationship to a context and the technology within that system. This imbalance allows the designer to look for the boundaries of the context through generation of different scenarios, and by doing so examine what roles are delegated to what actors, and what those roles mean when given to a human actor. Reflection of these delegations perhaps change how one perceives technology in the given context.

SF allow designers to engage participants in rebalancing the imbalance created with AS, and enable capturing the participant's reflection in real time. This opens up pathways of conversation not available in the typical interview session. Understanding how speculations would manifest in the participant's life and their reasoning for their decisions, allows the researcher to see values, boundaries, and beliefs that would otherwise be harder to obtain. In making relationships explicit, participants are provided an entry point to talk about their preferences if not reveal their values to themselves. SF are a useful way to gain access to participants' ways of thinking, and to build the variation of mental models towards a context.

Both techniques rely on the imbalance that switching actants provides. This allows one to examine the roles and meaning placed upon nonhuman or human actors. In the case study, the role an object or technology played became intrusive and awkward when a human performed the same action. As a result some participants attempted to dehumanize them and turn their role back into technology. Participants were more aware of the actions humans performed, rather than an object providing the same action. The act of understanding these tensions and attempting to rebalance the system so the

scenario becomes plausible if not preferable, uncovers implicit roles and its underlying contingencies and one's relationship to both the context and its technologies. The use of AS and SF can give powerful insights for discovering the intricacies of the implicit interdependencies internal to a system and our relationship to them.

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# The Use of Philosophical Theories in Design: A Research-Through-Design Case of Treatment Compliance

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Design has a key role in shaping humans. In the design process, an understanding of the complex human and its often conflicting relations could be fruitful to improve the design. Ideas from Philosophy of Technology could offer a different perspective on product design. In this paper it will be explored how a philosophical perspective can support the design process in case of a conflict of interest using the 'research-through-design' method with a case study of clubfeet treatment compliance. The comfort and usability of the treatment could be improved using a brace instead of a cast. However, this change raises two conflicts of interest between and within parents, child and medical experts. Two philosophical theories were used, the Mediation Theory and the Product Impact Tool, to analyse the problem and design solutions. The results are, finally, discussed in light of the general design process. This philosophical perspective in the design process enabled the designer to reveal the core problem and design solutions that go beyond a technical fix.

*philosophy of technology; product impact tool; design methodology; treatment compliance*

## 1 Introduction

The question of what design entails is one that is difficult to answer. Design has a broad scheme of fields and styles, from graphical to technological to service design. The overarching characteristic in all these directions is, however, that design is always about humans (Buchanan, 1995). Similarly, the design of products and technologies is also about humans because it contributes to the material environments in which humans live and are shaped (Dorrestijn, 2012; Verbeek, 2005). A merely engineering approach to the design of new products seems, therefore, not sufficient to create products that are compatible with the life of people. Humans are complex beings: the interests and requirements for a product are often conflicting between different stakeholders, between individuals and society and even within individuals themselves. Understanding humans and the relation they have to each other and their technical environment in the design of products needs an



approach that goes beyond the technical. Philosophy of Technology is a rising field of study that has potential to be fruitful in the process of designing products and technologies for humans (Dorrestijn, 2012; Verbeek, 2005), especially when there is a conflict of interest of any kind. Philosophy has a long tradition of trying to understand and find the deeper problems concerning humans. Could this tradition be useful in the process of design, a practice that is also deeply intertwined with humans? In this paper the question will be explored how a philosophical perspective can support the design process in case of a conflict of interest.

## **2 Research approach**

The added value of using philosophy in a design problem was explored during a case study about clubfeet treatment (van Belle, 2017). In this 'research-through-design' approach (Findeli, 2010; Frayling, 1993), two different tools derived from philosophy of technology were used to analyse and conceptualise a dynamic brace to treat clubfeet in which multiple conflicts of interest occur. The case study offers an active approach to find the practical uses of the philosophical perspective. First, the case study of clubfeet treatment is presented. Second, two philosophical tools are explained. Then it will be shown how these tools were used for the analysis and design of the case. Finally, the end results are discussed against the background of the general use of philosophy in design problems with a conflict of interest between and within different users and stakeholders.

## **3 Case Study: Clubfeet treatment**

A clubfoot is a congenital deformation of the foot that can be diagnosed at birth. Typically, the clubfoot is corrected using the Ponseti method, which entails a casting period of five to six weeks. During the casting period, the foot and leg of the baby are fixated with a plaster cast reaching up to the diaper (Pletch, Morcuende, Barriga, Segura & Salas, 2015; Scheurs, 2007). Even though the method is effective in treating clubfoot, the casting period offers multiple usability problems for the parents of the child. These problems range from practical to health to emotional problems. On the practical side, (1) it is hard to find clothing that fits, (2) it is difficult to bathe the child, (3) change the diaper and (4) clean the cast. Besides, (5) the cast feels wet and cold, which is an unpleasant feeling to both parents and child. The treatment also causes common health problems like (6) skin problems and (7) increases the risk of bladder infections. Additionally, (8) the cast itself is heavy on the legs of the child and immobilizes them, possibly affecting the development of the knee. Emotionally, (9) it is harder for parents to hug their child, (10) they get bad reactions from others and (11) are sometimes insecure on how the cast might look to strangers. Also, (12) parents reported that for example bathing is an important activity for bonding with their child, which is now practically impossible (Nogueira et al., 2013; van Doorn, 2016).

The Biomedical Engineering Department of the University of Twente is, therefore, developing a dynamic brace to replace the casting period. The brace would offer a more comfortable, hygienic and more efficient alternative, because it can be taken off by the parents when taking care of the baby. However, during the development of prototypes and feedback sessions with parents the department came across new problems regarding the usability and treatment compliance of the dynamic brace. The use of a brace instead of a cast means that the parents are now becoming an important part of the treatment. Where they first had to undergo the treatment together with the baby and deal with the consequences as they were, they will now be responsible for putting the brace on as often as possible. Since the possibility is there, the parents might impede treatment by taking the brace off for any small reason. The parents are now active attributers that need to comply with the treatment for it to be effective on the long run (Dobbs et al., 2004). The first conflict of interest is, therefore, the conflict between usability and responsibility, which changes the relationship between child, parents and medical experts.

The Biomedical Engineering Department is struggling with this problem, because there doesn't seem to be an easy technical fix. They want to improve the treatment in terms of comfort and usability,

but don't want the parents to obstruct the treatment. The dynamic brace places the parents in a difficult position in which there is an internal conflict between the short term intuition of preventing discomfort and the long term treatment and health of the baby. The second conflict of interest is, therefore, within the parents themselves in regard to the taking care of their child.

To analyse the problems regarding the non-compliance of the dynamic brace and create solutions, two different theories derived from philosophy of technology were used: the Mediation Theory of Peter-Paul Verbeek (2005) and the Product Impact Tool of Steven Dorrestijn (2012). First, these two theories were used to ideate on different solutions for the clubfoot compliance problem of the dynamic brace. Second, three ideas were elaborated into design proposals. The proposals are mainly focused on the interaction between the parents and the clubfoot brace. They consist of a visualisation of this interaction and the argumentation why it is likely to improve the treatment compliance of the brace treatment for clubfoot. Finally, the three proposals were evaluated using the two philosophical theories again and recommendations for the further development were proposed.

## **4 Philosophical theories**

To gain a better understanding of the problems concerning the case of clubfoot treatment compliance, the two philosophical tools were used to analyse the problem at hand. Questions were asked, following the theories, on how the stakeholders related to each other and the previous and new treatments. The philosophical perspective was then used to reframe the problem, so that different solutions can be found.

### **4.1 Mediation Theory**

The Mediation Theory is an answer to the question how the role of technologies in our lives can be understood. The approach stems from the idea of the mutual constitution of subject and object, that is, of human and world. Following the ideas of Post-phenomenology as laid out by Don Ihde (1990), it is understood that humans and their world are always interrelated. According to Verbeek (2005), technologies are mediators of the relationship between humans and their world: humans and technologies are intertwined instead of two opposing entities. Artefacts are not neutral intermediaries, but actively co-shape people's being in the world by mediating the way reality can be present for people and the way people are present in the world. By using technologies, humans change their perceptions of the world, like glasses change how we see the world. However, technologies also influence how people act and exist in the world. The mobile phone, for example, has changed how we interact with our friends and family. Designers could, according to Verbeek, anticipate the mediating role of products during the design process to ensure a better interaction and impact of their designs. This anticipation should not only look at the functionality and meaning of artefacts, but especially at the materiality. Mediation occurs, namely, because products are being handled and perceived by humans, and not only liked or used functionally (Verbeek, 2005).

Following the Mediation Theory, it can be found that the dynamic brace changes the parents' perceptions of, and actions, in the world. Where parents perceive themselves as a receiver of treatment with the cast, with the brace they perceive themselves as a giver of treatment. This raises insecurities and considerations on how to take good care of the child, because parents are not educated as medical practitioners. These insecurities are reinforced by the fact that a removable brace gives an image that it is sufficient to not follow treatment from time to time, because parents have by design the ability and authority to do so. Compliance with the treatment becomes a problem, because parents are not forced to comply anymore, but have to be motivated. This is a problem, because motivation is less predictable and needs to eliminate forgetfulness, laziness and a lack of knowledge. All in all, the underlying factor in compliance is the ability of parents to deal with new responsibilities in the treatment. The original cast treatment asks for a lot of engagement to keep the child healthy and clean during treatment, where the dynamic brace solution asks for a lot of engagement of the parents to make sure the clubfoot will be treated well on the long term.

Therefore, the role of the parents in the relationship towards the child has changed and given the parents more responsibilities (van Belle, 2017).

#### 4.2 Product Impact Tool

In contrast to Verbeek's philosophical theory, Dorrestijn (2012) has created a more practical method for analysing technologies philosophically. He combined the overlapping interests of both philosophy and design research concerning the mutual adaptation of technologies and humans. With the Product Impact Tool, Dorrestijn brought together the knowledge of design theory, psychology and philosophy on the impact of products on human and society. The tool consists of a model (figure 1) containing four quadrants. Each quadrant represents a different way an influence reaches the human: via the conscious decision-making process (before-the-eye), physically (before-the-hand), via the environment (behind-the-back) and by changing ideas and thought-structures (above-the-head). In each of the quadrants there are three different concepts explained that elaborate how products impact people more specifically. In the 'to-the-hand' quadrant, for example, the concept of coercion explains how products and technologies can physically force users into a certain kind of behaviour. An example is the speed bump that makes sure that car drivers have to slow down in order to not break their neck or car (Dorrestijn, 2012).

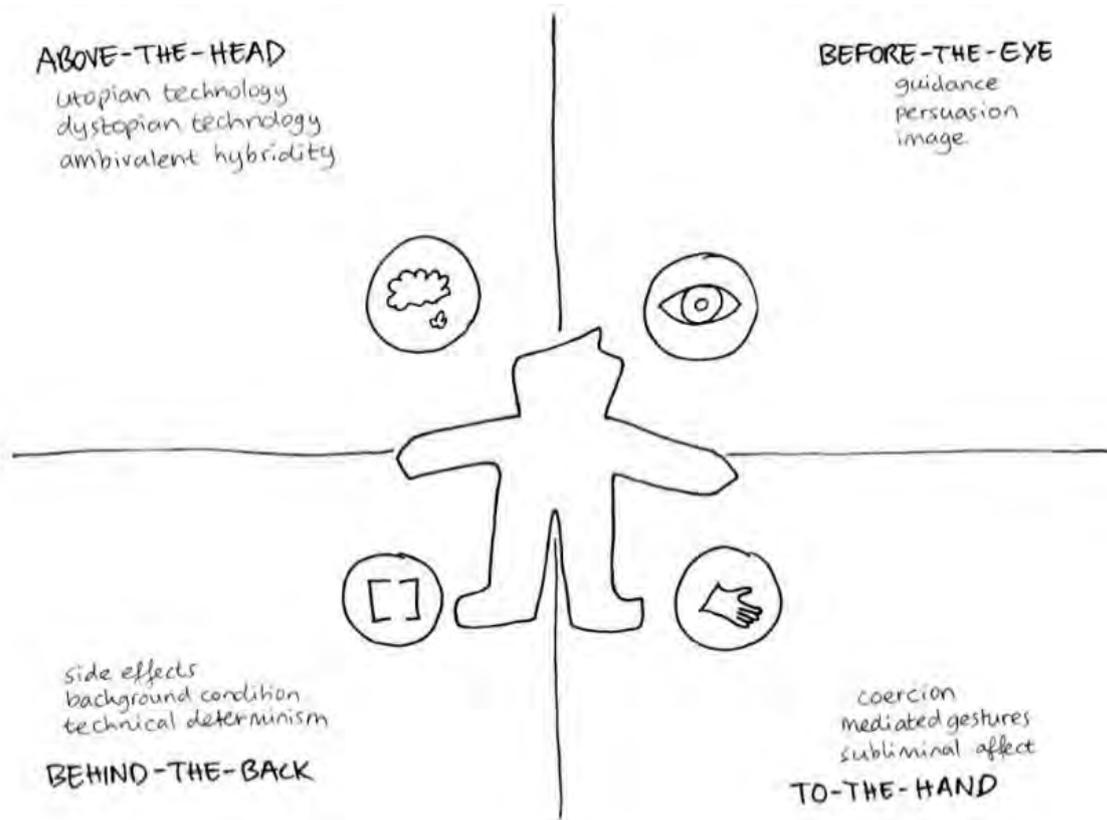


Figure 1: the Product Impact Tool (adapted from: <http://stevendorrestijn.nl/tool/>)

Different quadrants of the Product Impact Tool can be used to both analyse existing products for their impact and create new design solutions. Designers can use the tool in brainstorm-like sessions to take a step back from the design process and look at their product concept from a new perspective. The tool can also be used to create solutions for specific social and environmental problems of a product (Dorrestijn & Eggink, 2014; van Belle, 2016).

Using the Product Impact Tool, it can be analysed that the dynamic brace is a somewhat utopian solution. The brace tries to solve the usability problems of the cast by eliminating the coercing effect and giving the parents more freedom and responsibility. However, giving the parents more freedom

and responsibility turns out to have its own problems in the compliance of the treatment. Important values that are in play are the care and health of the child, but also the appearance towards others and the acceptance of the situation. In addition, the brace has a different image and association than the cast: it looks less serious and, therefore, less pitiful, but also less effective as a treatment than the casting treatment. There is also a shift in side-effects, from the usability issues to the compliance issues (van Belle, 2017).

## 5 Design proposals

The results of the analysis were used to create different design solutions during an ideation phase. Since the ideation phase offered a wide range of creative solutions, important points in choosing the best ones were the feasibility and amount of coercion in the design of the brace. To meet these requirements, it was decided to opt for the design ideas that can be taken off completely and were as simple as possible (no electronics and complex systems). Based on these ideas three design proposals were set-up and elaborated on their interaction, use and effectiveness: proposal “parent-participation”, proposal “baby-toy” and proposal “keep-it-close”.

### 5.1 Parent-participation

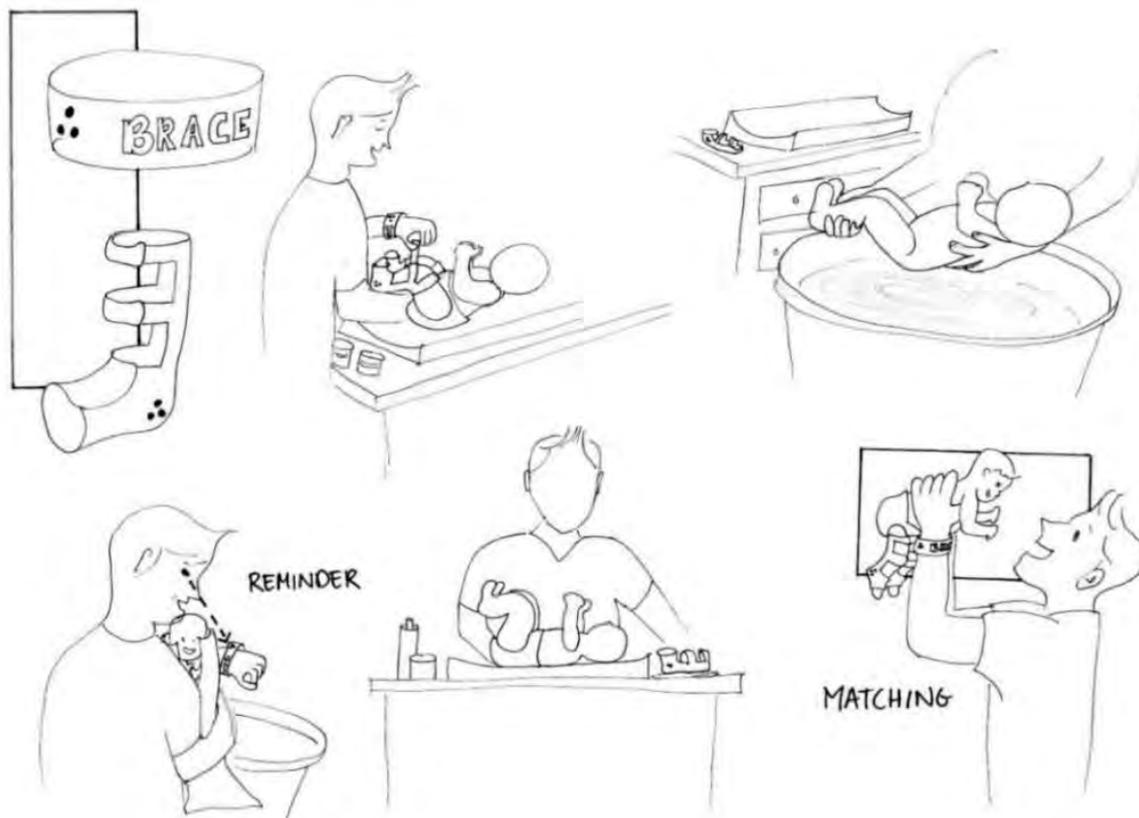


Figure 2: description of the parent-participation design proposal

With the parent-participation proposal (figure 2), the focus is on giving the parents the idea that they are partly undergoing treatment together with their child and giving them less opportunity to forget to put the brace back on by providing a little reminder. In this concept the parent is wearing a bracelet that matches the colours and patterns of the brace for the child. On the bracelet is an empowering quote (for example ‘Beat Clubfeet!’) to deal with clubfeet. This might improve treatment compliance for several reasons. First, the parents are more connected with the brace, because their bracelet is matching. It stimulates an idea that the parent and the child are together in this treatment, which could raise the motivation to comply with the treatment. Second, the bracelet works as a reminder to put the brace back on, making it less likely for the parents to forget. Finally,

the bracelet has a motivational quote which might raise the motivation to comply with the clubfoot treatment.

## 5.2 Baby-toy

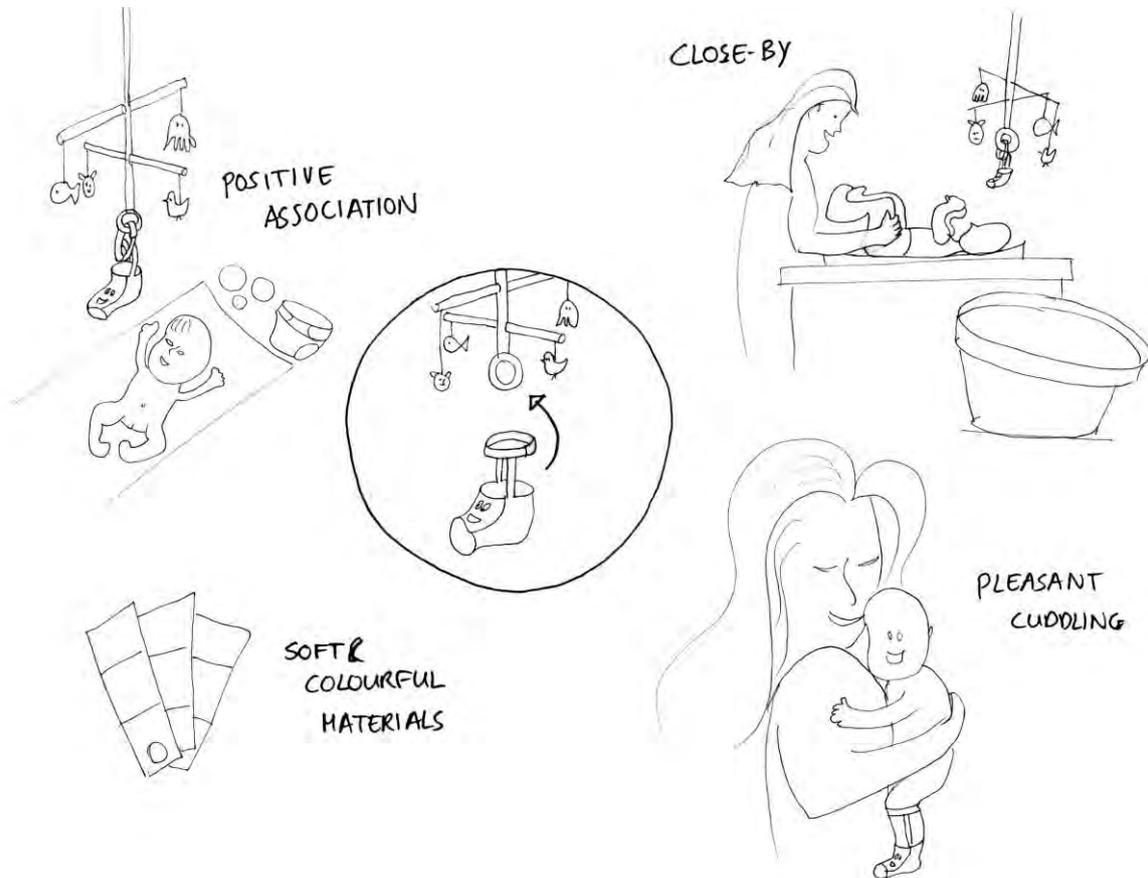


Figure 3: description of the baby-toy design proposal

The focus with the second proposal (figure 3) is on giving the brace a friendlier and more cuddly image, that is more comfortable to the senses of both the baby and the parents. The idea of this concept is that the brace has soft materials and can be used as a baby-toy when it is off. Babies of a couple months old can differentiate different colours (Bornstein, Kessen & Weiskopf, 1976) and a variety of objects that can be grabbed or reached in its environment stimulates the child positively (Yarrow, Rubenstein, Pedersen & Jankowski, 1972). In this proposal, when the brace is off, it can be hung in a part of a matching mobile above the diaper changing station. This is an improvement in comparison with just a plain brace for a couple of reasons. First, the brace is actively associated with positive aspects, like fun, diverting and decoration. Besides, it has soft materials, making it more pleasant to touch and less of an annoyance in cuddling and bonding with the baby. Third, if the baby enjoys the brace, it creates a more positive association about the treatment for the parent, making them more motivated to comply with treatment. Lastly, the brace is always kept close by the baby when it is off, making it harder to forget about it.

## 5.3 Keep-it-close

The idea of the last proposal (figure 4) is that parents are less likely to forget the brace if it stays close to them. Next to that, it stimulates the idea that parent and child are undergoing treatment together by providing a way in which the brace is always either on the feet of the child or around the neck of the parent. The brace in this concept has to be taken off with help of a key on a cord that hangs around the neck of the parents. As long as the brace is not on the feet of the baby, the key holds on to the brace, ensuring that the brace is always either on the feet or on the key cord. This

will improve treatment compliance, because the brace is always kept close (around the neck), so it is less likely for the parents to forget it. In addition, the parents are more connected with the treatment, because they are also “wearing” the brace for certain amounts of time.

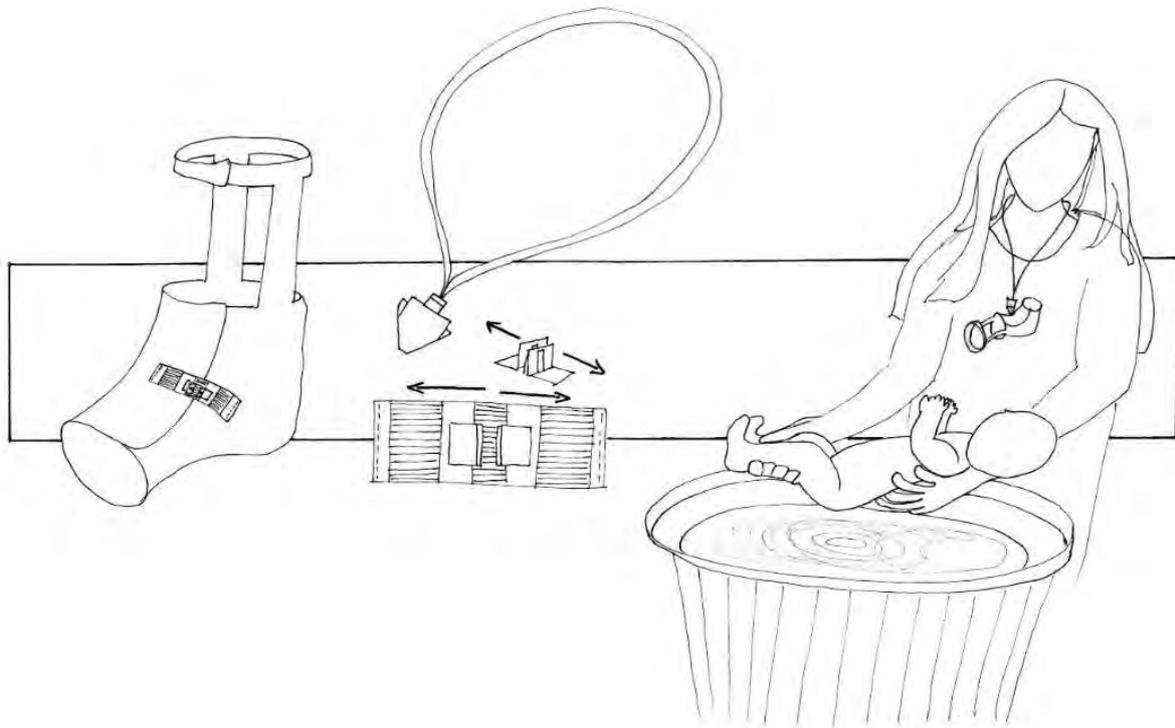


Figure 4: description of the keep-it-close design proposal

## 6 Evaluation of the proposals

The three design proposals were then again evaluated using the philosophical theories. This ensured the designer to take a step back and look at the bigger picture of the different relations between stakeholders and treatment.

Broadly seen, the parent-participation proposal is mainly based on the before-the-eye quadrant of the Product Impact Tool and makes use of conscious persuasion, guidance and a reminder to help the parent build a routine to comply with the treatment. In this concept the brace is accompanied by a matching bracelet for the parents, which creates an image of solidarity. Besides, the bracelet acts as a stimulus and a reminder from the doctor which can be perceived as supporting the responsibilities of the parents regarding the treatment. In addition, the motivational quote helps to perceive the disability as something that can be changed.

The baby-toy proposal takes another route by mostly focussing on changing the unconscious associations of the parents with the brace by use of physical properties and is therefore more fitting into the to-the-hand quadrant of the Product Impact Tool. In the before-the-eye quadrant, on the other hand, the soft feeling and friendly look of the brace gives a positive association and makes it more positively perceived as belonging to a baby, instead of a device for treatment that is imposed on the baby. In terms of the Mediation Theory, the attention and engagement of the parents is now also on the brace itself and not only on the treatment it embodies.

The third proposal is based on distance: by coercing the parent to keep the brace close it tries to lightly force treatment compliance, but creates at the same time a distance between the baby and the parent. To explain this further, it can be understood as the decreasing of the physical distance between brace and key, since the key is embodied in the parent. The brace can only be opened by them together. To use the terms of the to-the-hand quadrant of the Product Impact Tool, it coerces

the use of the key. On the other hand, the mental distance between parent and child is increased, because the using of a key to open the brace distances the action from the baby. Instead of taking off a brace, it might even feel like opening a device. This can possibly create an association with an unpleasant device from which the baby needs to be freed.

Based on the philosophical analysis and evaluation, the most important ideas to keep in mind when developing the brace are to be aware of the image and associations the brace gives to the parents and others involved; how it feels to the senses and the mind in handling the brace, and lastly, what the role is of the parent in the treatment. The parent shouldn't feel the pressure of a lot of responsibilities in the effectiveness of the treatment. To minimize their insecurities, it should be clear to the parent what their role is in the treatment. Even though they will always be responsible for taking the brace off and putting it back on, the design intent of the brace can be of help in making sure the parents feel not as responsible as they actually are, since having a new-born baby is already hard enough to deal with. The design of the brace should, therefore, help them by guiding, reminding and informing as much as possible.

In the end, treatment compliance is a human subject that needs an approach which takes the actual users into account. Proceeding with the design of the brace, it is of importance to involve the users themselves in the design process with questionnaires and user testing. Even better would be to specifically ask the input of the parents in the design of the brace itself by using co-design sessions. The Product Impact Tool can also be used in this case, because it has proven to be a great tool to use in a brainstorm session with users (van Belle, 2016). The different quadrants give a clear structure to such a session and can offer a new perspective on what it means to deal with the brace for the parents which can fuel their design inspiration.

## **7 Results**

The use of the two philosophical theories in the case study of clubfoot treatment led to three design proposals that are technically simple, but have potential to address the problem of treatment compliance effectively. The use of the theories, however, asked for a bit more theoretical philosophical study than a designer could be used to in the common design process, especially in the case of the Mediation Theory. There was some introduction into Philosophy of Technology required to understand the different concepts used. The Product Impact Tool offered an approach and terminology that fits the practice of design better. Despite this small obstacle, the use of the two theories provided an interesting and extensive way to not only identify the conflict of interest, but also find the assumptions, beliefs and images that lie beneath the conflict. The philosophical perspective enabled the designer to reframe the problem, so that different solutions could be found. An interesting insight was, for example, the fact that a brace gives a completely different image of treatment effectiveness than a cast, which could explain why in a previous study (van Doorn, 2016) the parents leaned towards a brace/cast-combination treatment instead of a complete brace. The use of philosophical tools could, therefore, additionally be of help in critically analysing the user input derived from questionnaires and user testing.

For the analysis part, the Mediation Theory proved to be more useful than the Product Impact Tool, which could have been for two reasons. First, the Mediation Theory is more focused on analysis, whereas the Product Impact Tool is more focused on design. Second, the use of the Mediation Theory before the Product Impact Tool might have influenced the amount of new insights found in the Product Impact Tool analysis, creating a bias that the Mediation Theory was more useful. However, based on the first argument, the use of both Mediation Theory and Product Impact Tool in the design process is a fruitful combination.

## **8 Discussion**

The deeper understanding of the underlying assumptions resulted in solutions that worked on a different level and were not just a technical compensation of the negative side effects. As a result,

the solutions were rather simple and intuitive, but well substantiated and potentially effective. The baby-toy proposal addressed the image of the brace not only visually, but also tactile and associative. A similar solution had previously already been discussed in the department, but the philosophical theories offered a stronger argumentation to go into this direction than 'it just feels good'. The parent-participation proposal offered, for example, a solution to the separation of parent and child in the treatment by recreating a mutuality in the treatment. The keeping-it-close proposal also offered a solution to the separation problem using the embodiment of the brace as a type of mutual identification between parent and child.

In general, the use of the Mediation Theory and Product Impact Tool in this case study achieved positive results. The philosophical ideas and analyses might be unfamiliar to designers, but can give an insight in how the design is perceived and how it influences actions and behaviour. It, therefore, contributes to the core of design by helping to create new solutions for human problems. This paper offered of course only one case study and wasn't able to make a comparison with the results without using philosophy, because it is practically impossible to control the conditions of such research, but it was able to show the potential philosophy of technology has in the process of design in case of one or multiple conflicts of interest.

## 9 Conclusion

In conclusion, the case study of clubfeet treatment showed how the design of a product that needs to address a complex conflict of interest can be supported by the use of ideas from philosophy of technology. Especially the Mediation Theory proved to be useful for the analysis of the problem, whereas the Product Impact Tool showed fruitful in the ideation of new solutions. A philosophical perspective and understanding in the design process enabled the designer to reveal the core problem and design solutions that go beyond a technical compensation of side-effects. In addition, the two philosophical theories used offered a framework to argue why the created solutions were a good answer to the analysed problem. The use of philosophy of technology was, therefore, able to bring designers the tools to better understand and design for the complexity of the human being.

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# Turning Philosophy with a Speculative Lathe: object-oriented ontology, carpentry, and design fiction

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Arising from the complex relationship between their physical affordances, digital shadows, and interconnections, the things which make up the ‘Internet of Things’ (the IoT) present designers, users, and society at large, with a range of unique and as-yet-unfamiliar forms of network-contingent agency. These new design spaces engender new forms network anxiety, that in turn can result in a range of ill effects including overstimulation, information overload, and paranoia. Contemporary philosophies of technology provide a theoretical base with which designers can temper these emergent techno-anxieties with a sort of scholarly comfort blanket, however, closing the loop between such theories and design practice so that one explicitly informs the other remains a rarely-tackled and elusive challenge within design research. To help explore how designers may underpin their practice with philosophical foundations, in this paper we recount our own experience of conducting an IoT-based Speculative Design project. This research attempts to encode, enact, and express ideas derived from a contemporary philosophical movement—Object Oriented Ontology (OOO)—and ‘Carpenter’ those ideas into designed artefacts using the Design Fiction as World Building approach to Speculative Design. To ‘turn’ a physical material—wood, metal or plastic—means reshaping the material with a lathe to afford it a tangible elegance and grace. Metaphorically speaking, in this paper, OOO is our material and Design Fiction is our lathe, we reflect on the process of sculpting and carving theory, lending shape and poise to OOO through Design Fiction enabled Carpentry.

*internet of things; object-oriented ontology; speculative design; design fiction*

## 1 Introduction

Design and technology shape and change both us and our world. Designers, the things they design, and the people who interact with those things, are instruments of rhetoric (Buchanan, 1985) and are mutually influential, together shaping the world (Silverstone, 2006; Stam & Eggink, 2014a). This holds true across many domains and contexts, with examples including industrial design (Lockton,



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Harrison, & Stanton, 2010), design of services or platforms (Stam & Eggink, 2014b), and even areas such as video game design (Coulton, Burnett, & Gradinar, 2016). By attempting to understand the nature of this reciprocity between designers, users and things, the social construction of technology—which can be cast in various lights such as domestication (Silverstone, 2006), mediation (Verbeek, 2015), or emerging lenses like ‘open script’ (Stam & Eggink, 2014a, 2014b)—is a key driver of the Philosophy of Technology’s so-called ‘empirical turn’ (Brey, 2010). Theories contributing to this empirical turn reject pessimistic-by-default and dogmatically-deterministic perspectives, and rather than referring to capital-T ‘Technology’ as a universal phenomenon refocus their interests on *specific* technologies and/or use contexts. Given the pervasion of technology through society during the late 20<sup>th</sup> century it was perhaps inevitable that pragmatic and empirically reinforced theories, equipped to differentiate between disparate technologies and contexts, also emerged in this period. During the 21<sup>st</sup> century technologies and the profundity of their impact on society have become even more ubiquitous. This ubiquity of effect brings with it, as Brey points out, the need for supplemental theories which help us make sense of a landscape that changes ever-quicker:

*“To better understand human-technology relations, we need theories of the interaction between technological artifacts and practices on the one hand, and human perception, cognition, action, experience, identity, body image, moral development, moral deliberation, human nature, basic beliefs and values, and so forth. Without such theories, either developed within philosophy or borrowed from the social sciences, we can make little progress in understanding and evaluating human-technology relations.”*  
(Brey, 2010)

The merits and necessity of this empirical turn notwithstanding, bridging the space between theory-derived insights and the messy tangibility of design practice—to take a so-called *practical turn*—is not straightforward. To explore aspects of this *practical turn*, within the context of the empirical turn, is the principle aim of this paper. We achieve this by using Speculative Design to enact and give form to Object Oriented Ontology (OOO)—a new materialist branch of metaphysics (which is, perhaps, in an *ironic* ascendancy, given the Philosophy of Technology’s relatively recent conveyance towards empiricism). Irony aside, within the domain that the design practice this research has emerged from (the IoT) OOO’s rejection of ‘correlationism’ (Gratton & Ennis, 2014) and proposed ‘flat ontology’ (Bryant, 2011) seem to be useful means to theoretically present the IoT’s network-and-data contingent ‘constellations’ of agency and meaning (Lindley, Coulton, & Cooper, 2017). We build on the OOO thesis and mediate the challenge of the practice-theory gap by experimenting with ‘Carpentry’— a kind of “philosophical lab equipment” (2012). Put simply, Carpentry is “making things that explain how things make their world” (ibid). The process we describe in this paper, then, is about making ‘Speculative IoT things’ whose purpose is to explain how ‘IoT things’ make the ‘IoT world’. While the work is based on insights gleaned from an IoT research project, the main contribution of this paper is *not* about the IoT itself, but rather the intention is to provide generally applicable insights about how to give shape, form and poise to theory—in this case OOO—by using Speculative Design.

The paper is organised as follows. First, we provide additional background with an introduction to OOO and Speculative Design. Then, we explore the design space of our case study, describing the IoT and then discussing contemporary IoT design issues. Next, we provide a reflexive account of how we brought these constructs together in a design process, detailing the designs themselves. Finally, we reflect on what we have learned about enacting and shaping OOO by using Speculative Design to inform future design practice.

## 2 Object Oriented Ontology

As we are not philosophers we willingly defer the task of arguing OOO’s validity and/or critiquing its merits to those more qualified than ourselves. However, what follows aims to articulate an

accessible summary of our interpretation of OOO and to contextualise the subsequent account of the interplay between our design practice and our engagement with theory.

In his seminal work *Being and Time*, Heidegger presents his view of ontology. By providing the foundations for OOO this highly influential 20<sup>th</sup> century philosophical text has taken on a new life in the 21<sup>st</sup> century (Harman, 2002). The traditional Heideggerian view argues that things—*objects*—are all but impossible to understand in their own phenomenological terms, and therefore, we should make sense of them in relation to human use. Heidegger coined neologisms to communicate his argument, and famously uses a hammer as an example. When a hammer (or other object) is in its normal context of use it is ‘ready-to-hand’ and if that context is disturbed (for example if the head of the hammer falls off) then it is described as ‘present-at-hand’. The metaphysics of this distinction are complex and must be negotiated outside of this paper, but the important point to note is that the hammer only comes into being via a human use (or perhaps non-use, in the case of the broken hammer). Central to the Heideggerian position is the notion that existence is a “correlate between [the human] mind and world” (Bogost, 2012). That these two constructs are inseparably linked is what Meillassoux refers to as ‘correlationism’ (Gratton & Ennis, 2014). OOO *rejects* this notion of correlationism and instead entertains the idea that objects have their *own* realities which are distinct from human use. From this post-correlationist position, anything—literally *any thing*, from a fibre optic cable, to a blade of grass, to a quantum computer, to a gooseberry fool—may be cast in the limelight of its own ontological resolve. If we consider the amalgamated glow that emanates from the bazillions of tiny *lights-of-non-correlationism* then the resulting luminescence is what illuminates the tundra of OOO’s so-called “flat ontology” (Bryant, 2011). Having departed from familiar and intuitive human-centric ontologies, the vantage point one must adopt when considering the nature of OOO’s flat ontology is a strange and conflicted place to stand:

*“In short, all things equally exist, yet they do not exist equally [...] This maxim may seem like a tautology—or just a gag. It’s certainly not the sort of qualified, reasoned, hand-wrung ontological position that’s customary in philosophy. But such an extreme take is required for the curious garden of things to flow. Consider it a thought experiment, as all speculation must be: what if we shed all criteria whatsoever and simply hold that everything exists, even things that don’t? [...] none’s existence fundamentally different from another, none more primary nor more original.”* (Bogost, 2012, p. 11)

This open-endedness is necessary because in OOO the scope of the term ‘object’ is not limited to *material* things, but extends to include *any* given idea or construct. Such a categorisation requires special appreciation, and a theory which allows for multiple types of ‘Being’ to meaningfully coexist. Exemplifying this Bogost uses the famously ill-fated video game *E.T. the Extra-Terrestrial* as an example. He muses that E.T.’s object, is in fact simultaneously many different things:

- 8 kilobytes of opcodes
- a compilation of source into assembly code
- a flow of radio frequency into a television
- a plastic cartridge
- memory etched on wafer
- a consumer good
- a set of rules and game mechanics
- intellectual property
- ‘the worst game ever made’
- a constituent of 728,000 Atari games buried in New Mexico<sup>1</sup>
- all of the above

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<sup>1</sup> cf. [https://en.wikipedia.org/wiki/E.T.\\_the\\_Extra-Terrestrial\\_\(video\\_game\)](https://en.wikipedia.org/wiki/E.T._the_Extra-Terrestrial_(video_game))

There is no elementary unit which comprises the video game, it is never a *single* one of the objects above, nor is it their conglomerate. Bogost tells us Latour refers to this as ‘irreduction’—or the idea that no single thing can be truncated to another. Irreduction’s consequence is that, in most cases, inter-object relations are devoid of intimacy or mutual-knowing. *Being* for different objects is usually uniquely distinct and thus “objects only unlock each other’s realities to a certain extent” (Harman, 2002). Although this notion is challenging even when considering the objects we are most familiar with—those known as homo sapiens—this view of ontology is evocative, powerful, and represents an enticing philosophical renaissance; “the epistemological tide ebbed, revealing the iridescent shells of realism they had so long occluded” (Bogost, 2012).

## 2.1 Carpentry

Beyond a shared rejection of correlationism there is much disagreement between OOO’s scholars. Our interpretation aligns with that Bogost presents in *Alien Phenomenology* (2012). Of particular influence is the notion of *Carpentry*; the practice of creating “machines” that attempt to reveal clues about the phenomenology of objects. While it’s accepted that objects’ experiences can never be fully or intimately understood, the machines of Carpentry act as proxies for the unknowable. They proffer a “rendering satisfactory enough to allow the artifact’s operator to gain some insights into an alien thing’s perspective” (Bogost, 2012, p. 100). A range of examples are cited some of which are created as deliberate acts of Carpentry whilst others simply demonstrate the properties of Carpentry serendipitously. One of Bogost’s examples is software to visualise how a 90s games console stores and constructs sprites and palettes using the finite memory available, the result is a unique view on the connection between the ‘raw’ versions of the image—perhaps closer to how the computer and software might see things—and the game as we see it on the screen (ibid). Another example, the *Latour Litanizer*<sup>2</sup>, is a carpentered machine which queries Wikipedia, calls upon the random article feature, extracts the article title, repeats, and then presents a number of these randomly extracted titles as a list. While its instrumental purpose is to quickly and easily generate Latour-like litanies, it also provides a portal of sorts into the interior reality of Wikipedia’s content: “Not only does the diversity and detachment of being intensify with each fresh litany, but those very qualities also invite further discussion of the object in question at Wikipedia” (2012, p. 96).

Whether achieved by leveraging computer code or some other craft “through the making of things we do philosophy” (Wakkary et al., 2017)—*that* is the essence of Carpentry. Wakkary et al. do their Carpentry through material speculations (ibid), and while Bogost sees himself as a philosopher-programmer, he notes that philosopher-chefs, philosopher-astronomers, and philosopher-mechanics are all uniquely equipped as Carpenters in their own right. In our case, we are exploring the practicalities of being, and the possibilities for, philosopher-designers. Couching OOO in some kind of applied practice is, in fact, the process by which it is lent a concrete legitimacy that other branches of metaphysics often evade. Hence, *material* engagements with OOO are what make the theory compelling, and Carpentry is the process by which that engagement happens:

*“If a physician is someone who practices medicine, perhaps a metaphysician ought be someone who practices ontology. Just as one would likely not trust a doctor who had only read and written journal articles about medicine to explain the particular curiosities of one’s body, so one ought not trust a metaphysician who had only read and written books about the nature of the universe.”* (Bogost, 2012, p. 91)

Having realised that computers have, by virtue of the programming languages we’ve created to tame them, relatively accessible inner worlds, Bogost uses computing as a compelling context to practice Carpentry. There is some shared ground between Bogost’s computer-centric approach to OOO and the way which we used Design Fiction in this work. We might say that computer programmers, emboldened by the ultimate control code has over the computer, allows them to ‘play God’ (within the realm of the computer or system they happen to be programming). This

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<sup>2</sup> [http://bogost.com/writing/blog/latour\\_litanizer/](http://bogost.com/writing/blog/latour_litanizer/)

demiurgic gift affords the philosopher-programmer a great deal of freedom to explore the objects of the computer realm (including the computer itself). As we discuss below, a similar quality is afforded when designers unshackle themselves from the preconceptions of contemporaneous truths of reality, and, with this freedom practice Speculative Design.

### 3 Speculative Design and Design Fiction

Design usually seeks to answer questions, and thus to *create* futures. Speculative design, in contrast, uses design to asks questions about *possible* futures<sup>3</sup>. Hence the family of approaches which we collectively refer to as Speculative Design do not aim to create a products for sale, or that necessarily solve a problem, rather they are design processes intended to elicit thought and provoke deeper understandings about whatever design space they address (Auger, 2013; Dunne, 2006; Dunne & Raby, 2013). There are many nuanced views on the Speculative Design landscape which are beyond the scope of what we can address in this paper<sup>4</sup> however the specific method of speculation we employ is *Design Fiction*.

There are a number of concurrent yet incongruent perspectives on what Design Fiction is; these disagreements with discussions about the most productive ways to create and use the practice. The school of thought referred to as *Design Fiction as World Building* (Coulton, Lindley, Sturdee, & Stead, 2017) most exactly describes the approach we adopt in this work. The World Building approach argues that Design Fiction is the creation of multiple artefacts that, when viewed together, describe the coordinates of, or ‘entry points’ into, a fictional world (ibid). As well as providing points of entry, these artefacts tend to depict aspects of that world at different scales. So, a given constituent artefact of a Design Fiction may either represent a large area of the world (providing a ‘zoomed out’ summary view), or a smaller area (providing a ‘zoomed in’ detail view).

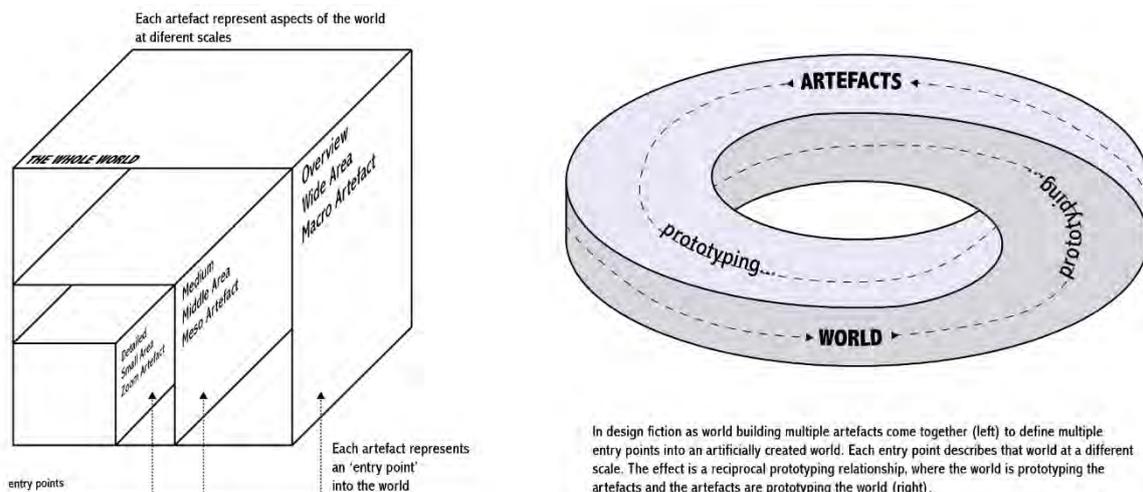


Figure 1. Visualising how multiple artefacts construct a fictional world and how this fosters a reciprocal prototyping relationship with the artefacts.

By creating multi-scaled worlds like this, Design Fictions produce a reciprocal prototyping relationship. The artefacts define the contours of the fictional world and simultaneously prototype the nature of that world; *meanwhile*, the world that emerges from the artefacts reciprocates and prototypes the contextualised properties of those artefacts (ibid). We also suggest that both the individual artefacts, and the whole Design Fiction world, may be seen in terms of Bogostian

<sup>3</sup> Although more couched in the related practice of critical design, this asking/answering contrast is summed up nicely in “A/B” (Raby & Dunne, 2009)

<sup>4</sup> For an overview, disambiguation, and exposition of Speculative Design’s internal we recommend reading Dunne & Raby (2013) and Tonkinwise’s review of the same text (2014).

Carpentry. Returning briefly to the notion of a programmer-philosopher playing God by manipulating computer code, the same logic plays out with Design Fiction but rather than the subroutines, APIs and procedure calls that the programmer-philosopher might utilise, a Design Fiction-philosopher has the texture and contours of the artificial world—and the design of the artefacts that *define* those attributes—at their creative disposal.

## 4 The Internet of Things

The term ‘IoT’ probably emerged from a presentation given by Kevin Ashton<sup>5</sup> in the late 1990s. Ashton was a pioneer of RFID and saw it as one of the technologies that would facilitate the realisation of a future akin to Mark Weiser’s ‘ubiquitous computing’ vision (1999). Reflecting on his coining of the term Ashton notes “If we had computers that knew everything there was to know about things—using data they gathered without any help from us—we would be able to track and count everything, and greatly reduce waste, loss and cost” (2009). Today ‘the’ IoT is in fact many related concepts and is defined variously depending on the interests and motivations of the person making the definition. Popular tropes include technologically driven explanations like Ashton’s original RFID-centric vision) and application-domain driven visions (e.g. IoT for healthcare, transport, or manufacturing). Ultimately, reductionist attempts to define the IoT are somewhat futile as it is the *implications* of IoT adoption that carries with it challenges, opportunities and risks (cf. Lindley, Coulton, & Sturdee, 2017). Notwithstanding the gamut of possible meanings for the term IoT, this research is part of an IoT-centric research project specifically interested in consumer-grade, domestic and home-based IoT devices and/or services.

Connected IoT products in our homes have a brief but chequered history. In recent years product manufacturers, spurred on by new market opportunities and the increasing accessibility and affordability of the hardware necessary to connect devices to the internet, have brought to market vast arrays of familiar-looking devices, but with somewhat unfamiliar IoT-enabled attributes. From toothbrushes to hair brushes; televisions to lightbulbs; washing machines to ovens; cameras to consoles; juicers to socks; kettles to t-shirts; health trackers to sex toys—the diversity of domestic IoT products is already extensive and continues to grow.

Amidst this variety of products there are many examples of innovative and novel designs—sometimes with distinguishable benefits over their unconnected counterparts—however issues with domestic IoT products have also come to the fore. For example, the television manufacturer *Vizio* was reprimanded for producing televisions that, without appropriate permissions or consent, gathered data pertaining to customers television watching habits<sup>6</sup> which the manufacturer then went on to sell for marketing purposes (Barrett, 2012). Other issues result from the fact that many IoT products rely on cloud services to function. This has potential unintended consequence that if the devices have been designed to be *dependent* on the cloud, and if these services go offline for some reason, it leaves customers with semi-functioning or worse, useless, hardware such as occurred in recent years with *Nest’s Revolv* hub and *Pebble* smartwatches. Perhaps the most pertinent issue around the IoT, is security. In a 2016 attack an array of IoT devices from various manufacturers were breached, then updated to run malware, before being utilised in a distributed denial of service (or DDOS) attack which caused web services including Netflix, Twitter and Airbnb to become temporarily unavailable. Although high profile because of its visibility and scale, this is but one of many similar attacks which are made possible by the most basic of security oversights, particularly prevalent in emerging IoT contexts. Exemplifying a great many issues in a single product/service, the toy doll *My Friend Cayla* was ultimately banned in Germany due to meeting the legal criteria of a digital surveillance device (Oltermann, 2017). Contributing to this legal classification are a litany of design flaws: its lack of security could expose child users’ to malevolent hackers; the privacy policy seems to provision for the *possibility* that recordings of child voices being

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<sup>5</sup> [https://en.wikipedia.org/wiki/Kevin\\_Ashton](https://en.wikipedia.org/wiki/Kevin_Ashton)

<sup>6</sup> These practices are, in fact, commonplace in modern televisions. Vizio received disproportionate coverage because details of their data collection were omitted from the user agreement.

utilised for unknown purposes by unknown third parties; the doll relies on an already-unsupported cloud system, and hence despite *still* being on sale from various retailers may be ‘broken out of the box’ (Moye, 2015).

As we begin to share our homes with the IoT, and transpose open aspects of our private space to the far flung reaches of the Internet, personal, societal and commercial impacts abound. Pierce and DiSalvo explore some aspects of the IoT’s advance into our homes with visual metaphors, and ultimately reflect on the “anxiety, exhaustion, overstimulation, overload, paranoia, unease, distrust, fear, and creepiness”—or what they collectively refer to as *network anxiety* (2017)—that has so far come hand-in-hand with the IoT. Emerging design research stances—from *Animism’s* objects-with-souls (Van Allen, McVeigh-Schultz, Brown, Kim, & Lara, 2013) to *thing ethnography* (Giaccardi, Cila, Speed, & Caldwell, 2016)—are unified by an awareness of this anxiety, and respond with varying theoretical foundations. Arguably the advent of OOO, as one of these new materialist perspectives, is also driven by the desire to facilitate our understanding of the new ways of Being that emerge as we adopt technologies like the IoT. Of course, these responses are not confined to academia, philosophy, or design. For example, the EU’s General Data Protection Regulations<sup>7</sup> (GDPR) is reflective of a Europe-wide realisation that IoT devices and the data they generate have the ability to impact upon citizens in terms of their most basic of rights.

GDPR is the specific design space around which the project we recount here was centred. The work aimed to take into account the unique properties of networked services and devices in the IoT, whilst responding to the yet-to-be-tested GDPR, and the fundamental ethical and rights-based contentions which underpin it. We do this, specifically, by invoking Bogostian Carpentry, which, in turn, is achieved by utilising Design Fiction as World Building.

## 5 Designing the IoT Around Meaningful Consent (or, ‘By Reading This Title You Agree to Positively Review This Paper’)

In the following we describe our journey through the design process. In order to better explain the context of our design space, however, first we review some of the GDPR’s protections and make comparisons to established practices in the design of digital systems. Although legal interpretations are so far untested in courts the articles of the GDPR theoretically protect the right:

- To be aware what personal data is held about an individual;
- To access any personal data that is held;
- To rectify inaccurate personal data that is held;
- To data portability (i.e. to extract data in a readable form to be taken elsewhere);
- To refuse permission for processing or profiling of personal data;
- That any consent obtained relating to personal data must be verifiable, specific, unambiguous and freely given.

The apparatus of consent (i.e. how information is presented to users, and how that consent is recorded) is the problem area that became of particular interest to us. Although some progress has been made recently, for example *pre*-ticked checkboxes and non-consensual cookie usage were both outlawed in Europe in 2011<sup>8</sup>, inappropriate apparatus for users to indicate they have, understood, and agree to conditions of use—for example a long body of text followed by an ‘I agree’ tick box—are still the norm. There are fundamental problems with this approach, the most obvious being that while pre-GDPR laws assume a tick in a box as legal consent, in practice it is very rare that users *actually* have read the terms, and even less so that they have understood them. Crudely but vividly demonstrating how such mechanisms are not an effective way to gain meaningful consent, a 2016 study found that of people who agreed to terms, only 25% of participants looked at the agreement at all, and only 2% could demonstrate reasonable comprehension (Obar & Oeldorf-Hirsch, 2016).

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<sup>7</sup> <http://www.eugdpr.org/article-summaries.html>

<sup>8</sup> <http://www.bbc.co.uk/news/world-europe-15260748>

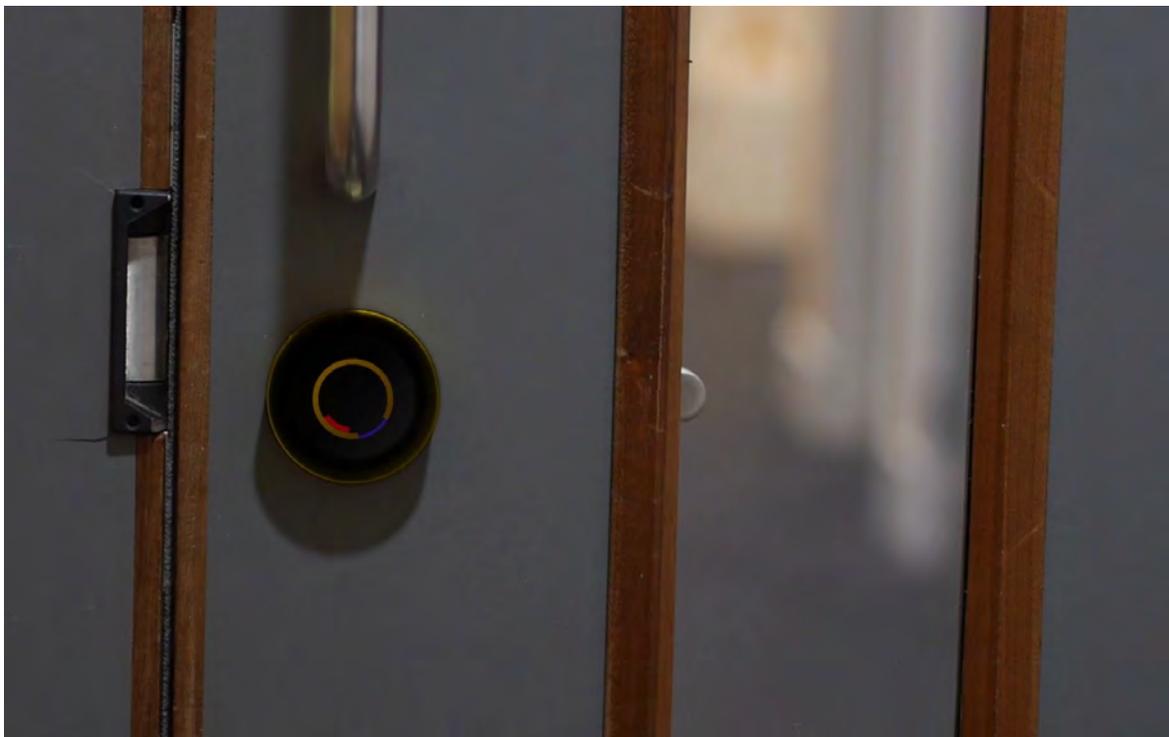
One-size-fits-all approaches, whereby user agreements are written in such a way as to obtain *all* the permission the device or system could *ever* need, structurally remove the ability for users to be selective about which features of a system they actually want to use, and thus denies them the GDPR protection for ‘specific unambiguous’ consent. These systems also tend to fail to account for temporality meaningfully; once consent has been given it is often difficult, and sometimes impossible, to revoke all or part of it at a later date.

### **5.1 *Carpentering a Design Fiction World***

Prior to directly considering how we might approach Carpentry we began the process by determining and shaping the entry points to our Design Fiction world. We elected to make this a product-led Design Fiction; focusing on a single product—an IoT door lock—which would act as a fulcrum, around which other aspects of the Design Fiction coalesce. Inspired by IoT locks that already exist on the market<sup>9</sup> the fictional lock has the following features:

- Keyless opening using NFC;
- Geofencing (automatically lock/unlock depending on user’s location);
- Providing guests temporary access via smartphone;
- Voice activation (via a voice agent such as Amazon Echo);
- Interfacing with other services (via integrative platforms such as IFTTT).

In terms of the design problem, each of the lock system’s features requires a subtly different relationship with collected data, where data is stored, and how it is processed. Keyless opening using NFC operation only requires that data be stored within the user’s own network; geofencing requires that data be processed by the lock company; and voice activation or services such as IFTTT could lead to data being shared with any number of 3<sup>rd</sup> parties. Given that the Design Fiction’s primary concern was GDPR, we opted to give technical implementation only cursory consideration and working around the assumption the lock is activated, via a hub, by an IoT radio standard such as ZigBee and that suitable APIs facilitate integration with external services such as IFTTT.



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<sup>9</sup> cf. <http://uk.pcmag.com/surveillance-cameras/77460/guide/the-best-smart-locks-of-2017>

Figure 2. Still from supporting video showing the simple lock design. The electronics are housed in this plate which would replace one side of the standard lock plate with the remainder of the lock mechanism remaining the same.

With the basis of the Design Fiction established the task was consider how we might ‘do’ Carpentry. Extrapolating backwards from central issue we were concerned with (ethical and rights-based concerns related to personal data in the domestic IoT) and attempting to consider what ‘unit operations’ should act as basecamp for our expedition into OOO<sup>10</sup>. Immediately it is obvious that whilst human object and the device object are, of course, relevant, it is the *data* object(s) that appear central to the issues here; they are the *containers* and *carriers* for the information to which we attach ethical and moral significance. With this in mind our experiments with Carpentry began by trying to understand what it is to ‘Be’ among the data. While it is generated from the material world we live in, once captured by sensors and processed by silicon chips the data is no longer of our world. We began by appropriating network analysis software Wireshark<sup>11</sup> for use as a Carpenter’s tool, to explore the otherworldly nature of the network and data.

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0010  00 91 00 00 40 00 04 11 2b 0e c0 a8 9a ab ef ff  ....@... +.....
0020  ff fa 0c 03 07 6c 00 7d ee 3b 4d 2d 53 45 41 52  ....\}.} ;M-SEAR
0030  43 48 20 2a 20 48 54 54 50 2f 31 2e 31 0d 0a 48  CH * HTT P/1.1..H
0040  4f 53 54 3a 20 32 33 39 2e 32 35 35 2e 32 35 35  OST: 239 .255.255
0050  2e 32 35 30 3a 31 39 30 30 0d 0a 4d 41 4e 3a 20  .250:190 0..MAN:
0060  22 73 73 64 70 3a 64 69 73 63 6f 76 65 72 22 0d  "ssdp:discover".
0070  0a 4d 58 3a 20 32 0d 0a 53 54 3a 20 75 72 6e 3a  .MX: 2.. ST: urn:
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0090  61 73 69 63 65 76 65 6e 74 3a 31 0d 0a 0d 0a    asiceven t:1....

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Figure 3. This is a ‘packet’ of data that an IoT device broadcasts on whatever network it is attached to, essentially saying “hello” to the network so that it can be discovered by any devices it needs to talk to.

Wireshark is a network protocol analyser, allowing an unadulterated view of data as it is moved around computer networks. We applied Wireshark to a private network with various IoT devices attached to it. Beyond the volume of network traffic (over 3000 individual packets of data going to/from a single computer on a network with only a handful of devices in under 15 seconds) one of the most striking things we noted when looking at data packets as OOO unit operators was the similarity between them. Packets are dissected into hexadecimal code and metadata, and hence trying to imagine the network hardware’s phenomenology, it may be rather like a postman’s; although packets are clearly packets, and the metadata is visible (i.e. address), a *qualitative* assessment of its *contents* simply isn’t possible within the system’s architecture. The same is true on the Internet, and while it may seem obvious, this very simple application of the Carpenter’s mind-set hints that there is likely no purely technological solution to the problem of GDPR-compliant personal data and privacy, because, vis-à-vis the network’s own tiny ontology, *there is no problem*: there are only data to identify, process, and ultimately deliver to the right recipient. Ideas like data protection and GDPR are human concerns. They have no gravity to the computer, network, or data objects. If we move away from the digital space, traverse the flat ontology, and adopt the more familiar human lens, we might ask “How would I decide whether this system’s data policy is private enough to be acceptable to *me*?”. Whilst Human-Centred Design techniques such as ethnography, activity analysis, focus groups or co-design (cf. Giacomini, 2014) could be used to *try* and elicit generalizable insights about human attitudes to data, humanity’s penchant for context may confound attempts to find a happy medium representing the ‘right’ way to interpret GDPR (schraefel, Gomer, Alan, Gerding, & Maple, 2017). This problem of ultimately particular context dovetails directly with our

<sup>10</sup> ‘Units’ and ‘unit operations’ are Bogost’s terms for individual objects within what Levi Bryant calls ‘mereology’ and Latour cites as ‘irreduction’—that any given object is simultaneously its own thing and inevitably part of another object too, e.g. an IoT lock is part of the door object, the house object, and the network object, and the lock object itself (Bogost, 2012, p. 22)

<sup>11</sup> <https://www.wireshark.org/>



Figure 4. Triggered by the user unlocking a door data flows across and is processed on different networks and does not necessarily have a specific end point.

To resolve our mapping-misgivings we needed to make two compromises, and although this changes the nature of the design space it does not hamper our enquiry’s overall aim to explore practice and philosophy. First, we reduced the scope of our interest from a very general notion around ‘GDPR compliance’ to the specificity of ‘personal identifiability’ (based on data). Second, we had to reject the wholly deterministic view that our exploration of data packets brought, and instead build a map with the ability to communicate aspects of context, risk, and probability. Hence, it turned out that the path our exploration with OOO took, was wholly different to what we had initially expected. We anticipated that exploring the tiny ontologies of the IoT lock itself, the data it produces, and its users, would lead us toward Carpentry applicable to one of *those* objects, what *actually* happened is that we arrived at an artefact of Carpentry around an entirely new object—one that communicates the *likelihood of identifiability*—and whose own tiny ontology, offers a new way to view any specific assemblage of devices, services, data, and people. By communicating the chance that a person could be identifiable based on the data associated with device use, and presenting that in terms of whether the data is held on devices owned by a user, servers owned by companies the user knows, or servers owned by ‘anyone else’, we aimed to have defined a construct that could represent both sides of the human/computer dichotomy that OOO helped us comprehend.

The most basic forms of the identifiability maps which reflect notions of risk and probability, are shown in figure 5. Due to some metaphorical and visual similarity to the Bohr model of the hydrogen atom<sup>13</sup> we have referred to these as ‘Orbits’, or Identifiability Orbits. These maps represent data that is generated, stored and processed as part of an IoT system, and specifically *where* that data is held. A circular band represents each ‘level’ of data and our key privacy construct of identifiability is communicated by how sharp or blurry the edge of that level is. Hence, if the circle is the middle is has a clearly defined edge, it is almost definite that the user could be identified by the data at that level. The blurrier the edge of any level is, the less likely it is that a user could be identified.

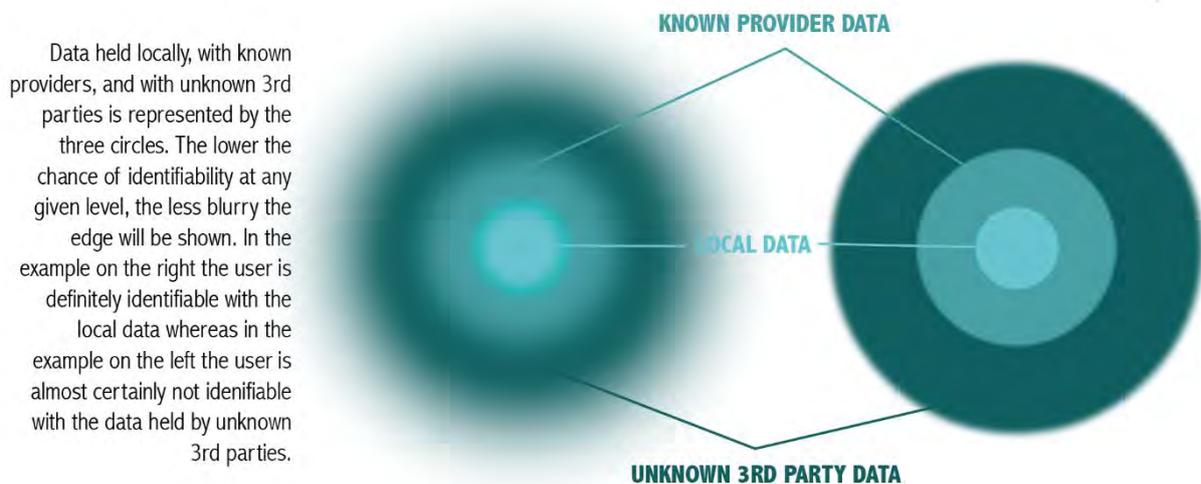


Figure 5. Early prototype design for identifiability Orbits.

Exploring how the design might be implemented in software, and how a user might interact with it, we implanted the Identifiability Orbits into our Design Fiction world by creating a film that depicts a user adding a lock to their smart home. The interaction in our film is triggered by instructing a voice agent to detect new devices; once the lock is detected the home’s, the voice agent instructs the user to use the supporting ‘Orbit Privacy App’ on the user’s phone so they can configure their privacy settings. By using a slider, the various functions of the lock can be enabled or disabled, and the data implications of those choices visualised using an Identifiability orbit.

<sup>13</sup> [https://en.wikipedia.org/wiki/Bohr\\_model](https://en.wikipedia.org/wiki/Bohr_model)

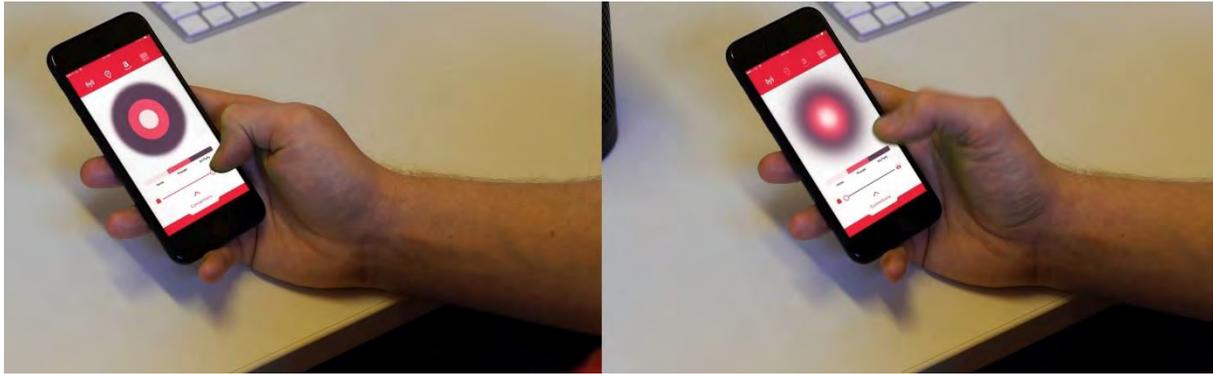


Figure 6. Stills from the Design Fiction film. A user uses the Orbit-based privacy app to configure which functions their IoT lock will have permission to use. On the left they have enabled maximum functionality, Orbit updates to show that the user will most likely be identifiable at all levels, although that is not certain with third parties. The inverse is shown on the right.

With the basic interaction demonstrated the film proceeds to demonstrate how a user may use such an app to dynamically modify their choices (figure 6). In our scenario, the user originally configured their lock for maximum privacy. The scenario extends to show that, if notified by a delivery company who require access to the house, the Orbit app communicates to the user identifiability implications of the data flow associated with provisioning temporary access to the delivery company, before revoking it again once delivery is completed. Although this work was completed before it was announced this is a data flow very reminiscent of what is being proposed to support Amazon Key<sup>14</sup>.

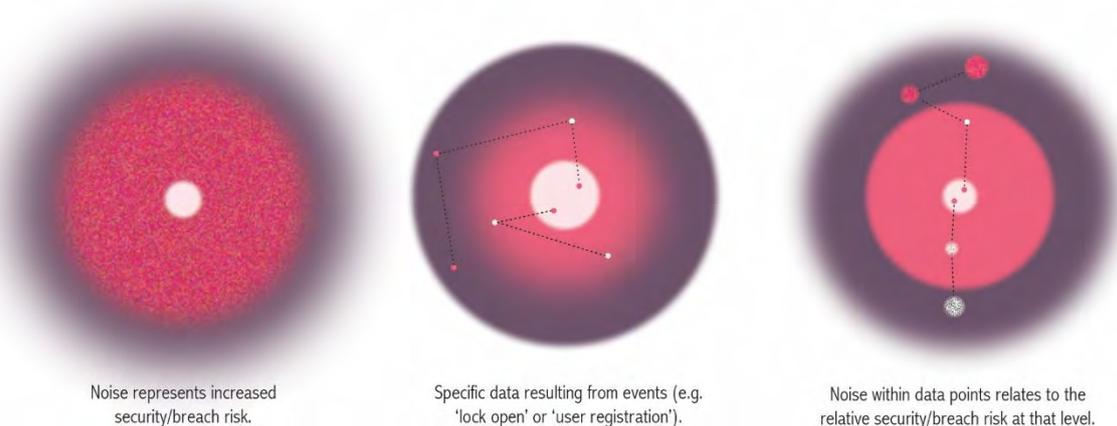


Figure 7. Prototype designs extending the core Orbit concept to communication richer information.

While this project explores how Design Fiction Carpentry is viable means to attempt to *do* OOO, it's worth noting the Orbit maps have some merit as a design proposal in their own right. If such a system were to be implemented specific areas that we identified for development include moving beyond the identifiability compromise and understanding how to augment the maps to include richer information (see figure 7), and on an operational level, understanding what background research would be necessary to create meaningfully-populated Orbits in the first place. However, these questions of implementation go beyond the scope of the academic enquiry we present here.

## 6 Concluding Reflections

Responding to the emerging network anxieties associated with our increasingly connected world, in this research we unpack and apply OOO in order to shed light on design's intersection with

<sup>14</sup> <https://www.theverge.com/2017/10/25/16538834/amazon-key-in-home-delivery-unlock-door-prime-cloud-cam-smart-lock>

philosophy. The case we draw is focused on the IoT's physical presence in our homes combined with its mostly-unseen data shadow, and the risks arising from how data flows, is processed, and has agency. Legislative responses such as GDPR are intended to protect citizens from these risks, and whilst contemporary scholarship has sought theories to conceptually contain these new complexities with a range of theories, including OOO, this research explores the practicalities of injecting this theory into design practice.

We are not philosophers and thus we acknowledge that this paper is built from *our interpretation* of OOO—heavily reliant on Bogost's *Alien Phenomenology* (2012), which itself is but a single scholar's take on a theory that is the subject of disagreement even among its proponents—and it is therefore likely other scholars' perspectives may be subtly or considerably contrast with ours! Whilst we do not argue that designers *must* incorporate theory into practice, our belief is that we've demonstrated that by recognising a synergy between the qualities *this particular theory* and the challenges we sought to address, OOO was demonstrably a generative and analytical tool to help understand the design context, and as such played a central role in both deconstructing the problem but also in assembling possible solutions.

To adeptly respond to the rafts of previously unknown technologically-driven challenges we collectively face, design's methods and metaphors need to be reimagined, invigorated and bootstrapped. Exemplified by the Orbit prototypes, this thesis is intended to be taken as an indicative example of how design researchers may dissect similar challenges, ultimately in pursuit of contemporarily-apt approaches. While the Orbits appear to be viable early design concepts, our main contribution with this work is to demonstrate how to *turn* OOO's metaphysics—to make OOO tangible through Design Fiction. Reflecting on this process it seems that OOO, performed in this way, has the potential to change the nature of the design space to which it is applied in the first place; in our case by arriving, unexpectedly, at a place where the Orbit concept emerged as a means to communicate aspects of data policies in a meaningful and potentially GDPR-compliant manner. Although extending from a relatively tightly scoped study, we suggest that to develop design methods apt for the modern world, design researchers may viably use Design Fiction as World Building to practically engage philosophies such as OOO, in the process helping to progress understanding of how design intersects with theory, as well as arriving at rewarding and useful design outcomes.

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## Aestheticising Change: simulations of progress

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If, following Rancière, politics revolves around who has power to articulate ‘the sensible’, then designers, as aesthetic practitioners, must be caught up in questions of politics. This is particularly so when design practice becomes part of the way public sector actors negotiate, envision and catalyse change in relation to public ‘problems’. However, this is also typically a form of design practice that eschews any talk of aesthetics — presenting as de-skilled, democratic and ‘de-aestheticised’, in a sense. By analysing and re-describing such design practice in aesthetic terms here — illustrated with an example from practice — we provide an alternative characterisation to the more instrumental account of design as a reliable route to innovation for public sector managers. This opens up a different perspective on what such practices function to achieve, and what is at stake: an effacing of the political nature of design decisions, and an obscuring of the real work of change by the seductive techniques of simulation.

*design; public sector; aesthetics; politics*

### 1 Introduction

It appears, at least according to mainstream media reports, that we are in an epic period of change. But what does all this change look like? How do we know when it is happening — and who benefits? To believe that one is experiencing change, or at the very least that change is possible, requires material evidence — to feel, see, touch and hear it. And so there is an aesthetic and material quality to change. We use the term ‘aesthetic’ here in its most general sense, to refer not simply to qualities of art or style (as aesthetic might often be interpreted when discussed in relation to design), but to those aspects of experience that manifest themselves to the senses, or as Rancière (2006) argues, “what presents itself to sense experience” (p.13).

Materializing change by embodying potential in artifactual form, and manipulating aesthetic experience, are defining features of design practice. Prototypes, for instance, have been called “figures of suspension and expectation” functioning as “traps’ for the emergence of compossibility” (Jiménez, 2013, p.381). They serve as provisional markers of change by way of their precarious and



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often rudimentary character. These artifacts draw upon broader narratives of change inherited by the design profession; a historicity wherein the design professional has been heralded as the creative genius from which innovation, progress and, by extension, change is realized (Sparke, 1983; Kimbell, 2011; Suchman, 2011). It is from this privileged position — designer as catalyst — that the “aesthetics of change” are monitored, curated and produced to make change knowable. These aesthetics, as we argue, have less to do with appearance and style, but instead the manner in which controversial issues are rendered sensible (knowable) for public consideration.

Our focus here is specifically on the public sector, where design is increasingly proposed and mobilised as a catalyst for change (Mager, 2011; Julier, 2017). On a global scale, there are emerging fields of design that are bound up in the shaping of government policies, strategies, services, innovation, and change. This intensification of design activity has led to new practices derived from design being gradually absorbed and normalised by non-designers within government, often under the guise of public sector innovation (Windrum and Koch, 2008), policy design (Junginger, 2017), and service design (Buchanan, Junginger and Terrey, 2017). This is evidenced in the uptake of internal design labs in public sector contexts (cf. FutureGov, 2017; Public Policy Forum, 2013), a growing field of public discourse and debate principally managed, curated and facilitated by the design industry (Julier, 2017), research into public sector design best practices (Bason, 2014), and the proliferation of consultancies that specialize in design related services for government, such as Livework in the United Kingdom and Doblin in Canada.

Theorisations of these trends, situated within broader discourses of innovation, public sector renewal, and democratic participation, follow a distinct pattern: design is positioned as a problem-solving faculty, coming to the aid of the public sector at a time of crisis. This positioning of design as a means of introducing “new ways of working” in an effort to combat “complex problems” is strengthened by actors in academia and industry who actively make the case for design intervention. The notion of a new kind of design practice thus flows through an international discursive community of designers, researchers, civil servants and others. Our project here is to question this narrative by looking at these practices from a different — aesthetic — perspective, one which exposes the political dimensions of the work, and opens up a more nuanced discussion.

We examine the field through the lens of each author’s localised engagement with it — both as practitioners and researchers — in Canada and the United Kingdom. We use an example from a local government change project to shed light on a wider field of practice, and demonstrate how the design profession carefully curates narratives of change in the public sector through the aesthetic choices made in the planning, enactment, and documentation of participatory design projects. We unpack the particular aesthetic modalities of what we have seen — design presenting as de-skilled, democratised, and in some ways ‘de-aestheticised’ — and discuss the function this might be serving: purporting to empower the bureaucrat while enrolling them as willing participants in change programmes, and presenting design practice as rational and logical in order to avoid the risks and complications of political entanglement. Drawing upon Jacques Rancière’s (2006) concept of ‘distribution of the sensible’, we argue that an aesthetic of ‘public sector change via design’ has emerged that obscures the practicalities of political change — messy, relational and often affective work — in favour of what *appears as* change: a simulation of what design purports to deliver. full paper submissions for DRS2018 will be selected through a double-blind review process conducted by an international review panel.

## 2 Standpoint and Methodology

We have drawn out some distinct aesthetic modalities through a socio-material reading of practice. More specifically, this analysis examines how “materials (objects, tools and infrastructures)”, “competencies (knowledge and embodied skills)”, and “meanings (cultural conventions, expectations, and socially shared meanings)” (Shove, Pantzar, & Watson, 2012, p. 23) are configured in specific design encounters, such as co-design workshops, to form ‘proto-practices’, or new ways of

working and doing in situated contexts. Design objects, interactions, and dialogue between participants become texts that can be read and interpreted discursively. Our analysis focuses on meta discourses that arise in these encounters in order to understand how they contribute to, are predicated on, and respond to discourses of public sector design and innovation.

While this analysis is illustrated with one concrete example of public sector design, it is informed by our ongoing PhD research that examines the importation of design methods, tools, and approaches to work into public and democratic contexts, drawing upon a range of case examples, interviews, participant observation, and auto-ethnographic accounts in Canada and the United Kingdom. More specifically, we examine the political implications of public sector design — the production of subjects and subjectivities — and situate this analysis within a genealogy of design: namely a practice that is born out of, contingent upon, and at times, functions in opposition to industry.

### **3 Aesthetics and Design**

Design is an aesthetic practice: both in terms of the decisions that are made through the process of giving form to objects and images, but also in terms of the kinds of experiences that design objects afford. And yet aesthetics in the context of design has historically been confined to discussions of beauty and taste, and more specifically, how objects are crafted to appeal to the eye. These accounts rely upon a philosophical and phenomenological tradition that enquires into the essential qualities of beauty that are manifest in art and literature, or as the work of Immanuel Kant explores judgements of taste. Design objects are difficult to assess according to this aesthetic approach because unlike art, they are also concerned with questions of function; design ‘objects’ (as in, the productions of design) must address practical human needs if they are to be deemed useful. Thus, the aesthetic quality of design objects is as much about capacity to fulfil a particular need as it is about appearance to the eye.

Perceptions of usefulness cannot be separated from appearance, as these qualities form part of the sensuous character of a designed object. Take for instance the term ‘affordance’ which is used in design to describe how the performative qualities of an object are rendered sensible to end users. During the process of design, the designer attempts to identify the wishes, aims, behaviours and skills of users. These things are instantiated in material form; the resulting artifacts are inscribed with actions, protocols and instructions for future use (Akrich, 1992). A chair, for instance, with its scooped bottom and straight back suggests by its aesthetic form that it is perfectly suited to accommodate a human body while in a seated position. The aesthetic of the chair, the manner in which it presents itself as sensible to the user, “mediates and conditions experience and our basic access to experience” (Folkmann, 2013, p. 26). The demonstrable aesthetic of the object “frames” the user’s experience (i.e. calling out its presence as a chair) and affording particular courses of action (i.e. to sit). Aesthetic practices, therefore, delimit our experience of the world inasmuch as our very sense of what is knowable is made possible only through ongoing material attachments. Put simply, the world may become knowable when rendered sensible through material action.

### **4 (Re)Distributing of the Sensible**

Jacques Rancière’s concept ‘distribution of the sensible’ is a useful starting point to consider the interplay between politics and aesthetics. As he puts it, “politics revolves around what is seen and what can be said about it, around who has the ability to see and the talent to speak, around the properties of space and the possibilities of time” (2006, p.13). If phenomena remain unknowable, that is they are not rendered in some sense-able way, then they cannot be spoken of, thought about or acted upon. Rancière argues that social order itself is established through the distribution of the sensible, which polices common sense and what becomes unquestionable within society.

Distribution of the sensible is a useful concept for examining how privileged narratives of change are articulated and circulated because it draws attention to those who have the authority to legitimize narratives. Rancière’s theory of aesthetics points to the political role designers play in managing a

design process: selecting what and whom to include, or who can ‘speak’ within the process, deciding how the problem ought to be framed, and which issues ought to be made sensible – predominantly through form-giving. As consummate form-givers, designers, working with project stakeholders, render images of the future-in-the-present (cf. Yelavich and Caccavale, 2014), and as such, have a political stake in delimiting the terms of how change is understood, discussed and realized in the public sphere. This work is made possible by way of aesthetic practice, such as prototyping, storyboarding and role playing, that becomes material evidence of the kind of public sector change envisioned by design.

The aesthetic practices of participatory design within this setting in particular demand scrutiny: at first sight they may seem more inclusive and accessible than dominant bureaucratic aesthetic modalities, and this is ostensibly why they are employed. In which case, the question of what is included and what is left out becomes even more acute.

## 5 Applying the Aesthetic Lens

Gagliardi (2006) makes the case for an aesthetic reading of organisations, arguing that all organisations have an aesthetic, meaning a set of ways the organisation manifests itself to the senses. This is reflected in architecture, branding, communications materials, and other physical, sensible things that are the carriers of organisational culture more than ephemeral actions, thoughts or speeches:

*Artifacts... are themselves ... primary cultural phenomena which influence corporate life from two distinct points of view: (a) artifacts make materially possible, help, hinder, or even prescribe organisational action; (b) more generally, artifacts influence our perception of reality, to the point of subtly shaping beliefs, norms and cultural values. (p. 706)*

This being so, the introduction and use of design practices into public sector organisations — which in general serve to introduce new and different artifacts — can be seen as an intervention in organisational culture and politics via a kind of aesthetic interference.

It seems, however, dominant design research and practice cultures are far from recognising this aspect of their own operations. Tonkinwise (2011) documents a concerted effort in “Design Thinking” to downplay the role of aesthetic judgment. He attributes this resistance to the perceived subjectivity of aesthetics: the managerial class considers aesthetics as “inherently subjective and/or cultural” and thus “foreground interpersonal politics” (p.536). Read historically, these actions sit within a broader history of consultant design which has tended toward a modernist ethic that eschews decoration and style for form and function: positioning design as a repeatable (rational) process for problem-solving, ‘design as science’ as opposed to ‘design as art’. This derives from a widespread reliance on Herbert Simon’s treatise as a means of legitimising both design research and practice, but this is not unproblematic, as Huppatz (2015) points out, “Much contemporary design research, in its pursuit of academic respectability, remains aligned to Simon’s broader project, particularly in its definition of design as “scientific” problem solving” (p.29).

As Tonkinwise concludes, “this risks concealing the way in which designing is the designing in, with and of styles; styles that make possible existing and new forms of social practices” (p. 543). The emphasis on rational process (rather than subjective form-giving) has produced a distinctive visual language, intended to emphasize neoliberal value creation, creative know-how, and entrepreneurial optimism (Julier, 2017, p145). Journey maps, process diagrams, sticky notes: each of these artifacts, through their associations and affordances, dispel the notion of design as an expert practice of object-styling. Insistence that design thinking reject style, a kind of anti-aestheticisation, is predicated on a series of aesthetic judgments intended to improve the allure of design, not as subjective cultural product, but as change process, equally applicable in a variety of contexts,

including the public sector. This is not an absence of aesthetics, it is a new and pervasive aesthetic idiom that requires critique.

## 6 Designing Approaches to Homelessness Prevention in the UK

To illustrate our analysis, we have selected an example of design practice deployed as public-sector change process — a project for the housing department of a UK local authority — which exhibits some of the typical aesthetic modalities in operation, and illustrates how design practice serves to render political issues sensible, or not, through careful aesthetic choices.

### 6.1 The Brief

The local authority in question commissioned a design consultancy (for whom one author was working) to help develop a homelessness prevention programme. This was to include early detection of those likely to be at risk of homelessness, early intervention and prevention strategies, and a culture change programme to support staff to transition to new ways of working. The brief was open-ended; the agency was simply asked to help the local authority work up a general strategy to be delivered over the following two years.

### 6.2 The Design Response

Working closely with managers in the housing service, and holding weekly workshops and conversations with the wider housing staff, the design team planned a three-month period of intense design work, following the double diamond process model (British Design Council, 2015). In *discovery*, a homelessness prevention map and a set of personas was created with housing staff and using housing data, which sketched out a typology of people in different risk categories — ‘not at risk’, ‘at risk’, and ‘in crisis’ — and the ‘triggers’ and ‘resilience factors’ that might tip people one way or the other.

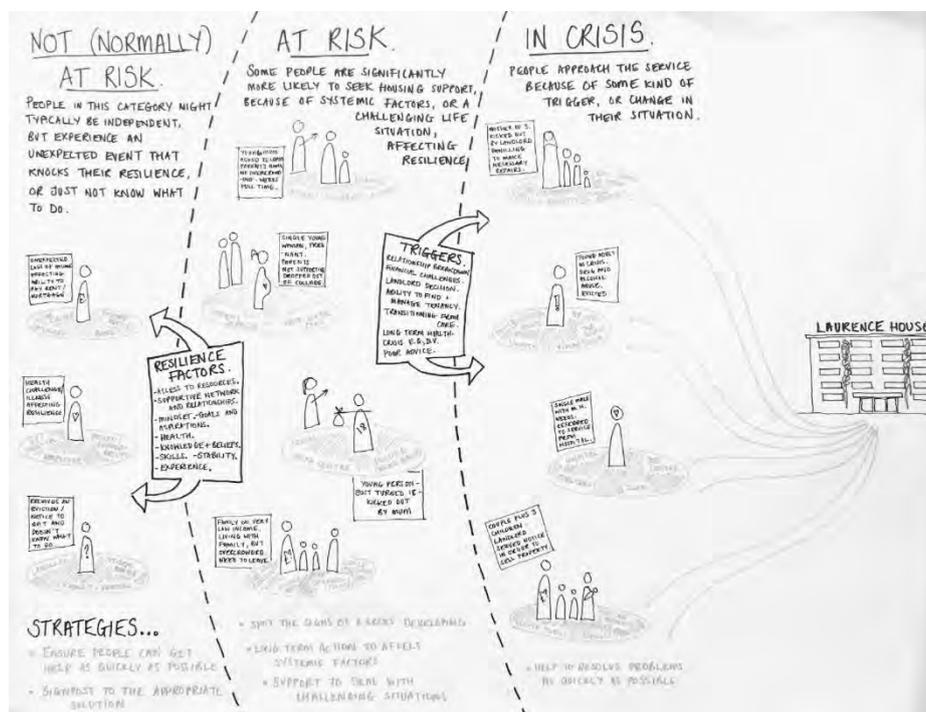


Figure 1: mapping people at risk of homelessness

In *define*, the project board (a mixture of team leaders across different parts of the housing service) used the persona stories to identify opportunities to intervene earlier in the journey towards homelessness — in some cases much earlier, for example in childhood. These were then regrouped into an ‘opportunities matrix’.

Long term strategies	Medium term strategies	At the front door strategies
Affecting the supply of affordable housing		
Managing difficult situations		
Shifting perceptions and expectations		
Equipping people to be independent		
Identifying problems before they become a crisis		
Making it easier for people to solve their own problems		
		Quick resolutions in a crisis

Figure 2: the prevention opportunities matrix (high level)

In *develop*, housing staff attended an ideas workshop, in which they were guided through collaborative creative activities and brainstormed new ways of responding to some of the opportunities.



Figure 3: the ideas workshop with council staff

In *deliver*, some prevention ideas were selected, developed, visualised, and in one case actively prototyped: housing staff role played, and then live-tested, a new way of having more ‘empathic and collaborative’ conversations with clients. The agency then produced a report summarising the overall strategy, identifying key changes that would support the organisational shift to prevention, and making recommendations around culture change.

## **7 Analysis**

This example serves as a helpful reference point to discuss the aesthetic modalities at play in this design-led approach to envisioning change, where design is emphasised as process (the double diamond) and method (workshops and design activities) as much as outcome. Beyond the general observation that this kind of practice marks a distinct break or departure in aesthetic terms from ‘normal’ civil service practice — a symbolic aesthetic disruption — we have identified some recurring aesthetic features of the idiom, which set it apart from other design idioms, and which we have articulated as ‘temporality’, ‘playfulness’, and ‘provisionality’.

### **7.1 Temporality**

Time is a pronounced feature of public sector design practice: both in terms of the pace and structuring of work, and as part of the material of design.

Speed seems to be essential to the narrative around how to do this kind of design. It is reflected in the nomenclature — ‘rapid’ prototyping, lateral thinking ‘sprints’, hackdays and ‘jams’ — and infused into practice — starting, stopping and developing ideas quickly in workshops; producing design ‘things’ and project outputs within short spaces of time; doing rather than debating. This is perhaps the colonising influence of Silicon Valley-style working practices: ‘lean’, ‘agile’, etc. (Avle, Lindtner and Williams, 2017), where pace has come to be synonymous with creativity, but it also plays into a sense of urgency in the (currently austerity-riven UK) public sector about delivering innovation and ultimately savings. In contrast to the supposed inertia of the bureaucratic machine, design proposes itself as a light-footed and entrepreneurial catalyst of change. The aesthetic communicates the value of trying things out and ‘failing fast’, and demonstrates that moving at pace is possible.

Time is also the material we are working with, brought into view as a dimension of reality through (for example) constructing an individual’s life history and projecting forward, developing service propositions as narratives that unfold over time, stripping away the messy non-linear complexity of life to highlight certain ‘key’ moments or issues in a trajectory. As a practice it introduces speculation as a valid form of data-gathering, thus proposing to make the future sense-able, knowable — and therefore manageable. It serves to bring subjects and their (past, present or future) capacities into range, manipulable as the material of public sector change.

### **7.2 Playfulness**

Play is implied through both activities and materials. Light-hearted ‘warm-ups’ begin the process of aesthetic disruption through physically mixing people, or inviting different modes of expression. Idea generation activities are deliberately far-fetched, asking people to imagine ‘what would happen if ...?’, and to push beyond the bounds of normality. Workshops loosely follow the structure of a game or competition — there are rules and guidelines, permitted and non-permitted behaviours, silliness and laughter. The materials of the craft invite play in various ways: some are deliberately reminiscent of childhood (pipe cleaners, coloured card, balloons, Play-Doh, etc.); some suggest neutrality and universality — post-it notes, sharpies, newsprint — and downplay the need for draughtsmanship or skill; others suggest disposability and impermanence.

All of this playfulness performs multiple functions: it invites participation and lowers the barriers to action, symbolises a break from business as usual, permits creative thinking, engenders collaboration, and (hopefully) elicits goodwill from participants.

### **7.3 Provisionality**

Provisionality is inherent to design process, and is perhaps the biggest point of difference when contrasted to ‘normal’ civil service practices as we have observed it through our ongoing research in this area. Provisionality is communicated both explicitly as part of the method: building iteration into the project plan, or holding a ‘prototyping’ phase. It is infused into micro-practices: the nature and quality of materials as noted above; constant representation and re-representation, making ideas

sensible for dialogic purposes; leaving things on the walls and building up layers of work; working interactively, visibly taking and incorporating feedback. It is also produced and communicated through the performance of (co-)design practices: symbolically breaking away from traditional meeting formats, literally changing the layout of tables and chairs, sticking things to the walls, and creating a sense of creative clutter. All of this affords the possibility to re-distribute the sensible, or at the very least to temporarily rescript these environments as venues to intervene and disrupt how one *ought* to behave when in a public sector organisation.

Provisionality serves multiple ends. This work privileges material practice as a mode of expression that gives provisional ideas a form other than words, spreadsheets, and powerpoint slides; in other words, it makes change sensible in different ways. Provisionality is dialogic: it allows ideas to emerge and evolve. And it is persuasive. Unfinished design objects can hold great rhetorical power. In the homelessness example, acts of representation — perhaps because of their clarity of communication — gave confidence and certainty to the client. What the design team experienced as subjective, sometimes arbitrary, and often simply expedient decisions, took on a life and rationale of their own: as one option is made sensible, all other past potential options fade from view.

## 8 Discussion

Design practice cannot escape its aesthetic modalities, and an aesthetic reading of practice, such as we have attempted here, serves to demonstrate what is made knowable, what can be discussed and what can be acted upon within the scope of the design process; and also, we argue, what design, performatively, is functioning to do. Design activities *police* the nature and quality of action that is directed towards “changing existing situations into preferred ones” (Simon, 1996, p.111); they determine how, who and by what means change is to be realized.

We have proposed three dominant aesthetic modalities to this new design idiom, and noted some common aesthetic markers. What is clear here is a kind of de-emphasizing of style and expertise. The sheen, degree of polish and state of completion of the objects is replaced with another aesthetic that implies creativity and inclusivity. In what follows we speculate on the function this might be serving.

### 8.1 (dis)Empowering Bureaucracy

These practices are symbolically different to ‘business as usual’ — a way of performing the work of change that differs in pace, tone, detail, etc., and also functions as a visible marker of inclusivity and organisational willingness to innovate. They promise to empower the apolitical bureaucrat with a neutral and logical set of tools for innovation, with foresight, and insight into the subjective selves of citizens. Creativity is democratised — evident in the particular kind of naive design language (the opposite of, for example, an architect’s drawing) that plays down the idea of expertise. The aesthetic suggests that anyone can (and should) do it. Or can they? In the homelessness example, despite performances of collective creativity, the ensuing ideas were not wildly different from the existing range of services, and had to be covertly supplemented by the design team. There’s a sort of skill-less design going on, where the ideas of the non-designers are overtly privileged, as though the appearance of a collaborative process, the democratisation of creativity, is more valuable than the actual ideas.

This begs the question of whether it is empowerment or distraction, innovation or anti-invention, grappling with politics or effacing them. In a time of political dysfunctionality, do we need more or less investment in the refinement of expertises of bureaucracy? As Di Salvo (2010) notes, “diverting attention away from the political by a focus on politics, i.e., a focus on the improving the mechanisms of governance, can endanger the practice of democracy because it draws us away from engaging in the contestation necessary for democracy” (p. 3).

## **8.2 Consensus, Dissensus and Issue-Framing**

Provisionality and playfulness grants permission — to have unfinished ideas, to explore concepts that can be discarded, to ‘try things out’ — and thereby signifies the opening up of a space of potential contestation and agonism. However, in practice, there are limits drawn around the allowable forms of dissensus. These design practices “overwhelmingly gather at that end of the spectrum governed by the principle of consensus” (Di Salvo, 2010, p.1): they do not have forms for dealing with disagreement, dissent, and polemic. Issues that sit outside the problem framing are ‘parked’ rather than wrangled with. In keeping with ‘managerial’ styles of government that seek to achieve consensus through promotional rather than political tactics, these aesthetic modes tend to neutralise resistance (Fairclough 2000).

In the homelessness example, often throughout the project, but particularly acutely within the ideas workshop, certain problems were raised that were deemed ‘out of scope’. In particular, the housing staff were quite united in their view that the causes of homelessness were political and structural, and therefore far beyond their remit to effect change: “It’s not a local government problem — it’s central government”. There was always some discussion about this fundamental contradiction at the heart of the project (in their view) — sometimes this coalesced into unsanctioned discussion outside of the main agenda, and sometimes it came out through the more imaginative and playful activities that encouraged them to express their wildest hopes and ideas for change. But in later stages these ideas were easily weeded out as impractical, and thus remained, ultimately, unrepresented. In determinedly solution-seeking within the local authority remit, solutions have predictably been found, and they operate either on the machinery of local government, or the psychology and behavior of individuals. Ideas that address national politics, macro-economic conditions, and wider social norms, are absent. But the tactics and forms of design as deployed here have helped enroll staff as willing participants in this approved programme of change.

## **8.3 Simulation and Change**

Simulation can be a useful and compelling step on the path to change. In our example, the act of role playing the new conversation held enough rhetorical power to spark action. A trial period of holding conversations with clients differently is underway, staff by their own admission have started seeing homelessness as one among many issues they might help with, and are experimenting with how they perform their roles and work.

The design objects (prototypes) produced here were simulacra of new situations, rather than the change itself. This is not a criticism of design — it is what design does. But there is a risk of misrepresentation — or misperception — of how much is actually being achieved in the design process. The sense of potential change afforded is powerful and attractive in the context of contemporary bureaucracy where public servants are frustrated and keen to find ways to empower themselves to create change. It is also attractive in the context of difficult public issues because it radically simplifies — reducing the challenge to a cluster of post-it notes or a tantalisingly clear service journey. People leave workshops with a sense of satisfaction. Something has been made. An idea has been realised; but only in the temporary reality of the workshop. There is a kind of virtualism to it: a prototype seems closer to a new situation than, for example, a white paper, even though it is not — and in some cases it might even hold less authority in legal terms.

Unlike other design fields, there is no clear account here of the journey from design to delivery — from prototype to real change. In this way, this aesthetic of change risks obscuring the practicalities of the messy, relational and often affective work that is required.

## **9 Conclusion**

If the dominant discourse around current emerging trends such as ‘design for government/ public services/ policy’ makes the case for such practice on the basis of increasing certainty about reaching the ‘right’ answer through a logical process (risk management around innovation and change), what

we are drawing attention to here is an alternative characterisation of what design does and what it produces. Its particular aesthetic idiom promotes design as a desirable, neutral and inclusive set of practices, in a way that masks the other things it might be functioning to do: dismantling resistance and enrolling subjects, and — through the seductiveness of design objects and practices, the clarity of the simulation — obscuring the political realities of change in government, or indeed the messy reality of governed subjects. As designers, the de-aestheticisation helpfully allows us to pass ourselves off as rational modernists, thus avoiding the need for political entanglement. But imagining or simulating the change will not do the hard work of making it happen, and it must not be taken as such. Taking a design approach to public sector change processes — instead of providing a straightforward path to an inevitable answer (as it might be marketed) — requires design practitioners, and those working with them through a design process, to make constant decisions, judgements, choices etc. about what, exactly, is made ‘sensible’, and how. Far from being neutral and rational, design practice is subjective and political—and must be so.

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# Using the Product Impact Tool for Prospective Thinking

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The ever-rising role of products and technologies in humans' lives is increasing the call for ways to understand and investigate their influences, in the form of prospective analytical methods. This paper proposes one such method, based upon the Product Impact Tool. This Tool was developed to combine both philosophy of technology and design for usability perspectives. Its effects offer potential for prospective and reflective purposes, and can be used to investigate and structure ideas about the impacts of both current and future technologies. The proposed method offers an addition to existing tools within the field of prospective analysis. This added value is demonstrated through a case study of a concept for future personal transport. Through this case study, it is shown that the proposed method can help uncover information that remained hidden by conventional approaches, by inducing a critical investigation of the subject from multiple perspectives. Such information will aid analysts and strategists in their work, leading to more effective, desirable, and responsible technologies being developed and implemented.

*product impact tool; prospective thinking; future planning; strategy development*

## 1 Introduction

The role of technology has become ever more important in the daily lives of humans. The products that they use change who they are and what they do. This prominence brings with it a need for analytical methods to investigate and discuss the potential impact of future developments. Current methods for analysis and strategic development of new technologies mainly focus on economic and logistical aspects, like price and roadmapping. However, they often do not take into account aspects like societal impact and human-technology relations (Raub, 2017). This represents an opportunity for the development of investigation methods that do look at new technologies from this perspective. One means for such a method can be found in the Product Impact Tool (PIT) (Dorrestijn, 2012). This paper will propose and discuss an analytical method of using the PIT to study future innovations, in an effort to aid analysts and strategists in their work.



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In the first section, the PIT itself will be discussed. The focus will lie on both the prospective and reflective capabilities of the PIT's four quadrants. This section will also examine the potential for extending the PIT's scope beyond specific and material products, towards also more abstract concepts like (innovation) strategies.

The second section will present the proposed analytical method of using the PIT. Both this method and the PIT in itself are compared to existing strategic approaches, in order to discern its place within and relation to the field of prospective analysis.

The third section describes a case study, where the proposed method is applied to a concept for future personal transport by the Dutch Study Centre for Technology Trends (STT). The concept proposes a system wherein autonomous vehicles become a rentable service, that fulfils people's everyday needs for transportation. This system is analysed with the PIT, to investigate its impact on its users and on society as a whole. In doing so, it can be shown what added value both the PIT and the proposed method can bring to the field of prospective thinking.

## 2 Product Impact Tool

The PIT, as developed and refined by Dorrestijn (2012), consists of four 'quadrants', each containing three 'effects' (figure 1). The twelve effects together aim to represent the ways in which products and technologies impact the lives of individuals, as well as society as a whole. These effects originate from the fields of philosophy of technology and design for usability. The PIT is meant to induce reflection on the way technology influences humans. Descriptions of each of the effects can be found on the PIT's website (Dorrestijn, 2016). In the following, each of the PIT's quadrants and effects will be shortly discussed on their potential for reflective and prospective thinking. For the purposes of this paper, the most recent iteration as of writing will be used (Dorrestijn, 2017).

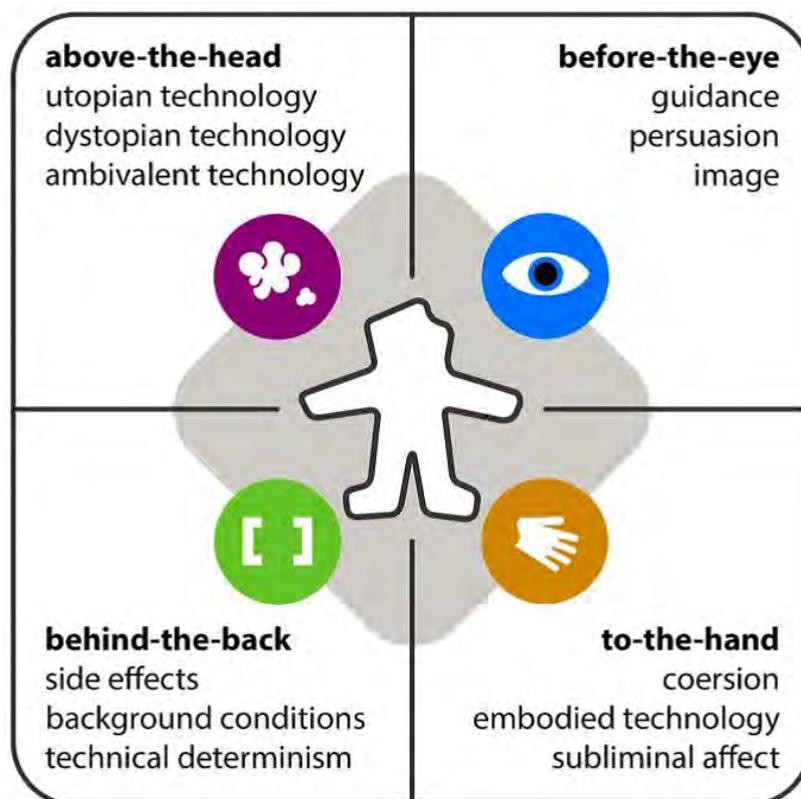


Figure 1 Product Impact Tool (Dorrestijn, 2016; <http://stevendorrestijn.nl/tool/>)

### **2.1 Before the eye**

The before-the-eye quadrant details the ways in which technology influences the cognitive systems, often making use of humans' senses. Through this direction, products impact the decision-making process, by providing information and ideas to their user, while still offering them a free choice. This can for example be seen in the usage cues of products, like how the user interface of a washing machine communicates to the user what each of its settings means and does.

The effects in the quadrant can be used early on in the design process, to consciously plan the message that a product communicates, and how it wants its user to act, and align this with the design intentions. For a more reflective purpose, they can be used near the end of the design process to study the contents and quality of a product's communications and cues, so that they can be evaluated for their desirability, and thereby also provide information for potential redesigns.

### **2.2 To the hand**

In the to-the-hand quadrant, the influences work directly on the user, skipping over the decision-making process. These effects need not always be physical to function as described. It looks at the ways that both users' actions and their routines can be restricted or changed. The effects are visible in for example the safety caps that are put on containers of medical and chemical products, or how supermarkets often use the smell of freshly baked goods to entice customers and make them feel comfortable in a subliminal manner that overrules the customer's conscious decision-making process.

The effects in this quadrant can be consciously added early on in a design process, in order to improve for example safety and effectiveness. As a reflective measure, it is viable to look at the direct influences that are present in a designed product, evaluating whether they are desirable and effective, and whether users will be willing to accept them.

### **2.3 Behind the back**

The effects in the behind-the-back quadrant are more indirect in the impacts they represent than the other quadrants. These effects relate to the environment surrounding the technologies, and how technologies and the environment influence each other. For example, the introduction of mobile phones has had the side effect that humans now feel a need to always be available and in contact with others, and has moreover lead to a need for strong ICT infrastructure. These effects are difficult to consciously apply when designing a new technology, but should nonetheless be studied to minimize potential negative consequences or product failure.

During development of a new product, knowledge of potential consequences and conditions can be useful to ensure successful and desirable implementation. It can also serve as a reflective means, to look at the societal effects that an existing product has had, and what environmental factors played a role.

### **2.4 Above the head**

The above-the-head quadrant focusses less on specific effects, and rather on general views on the role of technology in society. It is mainly meant for ethical reflection and discussion. These reflections can be used in a development process to think about how users may react to the introduction of the product that is being designed. It also forces one to look from a perspective that may differ from one's own, thereby potentially finding out new ideas. For a historical example, the deployment of the atom bomb near the end of World War II can be seen as a sort of turning point, that changed the widespread societal perception of technology from a utopian to a dystopian view.

When designing a new product, it can help to try to look at it from different angles, to more clearly see how it can change society overall in either positive or negative ways. Similarly, it can prove useful to also reflectively subject existing products and technologies to these perspectives, to potentially learn how negative consequences can be avoided in the future, while ensuring that the desirable ones will still be maintained.

## **2.5 Scope of the Tool**

Up until now the PIT has mainly been used as a framework for product designers, with the goal of better products being designed that can lead to a more desirable future (Dorrestijn & Eggink, 2014). This scope can be extended further, to also be used for more abstract concepts, like innovations, strategies, and corporate identities. Strategic development carries with it a relation with society, much like product design does, with decisions that are made having an impact. The PIT could serve as an aid in this field, providing insight into the different relationships that are present. The strategists will be able to affect society in a more conscious and responsible manner. As such, more effective strategies can be developed that serve more desirable goals.

## **2.6 Proposed method**

The PIT can be used as an analytical method in itself, to analyse (future) innovations and policies. Using its model's effects as a sort of checklist, different aspects of a particular subject can be listed and discussed. By analysing the chosen subject based on each of the PIT's twelve effects, one is forced to take a critical stance and to see things from more perspectives (Raub, 2017). The method is meant to be used by for example designers or strategists, in the form of workshops wherein the impact of a new idea is analysed. Diagrams can be used to complement the analysis with visual data (figure 2).

## **3 Comparison with existing tools**

To gain insight into how this method relates to the larger field of prospective analysis, it has proven useful to compare it with existing analytical means. Within the field of prospective and strategic development, different tools exist. The choice was made to distinguish two types, namely between corporate- and innovation-oriented perspectives. For each of these perspectives, different tools exist. In the following, a selection of existing tools is discussed and compared for their relation to the PIT and the proposed analytical method. The selection was made based on prevalence within the field and literature (cf. Glaister & Falshaw, 1999; Johnson, Scholes, & Whittington, 2008).

### **3.1 Corporate-oriented tools**

#### *SWOT-analysis*

SWOT-analysis serves as a strategic planning tool for businesses and organisations to analyse their position in the market, based on the four areas of Strengths, Weaknesses, Opportunities, and Threats (Osita, Onyebuchi, & Justina, 2014). SWOT largely focusses on investigating and structuring the results of a particular technology or policy, rather than looking at the particular explanations for those results. This relation to consequences of particular developments shows a kinship with the 'behind-the-back' quadrant of the PIT, specifically with the effect of 'side effects'. The PIT can add more user-interaction and societally related factors to SWOT's mainly economic and market-position focussed features. From this perspective, the right-hand side of the PIT's model (before-the-eye and to-the-hand) looks at factors mainly internally to the company, relating to SWOT's Strengths and Weaknesses, while the left-hand side (above-the-head and behind-the-back) looks at external factors, which in turn show similarities to the Opportunities and Threats of SWOT. The PIT can in this way supplement SWOT's information output.

#### *Five Forces Model*

The Five Forces Model of Michael Porter uses five dimensions that show the inherent potential for growth and profit in a particular market sector, and that need to be kept in mind by companies in order to successfully defend their position: the threat of potential entrants; the threat of substitute products; the bargaining power of suppliers; the bargaining power of buyers; and the rivalry among existing firms (Porter M. E., 1980, pp. 3-33).

## Ambivalent technology

As we are right now, from an ambivalent technology point of view, we are intricately interwoven with ICT, and can hardly do without the technologies anymore. However, it remains that we need to be vigilant of what the technologies do to us, and how they change who we are and what we do.



## Guidance

ICT organizations need ways to convey the meaning of functions and purposes to users. To this end, icons are used, but also textual aides, like help-screens.



## Dystopian technology

From a dystopian viewpoint, ICT companies have started to take over our lives, and distract us from ourselves and each other. ICT products stifle social contact, and take any and all meaning out of our interactions with other people.

## Utopian technology

From a utopian viewpoint, ICT provides us with new capabilities and opportunities, thereby unequivocally improving upon our lives and society as a whole.



## Side effects

There are various side effects that result from ICT. Among others, there is the electricity consumptions of datacentres, which impacts the environment negatively, and the fact that internet and computers has reduced the amount of physical social contact between people. Another side effect comes from the idea of products coming 'between' users, thereby stifling social contact between two persons, for example in the bus due to automatic payment systems for public transport.

## Background conditions

Besides the fact that ICT itself serves as a background condition that many products and services rely upon, the technologies themselves are also reliant on certain factors. For example, electricity and infrastructure, but also users' previous experience and familiarity with (similar) technology.



## Technical determinism

There is a certain fear with segments of the population that ICT has started controlling our behaviour, and making decisions for us. An example would be modern smart phones, that enable us to always be online and give us access to all kinds of apps and functions, but some people are afraid that these technologies have taken on too big an influence in our lives. It does ring true that ICT has changed our societal values, by creating requirements and demands that did not use to exist before their introduction.



## Embodiment

Especially younger generations have managed to make ICT products part of their routines and embodiment. Think for example of typing or touchscreens. While many companies try to do something similar with older generations, these types of endeavours often meet with problems.



## Coercion

Software systems often by their very nature limit the options available to their user, by providing them with a rigid framework to follow during interaction. Think of online forms, for example. A more physical example would be floppy disks, which were later designed to only be able to be inserted in the one correct manner.



## Persuasion

ICT products have in the past been used to encourage users to exhibit for example 'good' or healthy behaviour. For example, Fitbit. On websites, pop-ups and other adverts also work through persuasion of the user.



## Image

ICT products often carry a certain image with them, which the user may use to identify themselves with. There are also sometimes options for customization. For example, Apple vs. Windows, PC building, but also technologies designed specifically for men or women.



## Subliminal affect

ICT products have been known to make use of subliminal affects in order to get the user to act in a certain manner. For example, the use of certain adverts on websites has a subliminal affect.

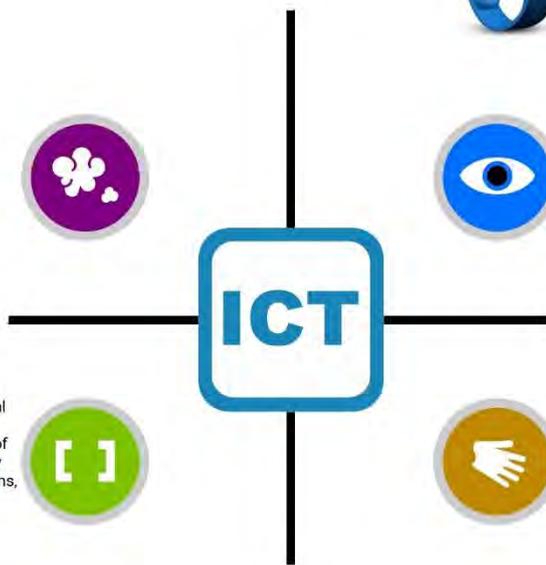


Figure 2 Example diagram of PIT, based on the sector of ICT Companies (Raub, 2017)

Porter's framework concerns itself with fairly abstract, business-focussed concepts, meaning less attention is given to the specific impact that a particular strategy or product can have in society. However, the Five Forces Model does relate to the 'background conditions' effect in 'behind-the-

back', as it looks at how external factors influence a proposed project. The two models handle these kinds of themes differently, with Five Forces taking a business-oriented approach, whereas the PIT looks more at societal and technological factors. Usage of both tools therefore can provide strategists and analysts with two important perspectives on which environmental factors may play a role.

### *PEST-analysis*

PEST-analysis serves as a framework for analysing environmental market-factors, clustered in Politics, Economics, Social circumstances, and Technological developments, and for each of these factors, separate influences can be listed to provide an image of the industry being worked on (Johnson, Scholes, & Whittington, 2008, pp. 55-57). Comparison with the PIT shows a certain amount of overlap between PEST's focus on environmental factors and the PIT's 'behind-the-back' quadrant, particularly the effect of 'background conditions'. This can for example be seen in the model of ICT companies (figure 2), where it mentions the technologies' reliance on not only infrastructure but also users' familiarity with technology. Both tools aim to analyse the role of influences in the environment on a product, service, or organisation. The PIT however adds one extra dimension to the discussion, mainly through the 'technical determinism' effect. This effect signifies how society not only influences (technological) developments, but that the reverse also happens, with said developments impacting and changing society. In this way, the PIT adds a new perspective to the conventional PEST-framework.

## **3.2 Innovation-oriented tools**

### *Technology assessment*

Technology assessment encompasses the practice of analysing the societal impact of new technologies, and is a tool for advising political changes and decisions by anticipating positive and negative consequences of future developments (Porter A. L., 1995, p. 136; Van Est & Brom, 2012). Both technology assessment and the PIT wish to investigate the potential consequences that may occur as a result of a particular technology being implemented in society. For the latter, this is most apparent in the 'behind-the-back' quadrant's effect of 'side effects'. For both methodologies, awareness of these impacts and consequences is meant to ensure that they are used in societally beneficial ways. The PIT can aid in technology assessment practices by structuring the different factors that play a role, with possible (moral) issues being shown in 'behind-the-back', whereas 'above-the-head' shows potential directions in which a particular technology can take society. The model for ICT companies (figure 2) for example discusses how technologies can come 'between users', stifling interactions. Meanwhile, the 'before-the-eye' and 'to-the-hand' quadrants show the available means to 'steer' a particular innovation in such a way that beneficial effects are ensured and negative ones are avoided as much as possible.

### *Scenario planning*

Scenario planning makes use of short narratives to analyse potential future situations that may come as a result of certain decisions and developments, helping analysts to consider and prepare for futures that are not readily apparent and may be overlooked (Schoemaker, 1995; Eggink, Reinders, & Van der Meulen, 2009). As has already been investigated by Dorrestijn, Van der Voort, and Verbeek (2014), there are certain ways in which scenario planning can be combined with and improved by the PIT. Overlap can mainly be seen in the left side of the PIT's model, in the quadrants 'behind-the-back' and 'above-the-head'. Within the proposed analytical method, the 'above-the-head' quadrant is used to present three scenarios of possible future states surrounding a particular development, as can for example be seen in the model of ICT companies (figure 2). Meanwhile, the findings listed in the 'behind-the-back' quadrant show the environmental factors and impacts that could potentially lead to those futures. In these ways, the PIT can be used to both create and improve scenarios, by raising understanding of the role of potential technologies in society.

### *Technology roadmapping*

A technology roadmap presents a plan or strategy for how a particular new technology or product can be developed and implemented in society, meant to be made in cooperation with as many relevant stakeholders as possible (International Energy Agency (IEA), 2014). The technology roadmapping process starts with an analytical phase, in which the PIT can prove useful. During this phase, different environmental factors that play a role are investigated, showing a relation to the effects in the 'behind-the-back' quadrant, particularly 'background conditions'. By understanding the factors that a particular new concept relies on, and the potential impact that it can have, it becomes easier to determine a desirable means of implementation. Moreover, the 'above-the-head' quadrant, through the potential futures that it presents, can provide information applicable for the 'envisioning' stage of the roadmapping process. Lastly, the PIT could be used as part of workshops with stakeholders.

### *Technology forecasting*

Technology forecasting concerns itself with anticipating and understanding future technological changes and innovations, looking also at potential (social) impacts that may come as a result of a particular technology's introduction (Firat, Woon, & Madnick, 2008). Technology forecasting uses various different tools in its pursuit of predicting future changes and impacts. Most of these take an economic or statistical approach. The PIT could be used to also add a philosophically and ethically oriented perspective that is not yet present. Looking at both desirable and undesirable consequences that may occur as a result of a particular technology's introduction can help when forecasting what possible futures said technology can lead to. The interaction-oriented effects in the 'before-the-eye' and 'to-the-hand' quadrants can help to show how an innovations effects can to an extent be 'steered' so that more desirable results are achieved. In these ways, the PIT can offer a valuable addition for the practice of technology forecasting.

### *Technological innovation systems*

The approach of technological innovation systems seeks to analyse technological change by looking at the broader social structures that connect different companies and organisations, and how these institutions impact a particular technology or technological field (Suurs, 2009). Inherent to the technological innovation system is the idea that social structures influence and impact technologies. This shows overlap with the views of the PIT, most noticeably in the 'behind-the-back' quadrant. In this regard, the PIT however also adds the perspective of technology's vice versa influence on society. The PIT and proposed methodology can structure those ideas that are relevant when studying the innovation system of a particular technology, while also adding this aforementioned perspective of the overall interdependency of technology and society.

### *Technology acceptance model*

The technology acceptance model provides different factors that play a role in whether a user will want to use a particular product, and how they will use it, mainly focussing on the two factors of 'perceived usefulness' and 'perceived ease of use' (Davis, 1989; Venkatesh & Davis, 2000). The technology acceptance model's focus on particularly the 'perceived' usefulness and usability can clearly be related to the PIT's 'before-the-eye' and to a somewhat lesser extent 'to-the-hand' quadrants. Study of these specific fields during analysis with the PIT can thus provide useful insights when determining whether a user will be willing to 'accept' a particular new product or technology. Moreover, the scope can be extended to not only look at whether users will accept a particular technology, but also to investigate whether said technology will be accepted by society overall according to its values. In this manner, the PIT can provide additional insights that further analyses using the technology acceptance model can benefit from.

## **3.3 Summary of results**

It can be seen that the PIT can serve as a useful addition for the field of future planning and prospective analysis. In the investigations of the different existing methods, no explicitly notable

difference in potential was found between the two categories of corporate- and innovation-oriented tools. By looking at societal impact and human-technology relations, the PIT adds new perspectives and dimensions to the perspectives by the existing methodologies. Conversely, current methodologies also provided information that could serve as effective input for analyses that use the proposed analytical method of the PIT. In this way, the PIT and existing methods and models can complement and benefit from each other, leading to more useful information being found. It is expected that the knowledge garnered in this manner will in turn prove valuable when planning the implementation of new strategies or innovations, by allowing those responsible to do so in an effective, desirable, and responsible manner.

## **4 Case study of future transport**

A case study will be presented to illustrate how the PIT can be used to analyse current and future concepts. Doing so can further demonstrate the added value that the PIT and the proposed methodology can offer to the field. While both corporate- and innovation-oriented subjects showed potential, the choice was made here to focus on an innovation-oriented subject. To this end, the following will first present a concept for future personal transportation, originally developed by the Dutch Study Centre for Technology Trends (STT), which will then be analysed using the PIT. STT serves as an institute that explores potential future concepts and scenarios surrounding innovative technologies, while also posing challenges and risks. Their approach can broadly be described as technology forecasting, to the end of which workshops are used with relevant stakeholders, as well as for example students, combined with desk research and interviews. For illustrative purposes, they also make use of scenarios. For the theme of future personal transportation, STT presents three concepts (Van Voorst tot Voorst & Hoogerwerf, 2014). While each of these have been analysed (Raub, 2017), the following will only present the analysis of one concept. In their report of the concept, STT themselves also offer an analysis of the potential impact (Van Voorst tot Voorst & Hoogerwerf, 2014, pp. 19-24), thereby offering a good point of comparison for the results that were found with the PIT.

### **4.1 STT's concept: Transportation on Demand**

In the proposed concept, in the year 2040, personal transportation will largely take place using autonomously driving cars. Moreover, people will no longer own their own vehicles, because these cars will be rentable on demand. The concept includes a so-called 'digital journey assistant', which will be used to operate the rental system. The expected form of this 'assistant' is a smartphone app. Shorter distance transport would be taken care of by individual vehicles, which will also be able to transport passengers to 'transport hubs', where the passengers can change over to other forms of travel, like train or plane, for longer distance travel. After transport, the vehicles can find a parking spot and charging station by themselves, where they will wait until they are needed again. The concept envisions that these services will be provided by not only conventional automotive

In the following, this concept will be analysed using the PIT. The analysis was performed by the authors themselves. For each of the PIT's twelve effects, ideas were generated for the potential impact that this concept will have. These ideas will be further explained in the text. A visual diagram was made to summarise the findings (figure 3).

## Dystopian technology

The concept of transport on demand will make humans more isolated, as they are driven around in their personal self-driving cocoons, disconnected from the world outside and from each other. Especially the elderly will lose all contact with others, as they are constantly alone in their autonomous cars. Brands will take control of people's lives, deciding over when, where, and how they will travel. The newly added free time will lead to humans losing their sense of purpose, becoming bored and depressed.



## Utopian technology

Transport on demand will allow people to travel more easily, and more often. Both long and short distance travel will be made available for everyone, including those who currently cannot drive a car. Travelling will become more enjoyable, and provide people with more time for leisure, as the burden of driving is taken off of their shoulders.

## Side effects

A first possible side effect of the concept is that certain jobs will become redundant. Further, due to the large variety of service providers, not all systems will connect perfectly, meaning users will still have to experience wait times between transport. There are also risks involved with putting citizens who are unfit to drive in a position where they may have to intervene with the cars' actions, leading to potential accidents. There is also the question of what people will do with their newly gained free time, as boredom can potentially lead them towards undesirable behaviour or depression.



## Background conditions

The proposed concept will require new laws and regulations, to allow the cars on the public roads. Regulations are also needed regarding insurance. Both users and other stakeholders in the traffic system would need to accept the new vehicles. Travellers will need to trust the service providers, as well as the providers trusting each other, for example when it comes to exchanging of data. There will also be a need for a reliable and robust ICT infrastructure to let the cars function.

## Technical determinism

As people will no longer own their own personal vehicles, they will become dependent on the cars and the service providers for transport. The value of independence may become less important, as becomes normalized for people to be driven to their destinations by the technologies. It may also change what it means to be old, as the concept aims to allow among others the elderly to be able to travel more and more easily, thereby removing the stigma of them being immobile and also isolated from the outside world.



## Guidance

The concept's 'digital journey assistant' will be a main form of guidance through information. The user will need to know how and when they reach their goal. The cars themselves will also need to make use of guidance and cues, to communicate not only with their passengers, but also with the people around the vehicles, using for example lights and sounds.



## Persuasion

The service providers and owners of the different 'digital journey assistant' apps will want to persuade consumers towards using their particular products and services. To this end, they can make use of adverts and special offers. Persuasion will also need to be used to lead users around the vehicles towards correct and safe behaviour.



## Ambivalent technology

Society will need to understand that transport on demand may sound very convenient, but it also comes with certain risks and caveats. It should be made sure that people, especially elderly, are not always travelling alone, and rather using their new free time in the car to connect with the people and the world outside. The cars themselves should be designed in such a way as to allow passengers to spend their new free time in a valuable and worthwhile way.



# Transportation On Demand



## Image

The new autonomous cars will be provided by different lifestyle brands. Each separate brand will bring with it a particular kind of image. The choice in different brands can allow users to choose the image that best fits them, in regards to both their needs, but also their lifestyle.

## Embodiment

The process of ordering a vehicle, sitting down in it, and then being brought to one's destination is meant to merge with its user's daily routines. To do this, the service will need to be easily accessible, so that the activity can after some uses become natural. After this, the user will more instinctively choose to use the services, whenever they need to travel somewhere.



## Coercion

Once in the car, the vehicle will start driving on its own, following a pre-planned route, which allows little freedom of choice for users. While it is moving, the passenger is confined in the car's interior, waiting until they reach their goal. In these ways, the proposed concept limits the user's options and actions.



## Subliminal affect

To encourage people to use the new services, companies will want to use subliminal affect. With this in mind, the cars themselves should be as comfortable and convenient as possible. By allowing for comfortable travel, and letting them do other things while in the car, like letting children play in a special area, the experience will be seen as more positive by the passengers. In doing so, they will be subconsciously affected to use the services again in the future.

Figure 3 Analysis model "Transportation on Demand" (Raub, 2017)

## **4.2 Before the eye**

The proposed implementation of rentable autonomous vehicles will need to convey information to its users and customers. Clear and neutral information will need to be given, but the service providers will most likely also want to apply persuasion. The concept specifically brings forward branding, so the effect of image will also play a part.

### *Guidance*

Guidance in this concept will first come as part of the 'digital journey assistant', that provides users with information about the transport they requested. The app needs to clearly communicate how the users will reach their intended destinations. The concept does not go into detail about information that the vehicles themselves will provide, but guidance will be needed here too. This can be in the form of for example displays that indicate how far the user is from their destination, or sound cues. Another aspect that is missing is the information for other people around the car, like pedestrians and cyclists. These actors will require information about what the vehicle is doing or about to do, in order to increase safety, which could be communicated using for example lights or sound.

### *Persuasion*

The service providers will want to persuade users towards using their particular cars. Though the concept does not go into detail about this, an idea about how this could be done is through marketing. Using adverts or special offers, vehicle providers can encourage users to choose their particular services. Similarly, the providers of the different 'digital journey assistant' apps will need to use such measures to convince consumers to choose their particular offerings. Another question about the concept is how it can lead people around the car, like pedestrians, towards correct and safe behaviour.

### *Image*

According to the concept, different lifestyle brands will try to get a stake in the self-driving vehicle market. These different brands will each offer a certain image. The Apple-brand car would be considered modern and functional, whereas the Walmart-branded one is seen as convenient and affordable, to name a few examples. The technology and its experience are in this concept meant to be somewhat customisable. Users will be allowed to create a driving experience that fits not only their particular needs, but also their personal image and lifestyle. The overall image of the proposed self-driving vehicle system will most likely be one of convenience and ease. There will also, at least at first, likely be an image of luxury, as the act of being driven around reminds one of the image of having a personal chauffeur.

## **4.3 To the hand**

This concept will interact with users in a direct manner as well. Coercive elements will be in place that limit the users' options. The technology is meant to merge seamlessly with people's activities. The self-driving cars will also have certain aspects of subliminal affect, that lead users to repeat usage of the services in the future.

### *Coercion*

After a user sits down in the car they requested, the vehicle will start driving on its own. It will follow a pre-planned route, leaving the passenger with little freedom of choice. Moreover, while the vehicle is moving, the user will be confined inside, needing to wait until they reach their destination or the car is stopped. This last point is especially relevant, since discussions by both STT and others often focus on the idea that passengers will be able to do other things while travelling, whereas the fact that they will still be confined to the car's interior is often forgotten. These two aspects represent ways in which freedom of action is taken from users through the proposed introduction of autonomous vehicles.

### *Embodiment*

The practice of ordering a self-driving vehicle, entering it, and then being driven to one's destination is meant to merge seamlessly with and become embedded in people's natural routines. To this end, the service will need to be easily accessible, so that it can become, after the first few uses, natural to the user to order a car this way. After it is embodied in this way, the user will no longer need to put active thought and effort into the ordering- and travelling-processes.

### *Subliminal affect*

In order to encourage people to make use of self-driving vehicles, the service providers will want to make use of subliminal affect. A main factor in this is to make the autonomous cars and the transport they offer as convenient and comfortable as possible. By allowing customers to travel comfortably, and enabling them to do other enjoyable things during travel, users will associate the experience with positive feelings. Thereby they are subconsciously influenced to more likely use the services again in the future.

## **4.4 Behind the back**

The concept will need to keep certain environmental aspects and factors in mind for it to be successfully implemented. Certain side effects may come as a result. The vehicles will also rely on certain conditions to function. Lastly, there is the potential for this technology to steer society, and change the values that are held.

### *Side effects*

One potential consequence of the proposed concept is that certain jobs will become redundant, like taxi and bus drivers. However, the act of travelling will be made more accessible and easier, potentially improving humans' cultural and social development. A related advantage of the system that STT themselves mention is the added independence for for example older citizens or people with no driver's license, as they will now be able to travel more easily (Van Voorst tot Voorst & Hoogerwerf, 2014, p. 23). This may however also first lead to a reduction in social contact for these people, as they will no longer be driven around by friends and family, but second also brings forth the issue of putting people unfit for driving into a situation where they may still need to take on a supervisory role over the system. Another benefit that is listed by STT is the added free time for work or leisure, due to passengers no longer needing to drive themselves. It is unknown however what people will use this newfound free time for. While the intention is to raise productivity and happiness by allowing people to either work or relax during travel, there is the risk that passengers will start to experience severe boredom and lack of purpose. This in turn can potentially lead to undesirable actions like vandalism of the vehicles, or even lead to mental health problems like depression.

### *Background conditions*

The concept itself lists certain 'preconditions' that need to be met to successfully implement the proposed system (ibid., pp. 20-21). First, new road laws will be needed to allow the vehicles to drive on the public road. There is also a need for new insurance regulations, so that the right actors can be held responsible in case of accidents. Second, autonomous vehicles will need to be accepted by both the users themselves, as well as other stakeholders in the transport system. Third, travellers will need to put their trust in the service providers, as well as the service providers trusting each other. For STT, this is specifically about the sharing of information and data, but in reality this need for trust will also concern subjects like safety. Besides these conditions, there is also for example a need for a strong ICT infrastructure, that can reliably handle the massive data exchanges that are needed to allow the self-driving vehicles to function.

### *Technical determinism*

The introduction of 'transportation on demand' has the potential to bring certain changes to society and its values. First, people will become dependent on the system for their travelling, as they will no longer be owning their own cars. The value that is held for human independence may thereby also

be lessened, as it becomes normalised for people to be driven to their destination by technological systems. In addition, if STT's intentions are fulfilled, the meaning of for example old age may be changed, as elderly citizens become once more able to travel easily, removing the stigma of them being immobile and isolated.

#### **4.5 Above the head**

There are different perspectives through which one may look at the social impacts of this concept. One can look at it fairly optimistically, seeing the potential benefits it can bring to improve our human capabilities. Or one can see its dystopian side, focussing on its possibly undesirable side effects. A third perspective would aim to look at the concept in an ambivalent manner, seeing both the risks and benefits, and to understand how it could be implemented in the most desirable way.

##### *Utopian technology*

From a utopian perspective, 'transport on demand' will lead to people being able to travel more easily and more often than they are currently able. Both long and short distance travel will be made available for everyone, even those that currently cannot drive a car. The act of travelling will be made more enjoyable, as passengers can spend their time on leisure. With the burden of driving taken off the shoulders of passengers, they get extra free time, which they can use to work towards fulfilling their true potential as humans undistracted.

##### *Dystopian technology*

From a dystopian perspective, this concept will lead to humans becoming isolated in their personal self-driving cocoons, disconnected from the outer world and the people around them. Elderly citizens will lose the contact they had with others, as they are constantly alone while being driven around by autonomous vehicles. People's lives will become even more controlled by brands, as companies come to decide over when and how they travel. The free time that is supposedly added will only lead to people losing their sense of purpose, becoming bored and depressed.

##### *Ambivalent technology*

From an ambivalent perspective, society will need to understand that, convenient as 'transport on demand' may sound, it comes with certain risks and caveats. It needs to be ensured that people, especially the elderly, are not made to always be travelling alone in their autonomous vehicles, but rather use their newfound free time in the cars to connect with others. The cars themselves will also need to be designed to allow passengers to spend their travel time in a valuable and worthwhile manner that stimulates them.

## **5 Discussion**

Analysis of the concept proposed by STT using the PIT showed that there is an added value in using it as a supplementary means of study. By ordering insight inspired by the PIT's twelve effects into the model, it became clear that certain aspects had been neglected by STT's conventional technology forecasting approach. Through use of the PIT, this missing information was found, and thus can be taken into consideration when planning the concerning technology's introduction into society.

The quadrants on the right side of the PIT's model (before-the-eye and to-the-hand) were largely used to theorize about how the proposed systems could function in detail, and other aspects that needed to be kept in mind with regard to usability and functionality. In doing so, details were added that were still missing from STT's own analyses.

The assessment of the concept by STT themselves could be considered fairly optimistic, if not utopian. Important negative consequences of the proposed plans had either not been found in the approach used by STT, or went unmentioned due to other reasons. That said, there were also certain positive effects and consequences of the concept that were not mentioned by STT, but were found out during analysis with the PIT. For example the increased accessibility and ease of travelling, which

can potentially improve cultural development. These types of aspects were mainly investigated through the quadrants on the left side of the PIT's model (behind-the-back and above-the-head).

Overall it became clear during the analysis that the added value of the proposed analytical method of using the PIT lies in providing new insights and perspectives. This is achieved by making the analysts look critically and from multiple sides on the subject they are working on. This also provides them with a more ethically oriented approach. The proposed method serves as an additional measure, that should be used in combination with the tools and methods that already exist. During the case study, it also became clear that this kind of intricate analysis of potential impacts can change one's perspective and opinion on the desirability and feasibility of a particular concept. By using this proposed method, strategists are provided with more information about the potential role and impact of their subject in society, aiding them in both studying its desirability and in determining the most effective and responsible manner of implementation.

## 6 Limitations and future work

Certain limitations and questions still remain within the research demonstrated in this paper. First, the present research did not include a critical assessment of whether the PIT includes all the necessary and relevant themes and aspects. The PIT may still require further refining and development. Improvements in the PIT will lead to the developed method functioning more effectively. Second, the research could benefit from the undertaking of a case study of a corporate-oriented subject, as the ones that have been done already are innovation-focussed. Third, the case study was performed by the authors themselves. The method has not yet been tested with experts in the field of strategic development and analysis. Doing so would garner more information about the added value of the method in actual practice.

## 7 Conclusions

This paper aimed to demonstrate the potential for using the PIT as an analytical instrument for prospective thinking about future strategies and innovations. The PIT's twelve effects were investigated, an application method has been proposed, and its position in relation to existing methods in the field has been examined. The method has furthermore been applied in a case study, to demonstrate its potential. In doing so, it was shown that usage of the PIT in this manner can provide analysts and strategists with new and relevant information. The method is explicitly meant to be used in combination with ones that already exist. Because of the reflective and human-centred nature of the PIT, analysts are aided in making decisions in the development of new technologies, so that these will have a more effective, desirable, and responsible impact in society.

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# Using Heterotopias to Characterise Interactions in Physical/Digital Spaces

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This paper addresses the complexity of designing interactions in hybrid digital/physical spaces, in which notions of public and private are becoming increasingly blurred, by using a philosophical lens to characterise such spaces. In particular it references the ideas presented by Michel Foucault in his essay *“Of Other Spaces”*. It proposes the presence of a spatial division within physical and virtual, in terms of private and public, and juxtaposes them through a Heterotopical Model for Inter-Spatial Interaction through which designers can examine the coexistence of physical and digital interactions. The purpose of modelling this juxtaposition is to help designers understand the nature of connections that happen between physical and digital objects in these spaces and consider how meaningful interactions can respond to this complexity.

*spaces; phenomenology; heterotopia; philosophy for design*

## 1 Introduction

This paper illustrates how philosophical constructs should not be viewed as separate from design practice but rather can augment the design process using the example of how to characterise complex interactions that combine both the physical and digital aspects. We establish the presence of a philosophical division of space developed through the ideas presented by Michel Foucault in his essay *“Des Espace Autres” (Of Other Spaces)*. This division plays a pivotal role in the creation of a framework for Inter-Spatial Interaction, acting as a philosophical lens through which we define interactions between physical and digital aspects that traverse over an imagined *Real Space* and *Digital Space*. Referencing Foucault’s idea of the heterotopia as the basis of this lens, we systematically define the presence of these alternate spaces and the nature of interactivity that could happen within them. Finally, a discussion is presented on the potential for designers to use this approach to understand the complex nature of objects that connect with digital interfaces and services in order to consider the “range of perspectives from which each device may be observed” (Lindley & Coulton, 2017) and thus comprehend the “complexity relating to the interdependence”



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between interactions, raising questions on the need for *'meaningful interactions'* between physical and digital in such environments.

### **1.1 The division of Space**

Space is described by Tuan (1977) as, “an abstract term for a complex set of ideas”, which he says comes from how, “people of different cultures differ in how they divide up their world, assign values to its parts, and measure them”. His definition assumes space in relation to the “intimate experience [of man] with his body and with other people”, wherein one, “organises space so that it conforms with and caters to his biological needs and social relations”. Architecturally space is seen through an idea of dimensionality, where it can be measured, yet “spatial dimensions such as vertical and horizontal, mass and volume are experiences known intimately to the body” (Tuan, 1977, p. 108), this allows architecture to traverse the boundary between *space* and *place*. Both terms “denote common experiences” (Tuan, 1977, p. 3) but they both expand on each other’s definitions where “place is security, space is freedom: we are attached to the one and long for the other”. Tuan’s exploration of space/place is more towards the study and experience of Geography, but it can be appropriated to encompass the digital as we have done within the research, as such:

*Consider the sense of an 'inside' and an 'outside', of intimacy and exposure, of private life and public space. People everywhere recognise these distinctions, but the awareness may be quite vague (Tuan, 1977, p. 107)*

The level of interaction a person might have within an open town square compared to their own house would be very different, as different amounts of trust would be associated with these 'inside' and 'outside' spaces. This space/place relationship transcends into our digital environments equally, with the “conceiving of cyberspace as a social space” (Slane, 2007, p. 12), it can be seen as being, “socially constructed, its meaning deriving from the uses to which it is put, and therefore capable of multiple simultaneous incarnations”—the word social here is taken liberally to include not only person to person interaction but also thing to thing interaction where digital terminals and objects would be included—therefore, a mobile phone would constitute as a personal space where as a message board online would be a public space only juxtaposed into a virtual world but in either case the interaction happens through a physical interface; here a mobile, or a laptop. These incarnations of digital spaces become more convoluted when imagining the plethora of Internet powered devices available, often with the *Smart* moniker preceding them; Smart Phones, Smart Watches, Smart TV’s, and so on. A cluster of communications that have us “entangled within the heterogeneous network of interconnected objects or things that are readable, recognisable, locatable, addressable, and/or controllable via the Internet” (Coulton, 2015; Lindley, Coulton, & Cooper, 2017). A space can thus have multiple places residing within it, each with its own meaning which is unique to the actors interacting within them.

Often these virtual interactions tend to mimic older real-world practices; a diary can exist in a physical and virtual form, both can be closed or open to others. The complexity ensues when multiple points of interaction come in to play with objects connected to wider constellations of interactions for instance when a Smart Assistant such as *Google Home* needs to connect with a mobile phone or a switch among multiple other points in order to request access and gaining trust to switch on a light bulb, these raise questions such as: what is the nature of these interactions? Are they meaningful for the actors? And how can one better design them to be not only efficient but also worthwhile?

## **2 Methodology**

Phenomenological research attempts to understand, “how people experience things and events”, by examining, “perspectives and views of various social realities” (Leedy & Ormrod, 2010; Muratovski, 2015, p. 79). The Stanford Encyclopaedia of Philosophy defines phenomenology as the study of, “things as they appear in our experience, or the ways we experience things, thus the meanings

things have in our experience” (Smith, 2016) and expresses an interest in a “conscious experience as experienced from the subjective or first-person point of view”. Philosophical approaches such as speculative realism, or object-oriented ontology put aside old philosophical dualisms and instead explore how objects “should be recognised for their indifference to us” (Cole, 2013, p. 106) and focus on the things they do “behind our backs” looking at their individual experiences as “actants”, moving in and out of “assemblages, entering into collectives of their own making”. Therefore, by seeing these interactions existing as a phenomenon we attempt to make sense of their complexity using philosophical references in tandem with real-life examples. By asking, “What is it like to do or experience [something]?” (Muratovski, 2015, p. 79), we attempt to empathise with these objects and see from their perspective what these Inter-Spatial Interactions are like.

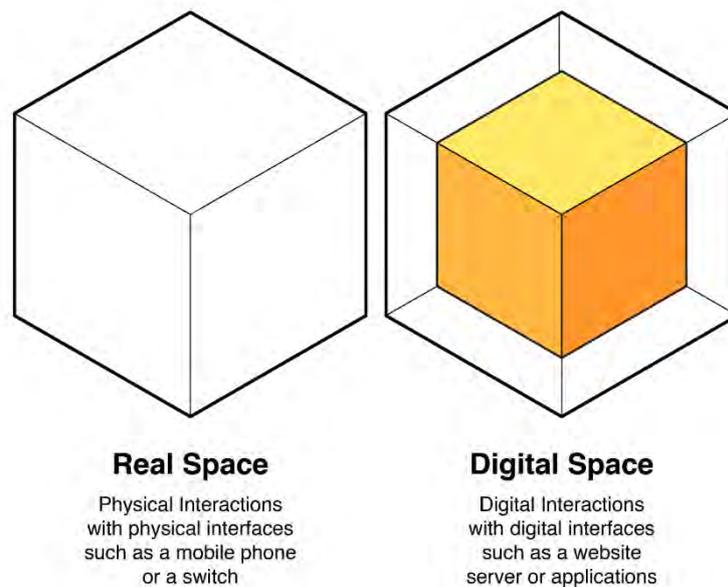


Figure 1. Imagining Digital Space as a subset of Real Space

For this philosophical lens, the actual space will be divided utilising Tuan’s (1977) perspective of spaces containing a “sense of an ‘inside’, and an ‘outside’”, by presenting two realities; one being the physical reality that we have around us in which we physically interact (Real-Space or RS), the other being a virtual one where interactions through/with digital objects occur (Digital-Space or DS) (see Fig. 1). In this particular view DS resides as an ‘inside’ or a subset of RS, allowing for physical objects to be present within the same space alongside their virtual counterparts; one being tangible the other intangible. The idea of virtual being present alongside the physical has been discussed by others seeing it as a “Virtuality Continuum” (Milgram, Takemura, Utsumi, & Kishino, 1995), one where, “both the real and the virtual coexist” (Coulton, 2017). Virtual worlds are also seen as literal places that, “can be construed not just in terms of globalised online networks, but in terms of space, landscape, and localities as well” (Rymarczuk & Derksen, 2014). Descartes’ explored the concept of a mind/body split which he called *res extensa* (extending things) and *res cogitans* (thinking things), commonly used to imagine the “physical world as having both extension and location in space” (Monk, 1997, p. 46), looking at psychological realities such as the virtual through this approach they, “do not have spatial dimensions, and their location is only metaphorically ‘in the mind’”; therefore, the division of space can be justified through a philosophical embodiment of the virtual space as a similar yet altered parallel space to the physical residing within it.

The second step is to further characterise these spaces with their ‘insides’ and ‘outsides’, and in this particular case to consider: spheres of Private and Public. These spheres house information with which we physically and/or virtually interact with. As an example, take a public message board online to be analogous with a discussion in the park where others may very well hear you, similarly a

personal passcode protected digital diary can be related with a physical key and lock diary. Although this is only in terms of the immediate relationship one has with objects and spaces around the objects and as we shall see for connected objects these interactions become considerably more complex.

## **2.1 Grounding the Philosophy**

Having acknowledged the spaces, we now see specific overlaps happening between spaces and spheres (see Fig. 2). Foucault once said: “What is interesting is always interconnection, not the primacy of this over that” (Brooker, 1999), keeping that in mind we come to the philosophical basis of this paper. In his essay “*Des Espace Autres*” (*Of Other Spaces*) Foucault (1967) introduced the concept of the *heterotopia* exploring how our lives are “governed by a certain number of oppositions that remain inviolable”, calling them “simple givens”, being, “between family space and social space, between cultural space and useful space”, but more importantly, “between private space and public space” (Foucault, 1967, p. 2). He explains these as ideals that are “nurtured by the hidden presence of the sacred” and calls these heterotopias *placeless places* because of their deviation from the norm. He goes on to assert that, “we do not live in a kind of void, inside of which we could place individual and thing” (p. 3), rather, “we live inside a set of relations that delineates sites which are irreducible to one another and absolutely not superimposable on one another”. These other spaces thus exist as a, “simultaneously mythic and real contestation of the space in which we live”. For Foucault, “Heterotopias are places of Otherness, whose Otherness is established through a relationship of difference with other sites, such that their presence either provides an unsettling of spatial and social relations or an alternative representation of spatial and social relations” (Hetherington, 2002, p. 8). Hetherington (2002) explains on how these spaces are created saying that they, “bring together heterogeneous collections of unusual things” (p. 43)—the deviation from the norm—where they have no, “order established through resemblance”. Furthermore, he discusses that what matters is the relationship seen “from the standpoint of another perspective, that allows a space to be seen as heterotopic”.

This approach makes it safe to imagine unique interactions that exist within the overlaps of the Inter-Spatial Interactivity model as residing within a heterotopia—or a series of heterotopias. A grounding factor of these spaces is that in these, “places of Otherness”, “unsettling juxtapositions of incommensurate ‘objects’” are established each contesting, “the way our thinking is ordered” (Hetherington, 2002, p. 42); hence presenting an alternate ordering of things that is unsettling because they have “the effect of making things appear out of place” (Hetherington, 2002, p. 50). This particular aspect allows us to view interactions in these spaces in a manner of urgency and thus challenging their meaningfulness towards the actors and the act.

Although the concept of heterotopia has most commonly been used to define alternate physical spaces as those referenced by Foucault himself—such as the cemetery, a festival, or the library—it also is used to define more abstract structures as he explains with the, “rug [being] a sort of garden that can move across space” (Foucault, 1967, p. 6). Another analogy he gives is of the boat which he calls a, “heterotopia par excellence”. Rymarczuk and Derksen (2014) discuss how the boat, “as a ‘placeless place’ applies to cyberspace as well, ‘particularly when it is a network, linking terminals in different places and times into a unified environment’”. They go on to assert through Sherman Young’s point of view of how cyberspace can have [further] heterotopias as well”.

## **2.2 Principles of Heterotopia**

Foucault (1967) established six principles to explain his ideology of a heterotopia, to begin he affirms that all cultures display the ability to create, or have created, heterotopias through which they, “take quite varied forms” depending on causal relationships to the space they inhabit, the culture they are tethered to and other factors. Second, society has the ability to “guide, push, and make established heterotopias”, in effect having of them, “change or adopt novel functions or new meanings” (Rymarczuk & Derksen, 2014). Foucault explains this in relation to the cemetery which having

evolved over time, “no longer the sacred and immortal heart of the city, but the other city, where each family possesses its dark resting place” (Foucault, 1967, p. 6). Third, is the “juxtaposing in a single real place are several spaces, several sites that are in themselves incompatible” (Foucault, 1967, p. 6). Rymarczuk and Derksen (2014) have expressed this to be a, “defining character of heterotopias”, allowing the, “merg[ing] of certain spaces”, such as public and private to exist. The fourth principle establishes a concept of heterochronies being that “heterotopias are most often linked to slices in time” (Foucault, 1967, p. 6), forcing an, “absolute break with traditional time”; cemeteries, museums, libraries, are examples of “becom[ing] heterotopias in which time never stops building up and topping its own summit”. Fifth, “Heterotopias always presuppose a system of opening and closing that both isolates them and makes them penetrable” (Foucault, 1967, p. 7). This can be imagined through metaphorical gatekeepers entrusted with responsibilities to allow certain things to enter and exit the heterotopia, digitally this can be imagined through payment, registration, and identification protocols. Finally, heterotopias have, “a function in relation to all the space that remains” around them. Foucault (1967) defines this as a function that, “unfolds between two extreme poles”, in a bid to, “expose every real space”, through creating an alternate, “space of illusion”, wherein defining a, “space of perfection to compensate for the flaws of real life” (Rymarczuk & Derksen, 2014).

As an example of a digital space being a heterotopia, Rymarczuk and Derksen (2014) uses the example of Facebook, affirming how it requires actors or in its case, “user[s] follow rules of conduct”, if they wish to, “start immersing themselves”, in its virtual world and have to agree upon, “terms of agreement — a contract essentially stripping away all property claims of information posted within this space”. They critique this aspect of the service saying that it is, “difficult to leave the space entirely”; recent updates of Facebook have added a deletion option though the design of the feature arguably discourages such activity which essentially aligns to the fifth principle of heterotopia. Moving on, they affirm that Facebook shows the, “distinct regime of time”, that Foucault describes in his fourth principle comparing it to museums that “accumulate time”, having it “share traits with but also combine them and add a dimension that marks it as an altogether new kind of heterochrony”, summing up that, “Facebook collapses past life, present life and afterlife into something very other”. They converge on the third principle by explaining how Facebook views privacy wherein the public domain, “is not invisible to the Facebook owners and administrators”, and at the same time individual, “social spheres form one big network, owned and administrated by Facebook”, and though individuals are divided into spaces, “the distinction between private and public does not hold”, because, “Facebook as a whole is not an undivided space”. Finally, for the sixth principle a discourse on the illusion that Facebook gives of connectivity which they, “characterise as a performance”, and give power to, “inauthenticity”, as people, “rejoice in the fact that it gives them the ability to present themselves to the world”.

### **2.3 A Model for Inter-Spatial Interactions**

These principles can just as well be established for physical devices that interact with-through RS and DS and while online services such as Facebook can on their own be seen as heterotopias, the following model is proposed to explore how physical and digital interactions can coexist in the same instance as a heterotopia. Figure 2 shows the proposed heterotopical model, inspired by Foucault’s (1967) example of a mirror:

*The mirror functions as a heterotopia in this respect: it makes this place that I occupy at the moment when I look at myself in the glass at once absolutely real, connected with all the space that surrounds it, and absolutely unreal, since in order to be perceived it has to pass through this virtual point which is over there (Foucault, 1967, p. 4)*

He describes it as a parallel space which appears to have traits of a “utopia” since you see yourself where you are not; or as he places it “in an unreal, virtual space that opens up behind the surface” (p. 4)—here the seeing of oneself is taken in the sense of the actor in that space, so a mobile phone, or a toaster that can connect to the Internet can be imagined similarly. The act of seeing your

activities on a Smart Phone, for example using Whatsapp, can also be understood from Foucault's example of the sounds on a telephone line which uses the same concept of the mirror analogy, wherein by talking to each other without being physically present in the same space and the hearing of each other's voice affirms their existence.

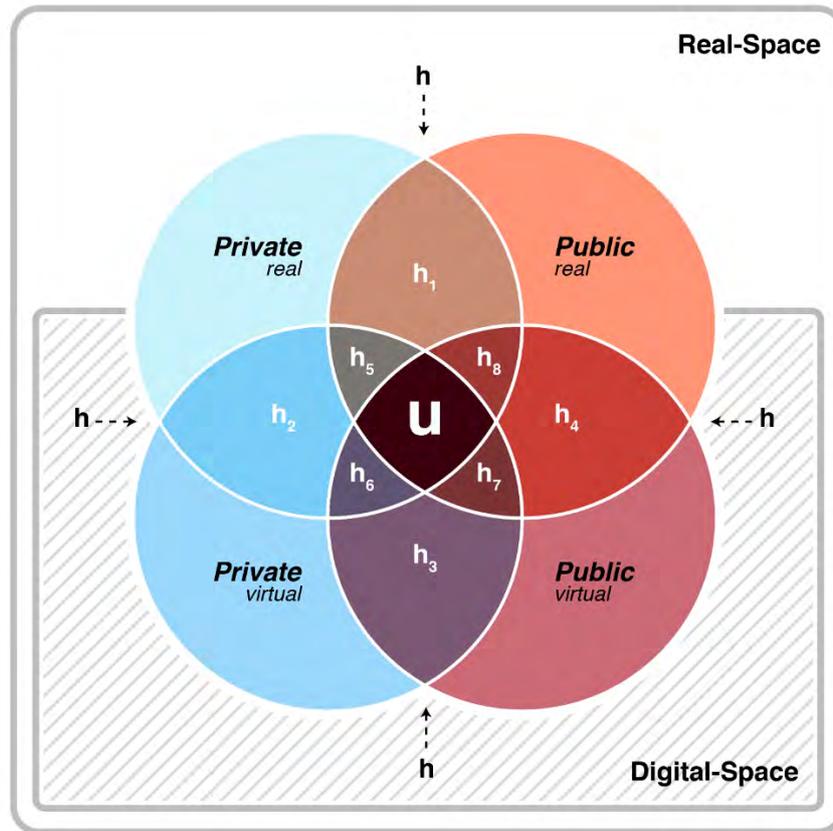


Figure 2. Philosophical Model for Inter-Spatial Interactivity

The model thus incorporates two spaces coexisting as one within the other each with its rules and regulations and encompassing individual spheres of privacy and publicity. The overlaps created can be characterised as: Private-Real (PrR), Public-Real (PuR), Private-Virtual (PrV), and Public-Virtual (PuV). Furthermore, overlaps are seen between the real and virtual iterations of privacy and publicity and they form the more unique and albeit complex heterotopias (h1 through h8).

**Private-Real:** One of the two divisions of RS, it encompasses ideals and information that are most intimate to us forming our inherent acknowledgement of the private. For instance, the physical space of a bedroom could be considered as a very real private space. Being a personal perspective it is hence of more importance to the individual to acknowledge it as such, but in order to function as a true 'private' it requires an understanding of a corresponding opposite;

**Public-Real:** Opposing general notions of privacy, it defines the private as much as it defines itself. An open reality that exists around us, governed by culture, society, government, policy, to name a few. The public exists as a platform of interaction that is open and valid for all to interfere/intersect with. Carrying on the example of a home, a communal living room could be accepted as real public space, and in a larger perspective a park where one can be easily seen and interacted with.

**Private-Virtual:** First of the two counterparts in DS, it incorporates rules that are defined by the individual to replicate their real notions of privacy. "The always-on, always-accessible network produces a broad set of changes to our concept of place" (Varnelis & Friedberg, 2008). Referring to the mobile phone as a "telecocoon" Varnelis (2008) discusses how it "maintains intimacy at a distance,

facilitating private encounters in public spaces”, therefore creating the counter existence of the private in DS. A personal Smart Phone can be considered as a private virtual space within a physical object.

**Public-Virtual:** Second of the two counterparts this facilitates the public sphere through digital interfaces, Varnelis (2008) takes a cue from Jane Jacobs saying what “makes the public sphere vibrant is the continual contact with unexpected forms of interactions”, the DS allows for a continuum of those interactions between Public-Real through to the virtual. A television can be seen as a virtual public space, one where interaction can be achieved through experiencing it, and since multiple people can experience the same thing together it allows for something akin to being at a concert.

**Heterotopia 1:** The first overlap to occur is between Real Private and Public spheres, here the interactions are those that happen in our daily physical lives influenced by very physical elements in the world around us. For the purpose of this paper and to aid understanding we will be using an example of fitness tracking to illustrate the differences within the model. An actor could imagine the physical steps they take as being a very physical private interaction that in truth is very public as the steps could be seen being taken by others in the same physical space. In both instances, the actor is in-charge of the act to happen becoming the gate-keeper, they take a step and in doing so have others potentially see it happen; an amount of time is accumulated in order to take each step and view it hence the acts are hetrochronies; each step being taken has an illusion of displacement which in this instance conform to the laws of physics and subsequently remove one from their initial stance (standing or moving) towards another.

**Heterotopia 2:** Moving clock-wise around the model shown in figure 2 the next overlap is seen between RS and DS, here using the same example of fitness tracking, this form can be seen when an actor uses a physical tracking device such as a FitBit to represent real steps in an alternate state, in this case numeric data. Although the information is the same, they both represent physical steps but due to the fact they are within two different spaces (RS and DS) they are visible in different ways. Variations of the Private clash together creating an alternate reality of privacy which exists only in DS hence it is in many ways similar to the illusion in Foucault’s mirror; one version looks at the virtual version of themselves and grounds the others visibility in their own respective realms.

**Heterotopia 3:** Next we see an overlap between *PrV* and *PuV*, the interaction here should abide primarily by rules in the DS with little influence from RS. Continuing with our example, the steps saved to the fitness tracker are now allowed by the wearer to be saved to a server online. The reason this is a *PuV* interaction is because the server will be operated by other entities who could prescribe policies and regulations to oversee this information.

**Heterotopia 4:** The next overlap is between both iterations of public. Many interactions tend to exist in this space which are free to access through open data in order to create a publicly viable connection between the real and the virtual. Looking back at the steps taken example, imagine a wearable device that doesn’t share data with its wearer but instead saves it immediately to a public server. A service such as *If This Then That (IFTTT)* could then be used to parse this data and initiate some action, for example, the step data is sent from the device directly then parsed into an online spreadsheet. Another way of considering this is through the example of a wifi light-bulb that’s connected to a digital interface allowing you to turn it on or off via a mobile device. The bulb is in a room that can be operated through a public link on Facebook, anyone can access it and change the status of the physical bulb. The bulb exists as a physical object and has a digital presence accessible through the mobile device making it exist there as an alternate of itself. When turning the bulb on from the mobile there is no physical interaction being made with the bulb yet a very physical alteration occurs in the state of the bulb wherein it turns on. This makes this interaction a very public one where even though physical contact is not happening a very visible physical change occurs.

**Heterotopia 5:** The inner overlaps of the model are where more complicated interactions begin to appear governed according to orders. The first of which occurs as a *PrR-PrV-PuR* interaction. As this occurs primarily in *PrR* it would be more influential but the interaction would have traits of the other

spheres. Take our steps being saved from our FitBit, what if that data were to be synced with another device of another wearer and they could scroll through data that's been shared with them and vice versa? Although the information here is present in different versions (real steps and numeric iterations) the presence of another individual and their physical device can be taken as it being in both real and digital spaces

**Heterotopia 6:** Here we see a *PrV-PrR-PuV* overlap with things primarily grounded by the *PrV* but influenced by others. This can be imagined very similar to example in H5 but substituting the second device with a website where all data is synced and shared with a wider community. The use of social media can also be imagined here, your fitness tracker saves physical data it interacts with and sends that to a digital server which subsequently interacts with a social network such as Facebook and shares the information publically. The movement of this information from RS to DS and then again into DS but as a very different version of itself shows how simple data collection can be repurposed exponentially, with every jump changing the data to reaffirm according to the nature of the other space it inhabits.

**Heterotopia 7:** In a *PuV-PrV-PuR* overlap a more digital approach of trust can be observed. The IFTTT protocol earlier imagined to save data to a spreadsheet can be reconsidered, only this time instead of saving to a personal spreadsheet the data is visualised on a public device such as a digital display in an office telling all its employees about how many steps have been taken in the office only by the employees.

**Heterotopia 8:** Finally, in a *PuR-PuV-PrR* overlap one can see a physical dominating the virtual. A way to picture this interaction would be with a door that can monitor people going in and out of it using wearable RFID tags. The data is coming from a physical source and returning to a physical source by being displayed publicly but what makes this unique from the H7 is that here the data is taken directly from the physical source and not through any virtual channels, alternatively to make it more interesting, the *PuV* can be a source of information that could be syncing a particular individual according to their interaction with the door. So, imagine a shoe with an RFID tag, it moves between the door and registers the wearer syncing fitness data that is tracked by the shoe, this in turn is returned to a physical output like the same bulletin board but this time through direct physical interaction.

Previously we discussed the many interactions happening in the model, but at the centre much more complex interactions take place. Utilising from the mirror analogy of a utopia this space has been marked **U** and here is where a *virtually private-public yet simultaneously physically private-public* interaction takes place. In order to imagine this, levels of permission and trust need to be facilitated and that can only happen if the different interactions allow for major alterations in the nature of information handling. Imagine a scenario where your fitness data is tracked to your FitBit, that in turn sends data to a digital server, which allows access to physical devices to relay that information when and where they wish, now picture going into a gym and seeing a wall light up with your specific information keeping track of your steps and sharing it with you but very openly so others can see and possibly interact with it as well. Such an interaction can only take place when levels of permissions have been allowed over different spaces through policies, regulations, different terms and conditions and so on. By making this interaction between user-device-service-institute and so on new heterotopias are dynamically created where the rules differ and thus the device has to operate in that particular way; any change happening in any of those rules reverberates through the entire constellation.

### 3 Conclusions

In this paper we have presented a way of characterising digital and physical interactions by imagining a relationship between spaces and levels of permission explained through a philosophical lens of heterotopias. It can be seen through Figure 3 that the closer one gets to the centre of the Inter-Spatial Interactivity Model the greater the complexity of interactions occur. The increased levels of complexity, which includes increasingly diffused relationships of trust, raise a question into the

meaningfulness in how these interactions happen. Interconnectivity between physical and digital interfaces are becoming more and more common with IoT surfacing in newer more seemingly efficient forms often as designed artefacts. But the complexity that ensues from these interactions means that a lot of information is either lost, ignored, or deliberately obfuscated. When various previously clear relationships of trust are being altered, is the interaction still worth it to the actor? Are there any measures that can be taken in order to renegotiate this trust or indicated that it has changed?

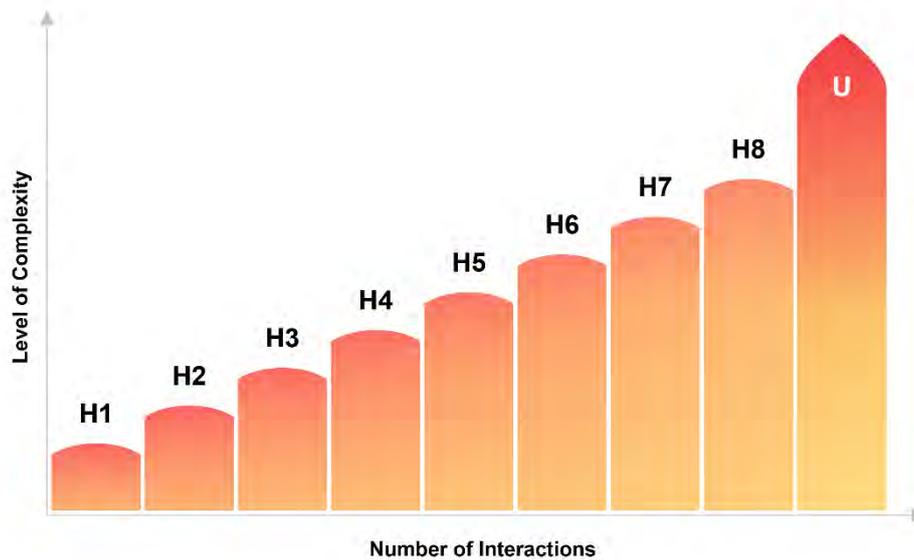


Figure 3. Relationship of number of interaction to level of complexity within Inter-Spatial Interactivity Model

Though Human-Centred Design (HCD) “has become the de facto *modus operandi*” (Lindley et al., 2017) for designing for IoT, concerns have been raised over how this approach “obscure[s] underlying complexities from users”. Designers have always affected the “well-being and lives of users and society at large” (Stam & Eggink, 2014), Stam and Eggink (2014) have argued for the use of philosophy in design saying that “encouraging designers to engage with deeper philosophical issues about their practice and research will contribute to a more profound understanding of design” (p. 5), this approach of using philosophical constructs as a support structure to look at the larger picture of a design problem can allow designers to be “more aware of the power of design and help them to envision how their designs can contribute to a more desirable future” (p. 5). The use of Michel Foucault’s philosophies as a basis for studying complex digital/physical interactions is in effect a way to help better understand HCD pitfalls when designing for these kinds of interactions. Using the above model in conjunction with philosophical constructs such as Object-Oriented Ontology (OOO) it is possible to use philosophy further as a tool to help in design research with relation to dissecting the inevitable *messiness* that is associated with digital and physical interactions seen in IoT devices.

Lindley et al. (2017) have referred to the interaction between people and technologies as a “Pandora’s box of possibility” being opened, this model and approach allows to mitigate these possibilities and force us to focus on individual interactions to see them as acting indifferently to their surroundings raising questions for other areas of study that could benefit from the information extracted in this process. One particular direction to move on from here could be looking at where value for stakeholders lies in this model? When seeing physical/digital interactions happen in this fashion, is it possible to further utilise it to see how design could be used to benefit or contest any political or economical interests? Foucault once defined discourse as “going outside of oneself ultimately to find oneself” (Foucault, 1987, p. 16), using philosophy as a discourse building activity to better understand the complexity of design problems—as in this case giving meaning and purpose to objects and spaces in order to understand physical/digital interactions—can prove as a strong tool in

a design researchers belt and possibly help in establishing the need for meaningful interactions to be taken into consideration through larger perspectives as well as individual ones.

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# DRS Conferences: barometer and mirror of theoretical reflection of design discipline

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The so-called "Design Methods Movement" emerges in Europe in the late 1950s, connected with the on-going technological developments, and new theories –systems and problem solving– within an economic-social-cultural space where new productive-economic paradigms, new social demands, environmental issues, etc., will compel designers to deal with complexity, using methodological (ergo theoretical) tools. "Design Methods", different than "Scientific Method", will improve the approach to design process problems –a non-predetermined process; at the same time rational and creative. Design reflection will elaborate conceptual constructs that, today, have already gone beyond design discipline itself such as "design thinking" or "designerly ways of knowing". The first "Theory and Design Methods Conference" will give rise to the Design Research Society (DRS), which will organize Design Research Conferences, until today. The present work will describe –over the timeline of Design Conferences, from 1962 (pre DRS) until 2016 (last DRS Conference)– the evolution of theoretical design reflection regarded in a wide context, in order to provide a new theoretical perspective, contributing to critical visions and disciplinary discussion.

*design research; design theoretical evolution; design praxiology; design phenomenology; design epistemology*

## 1 Introduction

The present work is an effort of comprehension regarding the visions, approaches and emphases that have been produced during the last, almost, 60 years in design research and design theory.

The emergence (origin) of methodological reflection in Design is closely associated with the new post World War II scenario, where the same technological advances that served both to carry out, and to finish of that conflict would have changed society forever, as a result of new productive and economic paradigms, new social demands, environmental issues, etc.

As Nigel Cross described:



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*The origins of the emergence of new design methods in the 1950s and 60s lay in the application of novel, 'scientific' methods to the novel and pressing problems of the 2nd World War - from which came OR and management decision-making techniques - and in the development of creativity techniques in the 1950s. (The latter was partly, in the USA, in response to the launch of the first satellite, the Soviet Union's 'Sputnik', which seemed to convince American scientists and engineers that they lacked creativity.) The new 'Design Methods Movement' developed through a series of conferences (De Vries, Cross, Grant, 1993, p. 16)*

In that scenario, with technological developments in progress, and the influence of new theories — Morphological Method (Zwicky, 1948), General Systems Theory (developed from 50s to 60s), Syntectics (50s), Cybernetics (late 40s to 70s) — Design would have to takeover the complexity of — in engineering words— an "open system of decisions" (Gregory, 1965, p. 83), where would be unavoidable methodological tools, that is, theoretical.

At the beginning, visions and theoretical conceptions regarding the design process install fundamental questions regarding a process that is not predetermined –at the same time creative and rational– where an essential aspect is decision-making.

Some simple —and revealing— questions contained on the initial reflections are:

*Is there a science of design? (Gropius, 1947, in Gropius, 1955, p. 30)*

*If science is concerned with knowledge and design is concerned with action, is it reasonable to speak of scientific method in design, or a science of design? (Esherick, in Jones & Thornley, 1963, p.78)*

*What is it that makes a form-making process good or bad? (Alexander, 1964, p.36)*

*What is a decision?*

*How are these decisions made?*

*How does a designer decide what information to feed in next, and how much of it, and in what detail, and how does he decide when to do it?*

*How does a designer decide what to do with this information, when and how to carry out consistency testing or comparison and selection?*

*And, in making these decisions, how much discretion has he?*

*What is it that limits his freedom to exercise this discretion?*

*(Levin, 1966, reprinted in Cross, 1984, p. 107-115)*

The methodological reflection who was trying to answer those questions will find a convergence space, at the so-called Conferences on Design Methods, whose first version was organized by John Christopher Jones and Peter Slann, in 1962, in London, with a very simple purpose at that time, in Jones's words:

*It was the first conference of its kind and enabled everyone who had an interest in 'systematic and intuitive methods' on design to get to know of each other's existence. (Jones, 2002)*

Jones, at that very Conference, will define design methods as "a means of resolving a conflict that exists between logical analysis and creative thought" (Jones & Thornley, 1963, p.54).

Later, in 1970 Jones will publish his book *Design Methods, Seeds of human futures*, reflecting about design, designers, their role, their performance in the world, and specially making a compendium of

methods—a taxonomy—that would allow to value and differentiate the way in which design process can be approached.

At the time of publication of *Design Methods ...* there were still more questions than answers in methodological reflection, and those questions revealed the uncertainty, inherent to a theoretical attempt, that would propel the searching for answers through design research, initiating the construction of a theoretical "corpus" which is still in process.

Thus, the Conferences, from the beginning, will receive the theoretical concerns of the discipline, materialized in research works, proposals and methodological reflections, case studies, etc. Thereby, the Design Conferences have become a space of visibility and dissemination of design theoretical effort.

## **2 About the research**

### **2.1 Core questions of the present inquiry**

What kind of theoretical approaches have emerged in these, almost sixty years? How do these approaches reflect, confirm, or deny emerging interpretations around "Design Methods" or "Design Theory"?

### **2.2 Objectives**

#### *General Objective*

Visualize the evolution and state of the art of design's theoretical effort in order to collaborate in understanding the role of theory and research in design discipline.

#### *Specific Objectives*

- Establish a synchronic panorama, review and discussion of results.
- Collaborate with a more wide insight about the "invisible threads" of design theoretical reflection, closely engaged with the origins, birth and growing of the DRS and DRS Conferences.
- Collaborate with a more wide understanding of the influences and the way that influences have impacted the development of the discipline in other scenarios, such as the Latinoamerican.
- Create a database of proceedings of all the DRS Conferences over almost 60 years (and back to the origins in the 1962 Design Methods Conference), accessible to other scholars.

### **2.3 Working hypothesis**

The topics addressed at the Conferences on design Methods reflect the evolution of design and methodological reflection and reveal the predominant research areas of the discipline.

### **2.4 Description of the inquiry**

This work, in its first stage, consists in visualize the key areas of research—and reflection—that have been addressed in the Conferences on Design Methods, Design Theory and Design Research from 1962 to 2016.

To do so it will utilize the taxonomy proposed by Bruce Archer in 1980 (Jacques & Powell, 1981), where he identifies ten areas of design research, as follows:

1. *Design history. The study of what is the case, and how things came to be the way they are, in the Design area.*
2. *Design taxonomy. The study of the classification of phenomena in the Design area.*
3. *Design technology. The study of the principles underlying the operations of the things and systems comprising designs.*

4. *Design praxiology. The study of the nature of design activity, its organisation and its apparatus.*
5. *Design modelling. The study of the human capacity for the cognitive modelling, externalisation and communication of design ideas.*
6. *Design metrology. The study of measurement in relation to design phenomena, with special emphasis on the handling of non-quantitative data.*
7. *Design axiology. The study of worth in the Design area, with special regard to the relations between technical, economic, moral, social and aesthetic values.*
8. *Design philosophy. The study of the logic of discourse on matters of concern in the Design area.*
9. *Design epistemology. The study of the nature and validity of ways of knowing, believing and feeling in the Design area.*
10. *Design pedagogy. The study of the principles and practice of education in the matter of concern to the Design area.*

*(op. cit., p. 33)*

Archer synthesizes these ten areas into three broad areas:

1. *Design Phenomenology, in which I would include, for the time being, design history, taxonomy and technology, as I described them earlier;*
2. *Design Praxiology, in which I would include design modelling and metrology; and*
3. *Design Philosophy, in which I would include design axiology, epistemology and pedagogy.*

*(op. cit., p. 35)*

To clearly differentiate these three categories and considering that "Design Philosophy" refers to *knowledge* (its acquisition and value), it has been decided to name this category according to the proposal of Nigel Cross (Michel, 2007, p. 48), also based on the same Archer's categories:

*Design phenomenology – study of the form and configuration of artefacts*

*Design praxiology – study of the practices and processes of design*

*Design epistemology – study of designerly ways of knowing*

## 2.5 Research domain

Includes the papers published at the Conferences on Design Methods and Design Theory, between 1962 and 1967, in England, and those organized by the Design Research Society (DRS) from 1971 to the present days.

The time range is 1962 to 2016, according to the following list:

### *Foundational Conferences on Design Methods (pre DRS)<sup>1</sup>*

1962	Conference on Design Methods	London, UK
1965	The Design Method	Birmingham, UK
1967	Design Methods in Architecture	Portsmouth, UK

### *Design Research Conferences organized by the DRS*

1971	Design Participation	Manchester, UK
1973	Design Activity	London, UK
1976	Changing Design	Portsmouth, UK
1978	Architectural Design: Interrelations among Theory, Research, and Practice	Istanbul, Turkey
1980	Design: Science: Method	Portsmouth, UK
1984	The Role of the Designer	Bath, UK
2002	Common Ground	London, UK
2004	Futureground	Melbourne, Australia
2006	Wonderground	Lisbon, Portugal
2008	Undisciplined!	Sheffield, UK
2010	Design & Complexity	Montreal, Canada
2012	Research: Uncertainty Contradiction Value	Bangkok, Thailand
2014	Design's Big Debates	Umeå, Sweden
2016	Design + Research + Society Future-Focused Thinking	Brighton, UK

### *Other DRS Conferences not included*

Since not all the Proceedings of the Conferences have been published, there are five Conferences of which, at the moment, there is no detailed information available<sup>2</sup>.

1964	The Teaching Of Engineering Design	Scarborough, UK
1972	Design And Behaviour	Birmingham, UK
1974	Problem Identification For Design	Manchester, UK
1982	Design Policy	London, UK
1998	Quantum Leap	Birmingham, UK

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<sup>1</sup> The Design Research Society was founded in the UK in 1966. As it is described in its website: the origins of the Society lay in the Conference on Design Methods, held in London in 1962, which enabled a core of people to be identified who shared interests in new approaches to the process of designing. Since 1971 the DRS organize International Design Research Conferences. See: <https://www.designresearchsociety.org/cpages/history>

<sup>2</sup> See: <https://www.designresearchsociety.org/cpages/publications-1>

### 3 Methodology

#### 3.1 Management of data

##### Collection of Conferences data

The papers have been collected, counted, and all data has been represented in tables and charts allowing comparison of quantity of research works published at the Conferences.

On doing this count, it has been left out the *keynote speeches* and *introductions* of each session.

Figures 1 and 2 depict this first stage.

VENUE PLACE	YEAR		PAPERS
London, UK	1962	■	16
Birmingham, UK	1965	■	35
Portsmouth, UK	1967	■	18
Manchester, UK	1971	■	20
London, UK	1973	■	105
Portsmouth, UK	1976	■	22
Istanbul, Turkey	1978	■	45
Portsmouth, UK	1980	■	35
Bath, UK	1984	■	60
London, UK	2002	■	91
Melbourne, Australia	2004	■	203
Lisbon, Portugal	2006	■	233
Sheffield, UK	2008	■	112
Montreal, Canada	2010	■	130
Bangkok, Thailand	2012	■	148
Umeå, Sweden	2014	■	127
Brighton, UK	2016	■	241
TOTAL PAPERS			<b>1641</b>

Figure 1: Summary table showing Conferences, Years, Venue Places and quantity of papers. 1962-2016.

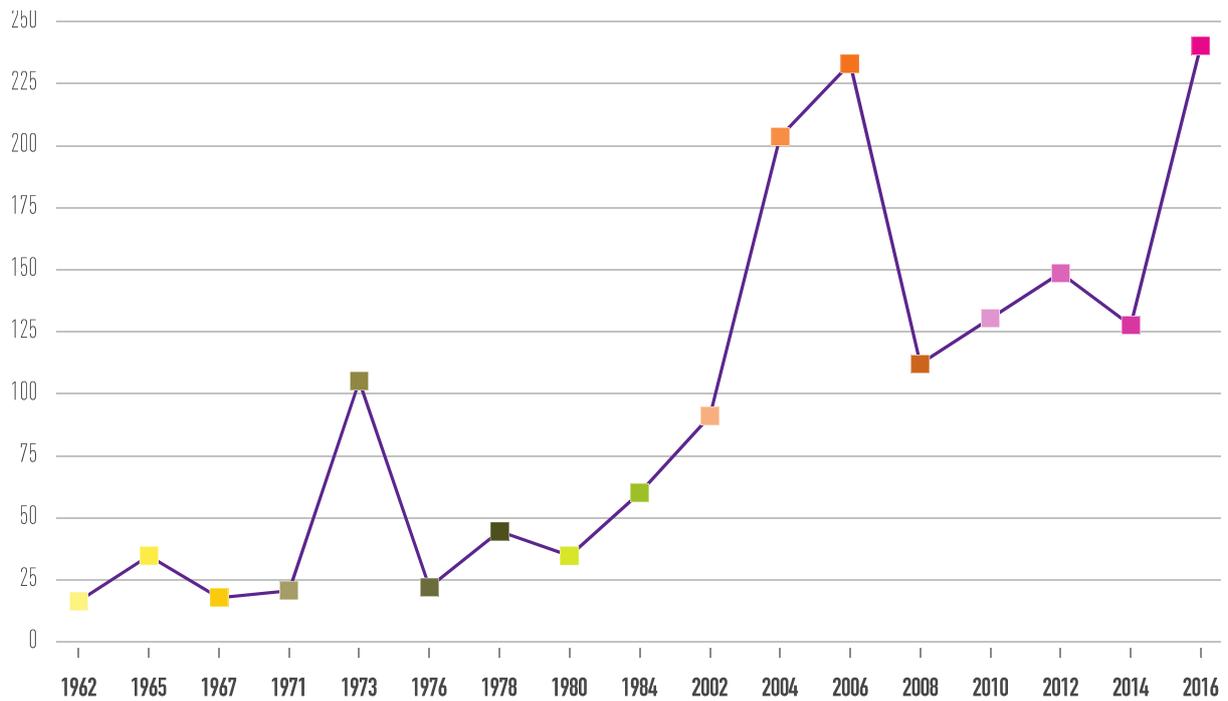


Figure 2: Comparative chart, quantity of papers on each Conference. 1962-2016.

These two figures allow appreciating the growing publication of papers in the Conferences.

#### *Papers grouped by Session Titles or Chapters Titles*

For each Conference, the papers have been separated by *session title*, according to available digital Proceedings and Conference Programs (e.g. "Design Culture" or "Sustainability").

In the case of printed publications (specifically the pre-90's Conferences), were considered the chapter's titles of the publication (e.g. "User Participation" or "Products and System research").

In the case of the Conferences of 1962, 1967 and 1971, these Proceedings did not organize the papers into chapters so, for the moment —since there is no information about daily programming— it has been considered the title of the book (printed Proceedings) as a category/concept (i.e. 1962 and 1967: "Design Methods", 1971: "Design Participation").

Figures 3a and 3b allow visualization of all sessions titles as well as the number of papers per session.

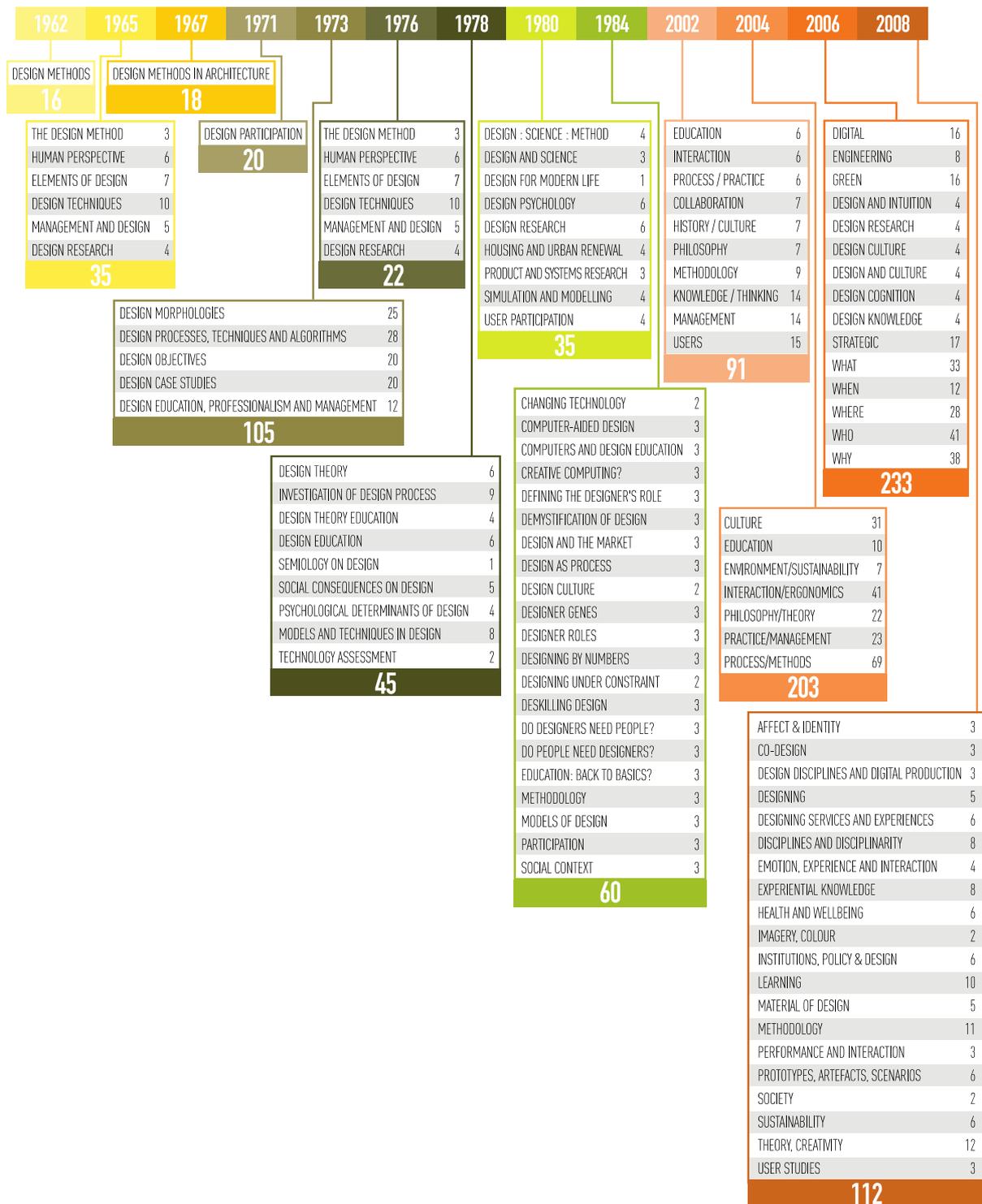


Figure 3a: Detailed information about session or chapters titles, and quantity of papers on each one. 1962-2008

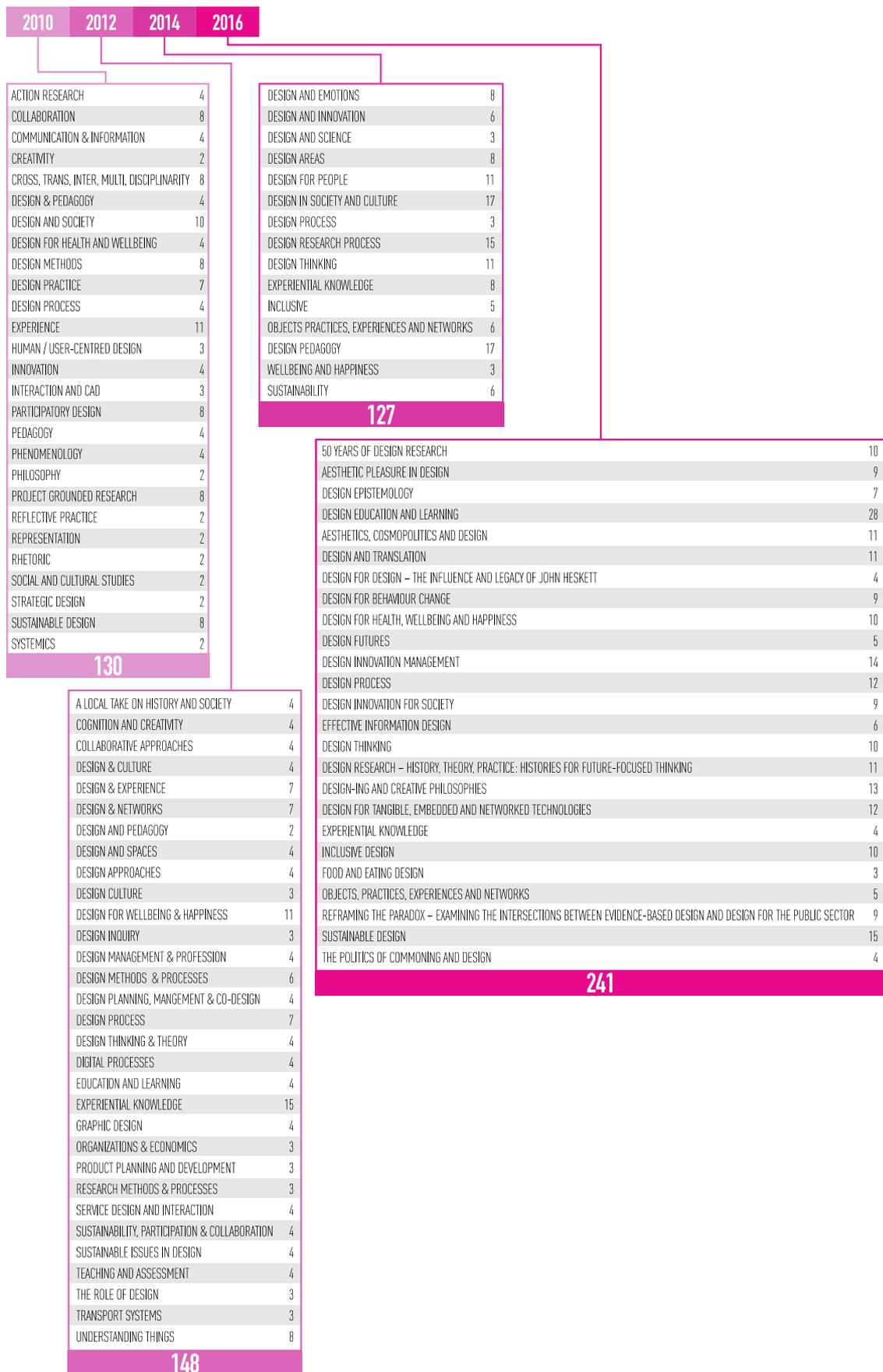


Figure 3b: Detailed information about session or chapters titles, and quantity of papers on each one. 2010-2016

### Categorization criteria

Once the list of topics and the quantification of papers by theme has been made, the next stage has been the classification of each topic (and the papers within each one) in one of the three defined categories of design research:

*Design Phenomenology, Design Praxiology or Design Epistemology*

Figures 4 and 5 allow visualization of the existence, ascent and/or descent of each kind of design research category.

This process has been carried out considering the affinity of the concepts expressed in the titles of the sessions (or chapters/sections in printed texts) with one of the three design research categories. Also, in some cases, when the session title is not clear enough, or is not descriptive enough, the procedure has been to review the titles of the papers and their keywords.

VENUE PLACE	YEAR		PAPERS	design phenomenology	design praxiology	design epistemology
London, UK	1962	■	16	0	16	0
Birmingham, UK	1965	■	35	6	25	4
Portsmouth, UK	1967	■	18	0	18	0
Manchester, UK	1971	■	20	20	0	0
London, UK	1973	■	105	40	65	0
Portsmouth, UK	1976	■	22	22	0	0
Istanbul, Turkey	1978	■	45	18	17	10
Portsmouth, UK	1980	■	35	9	7	19
Bath, UK	1984	■	60	22	23	15
London, UK	2002	■	91	28	33	30
Melbourne, Australia	2004	■	203	79	102	22
Lisbon, Portugal	2006	■	233	109	78	46
Sheffield, UK	2008	■	112	57	32	23
Montreal, Canada	2010	■	130	69	49	12
Bangkok, Thailand	2012	■	148	92	47	9
Umeå, Sweden	2014	■	127	64	35	28
Brighton, UK	2016	■	241	127	66	48
TOTAL PAPERS			<b>1641</b>			

Figure 4: Table with quantity of papers categorized in one of the three research areas. 1962-2016

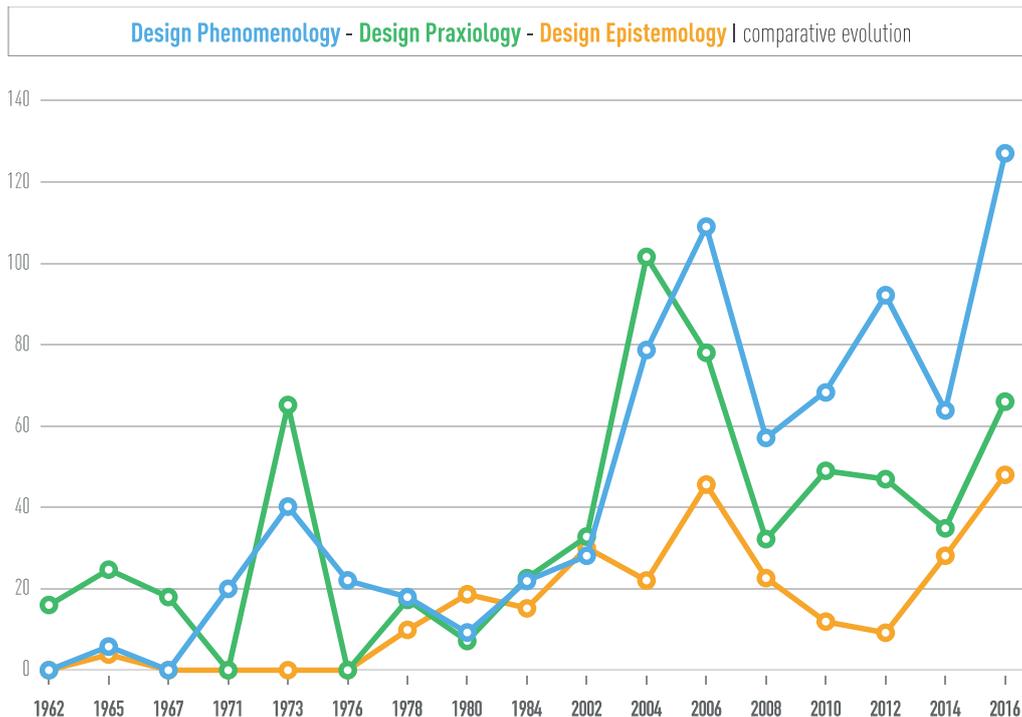


Figure 5: Chart comparing quantity of papers categorized by one of the three research areas. 1962-2016

### 3.2 First discussion about categorization criteria

The categorization of papers by topics in the Conferences, in some cases, could not give a true account of the precise meaning of a specific work within that category. Therefore the assignment of them to the major research categories - Phenomenological - Praxiological - Epistemological - should be adjusted, at a later stage of the investigation.

To verify the results it could be necessary re-categorize the papers based on a new reading considering hypothesis and research objectives. The new categorization should be compared with the first one. This will be particularly relevant in the Conferences of 1962, 1967 and 1971, where, the categorization criteria have considered the general theme (title) of the Conference.

## 4 Construction of a synchronic time-line

A comprehension exercise that is still in process.

### 4.1 Methodology

#### Organization of data over a time-line

The total papers, ordered by year, and classified on one of the three categories will be displayed on a timeline, where it will be possible to appreciate range of time between Conferences.

Also, some relevant facts have been added to this graphic:

- First specialized publications on design.
- Emergence of first design organizations or associations.
- First conferences organized by these groups, which continue to this day.

Figure 6 shows a big picture, where Conferences have taken place in the last almost sixty years.

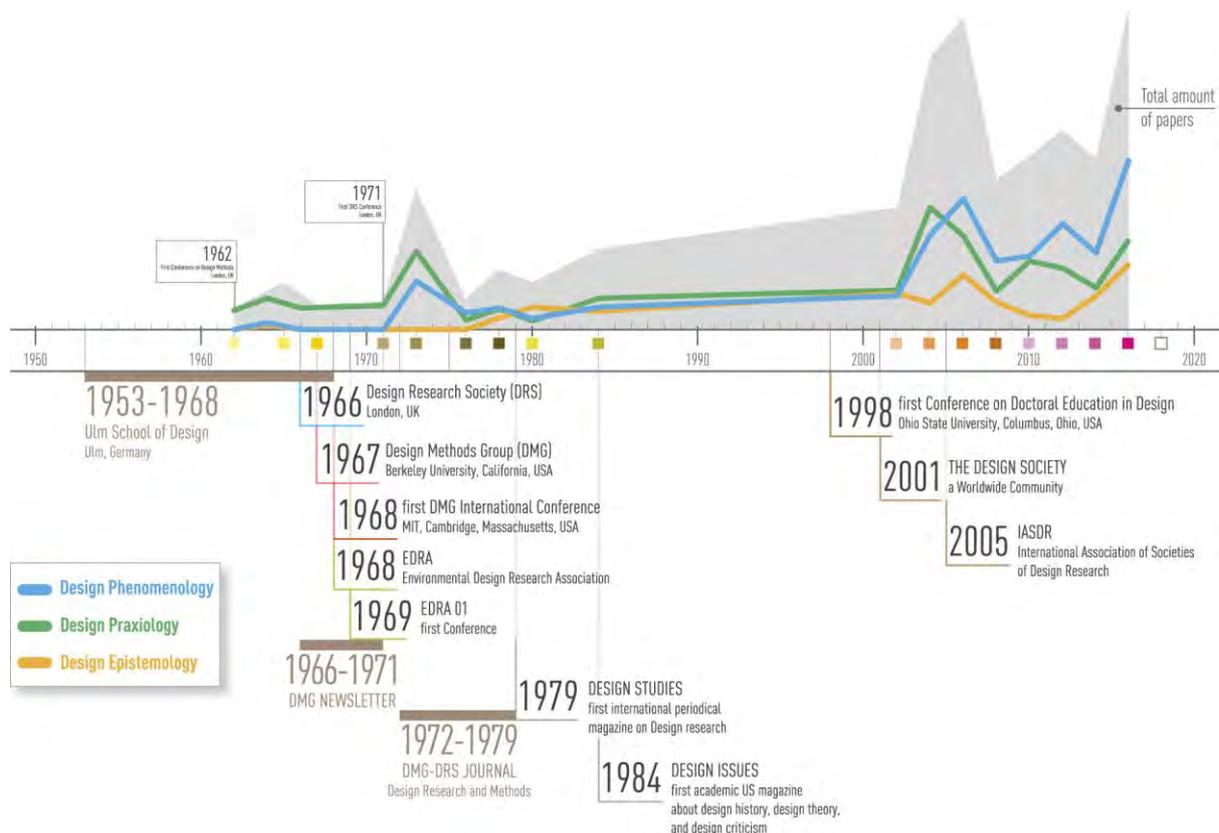


Figure 6: Synchronic timeline showing Conferences in historical “Design context”.

#### 4.2 First descriptions about relationship between Conferences and “Design Context”

a. As a first way of interpreting the relationship between the Conferences and the design context, the concepts of Horst Rittel (1972), identifying two ‘generations’ of Design Methods, will be used as a tool.

Figure 7 includes two vertical strips that mark the range where, according to Rittel, these two different emphases occur. *First generation*: In the sixties, Operations Research predominance, with “a particular type of systems approach” (Rittel, 1972). *Second Generation*: Early seventies, where design problems are defined by Rittel as “wicked problems” (Rittel, 1973).

Some relations observed:

- *First generation*: As can be seen in Figure 7, during the 60s the focus of design research work is predominantly aimed on procedures (Design Praxiology).
- *Second Generation*: At the beginning of the 70s, along with the praxiological line, the line of Phenomenological research emerges and grows.

b. A second “tool” that allows to “read” the relations between Conferences and context, is the research work carried out by Fatima Saikaly (2004), who offers a detailed overview about doctoral research in design.

Figure 8 highlights the space of time where there is an absence of International Conferences organized by the DRS. In this period, according to Saikaly, the first PhD programs begin in the United States, Australia, Europe and Japan.

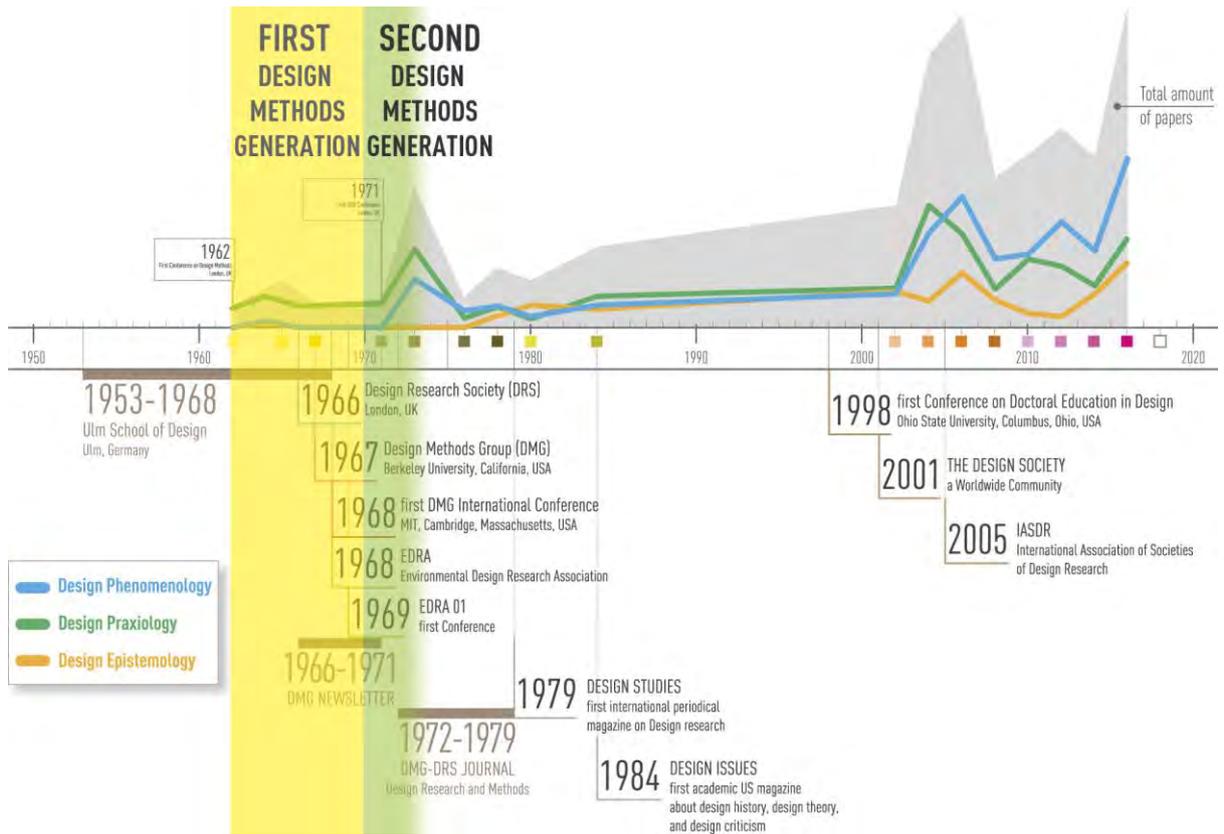


Figure 7: The Rittel's First and Second Generation Design Methods, viewed over the synchronic timeline.

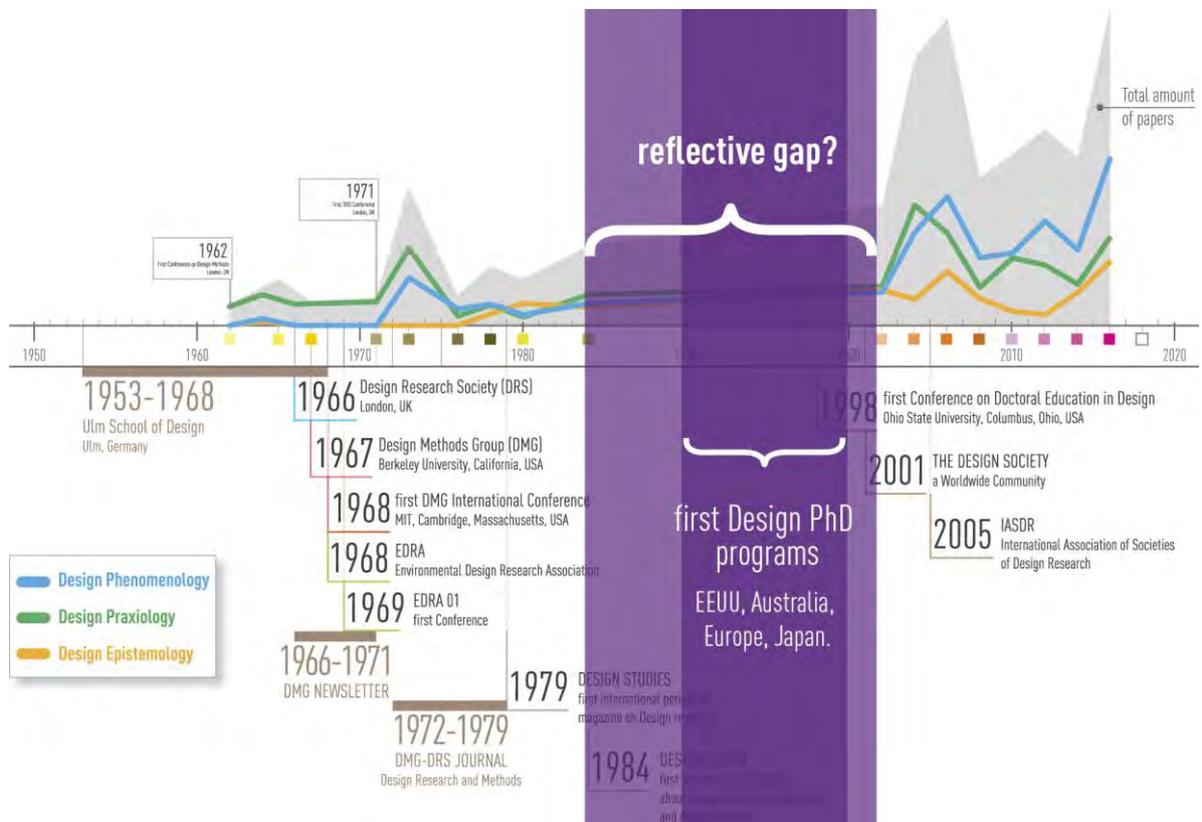


Figure 8: The relationship between the "gap" produced within international DRS Conferences, and the emergence of PhD Programmes in Design.

### 4.3 About the hypothetical “reflective gap”

As it was explained before, the research domain of the present work does not include five Conferences (1964, 1972, 1974, 1982, 1998). One of them –the DRS 1998– took place within the period highlighted in Figure 8.

However, considering that the period described covers eighteen years - between 1984 to 2002 - within this period only the Conference of 1998 was held.

## 5 First discussion

The construction of a timeline based on (or describing) design activity has already been carried out by other researchers. In the present paper, one of these approaches has motivated a comparison exercise, and then a first discussion.

*The Gui Bonsiepe’s Hypothetical timeline:*

*In 2004, Gui Bonsiepe proposed a timeline that he called “Hypothetical Timeline of the designdiscourse”, then, in 2007, the same timeline was published in his article “The Uneasy Relationship between Design and Design Research” (Michel, 2007, p. 25-39).*

Figure 9, depicts his speculation about the evolution of “designdiscourse”, from the fifties to the nineties.

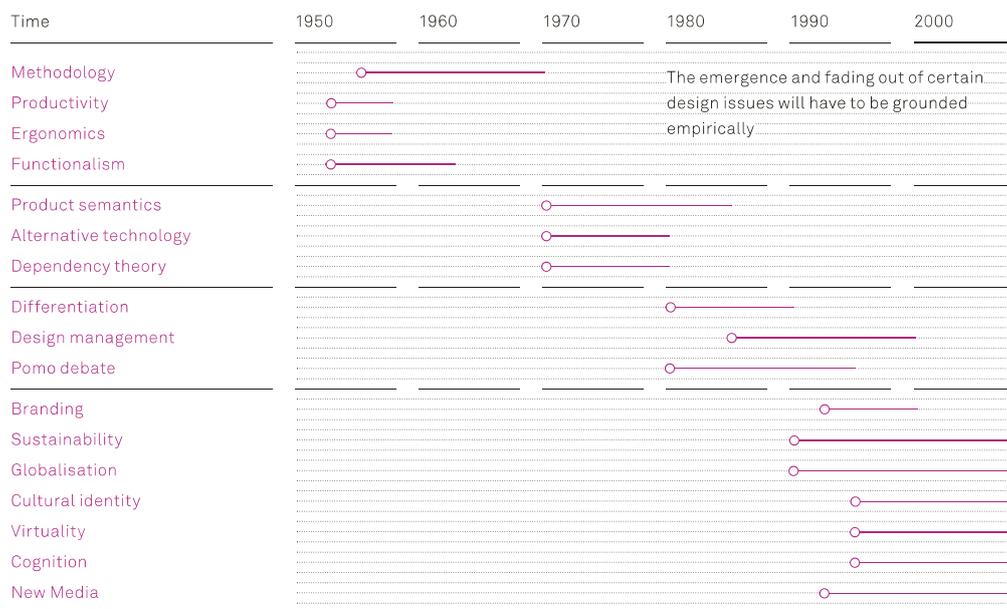


Figure 9: Gui Bonsiepe’s Hypothetical Timeline of the designdiscourse.  
 (© Gui Bonsiepe 2004, *On the Ambiguity of Design and DesignResearch*)  
 From: Michel, R. (2007). *Design research now: Essays and selected projects.* (p. 33) Basel, Switzerland: Birkhäuser.  
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According to Bonsiepe, the 50s were predominantly focused on: Methodology, Productivity, Ergonomics and Functionalism, which can be categorized within the areas of Praxiology and Phenomenology. Nevertheless, the 50’s period is not considered within the range of Conferences of the present paper.

In the 60s, the main “designdiscourse” appear to be Methodology and, –in part– Functionalism. The taxonomy constructed in the present work shows a Praxiological emphasis at that period, that means the kind of issues that researchers would be more focused on is design processes.

The 70s would be focused on Product semantics, Alternative technology, and Dependency theory. Compared with the results of this inquiry, they correspond to Phenomenology and Praxiology.

In the 80s, the “Pomo Debate” (Post-Modern debate) appears to be the first different focus, a Phenomenological view that, looking the results of this inquiry, is consistent.

Finally, in the 90s, according to Bonsiepe, emerge many subjects of discussion (and “designdiscourse”): Branding, Sustainability, Globalisation, Cultural Identity, Virtuality, Cognition, and New media. All of them seem to be closer to Phenomenology too.

## 6 First conclusions

a. Results of the present work show an increase of design research works within the period studied; this would reflect the growing number of researchers and also the need of this reflection for the discipline. In general, Phenomenological and Praxiological lines of design research have tended to be prevailing against the Epistemological line. One possible interpretation is that the epistemological reflection would not have had the urgency of the other two, at least from the 60s to the 90s.

However, Phenomenological line has prevailed in the last three Conferences. This tendency would reflect that theoretical approaches and inquiries have been predominantly oriented towards the users and contexts in which Design acts as well as the procedures that allow carrying out the design process. Besides, an increasing of Epistemological research (in the same last three Conferences), would reveal an emerging focus on design knowledge, and, also design education. However, the upward trend of the Epistemological line will have to be evaluated (confirmed or not) after a review of, at least, the two Conferences programmed in the current decade (2018, 2020).

b. After contrasting the Rittel ideas about “Generations” there is a consistency between the emphasis shown by the Design Research areas, within the Conferences, and Rittel descriptions. It is very clear that in the sixties (First generation) the big focus was in Praxiological issues. Then, in the following years (Second Generation) it take place a Phenomenological turn. In the same way, Saikaly results of research, fit with a stage where the efforts were oriented predominantly towards a reflexive activity.

c. Regarding the comparison made with the hypothetical timeline of Bonsiepe, the subjects that “designdiscourse” has addressed, and its relationship with design research areas –or emphases–, reflect the almost absence of epistemological research efforts between the 60s and 90s. In general, the hypothetical timeline of Bonsiepe is consistent with the evolution described in this investigation.

## 7 Further inquiries

Faced with these first results, new questions arise, in order to describe more precisely the scope of investigation of each paper, considering their particular hypotheses and research objectives.

Another research issue would be to explain the fluctuation of certain lines of research over time, considering other aspects, such as technological, cultural and social context in which these reflections take place and the specific historical moment in which they occur.

This research could take several future paths, trying to answer new questions and, with them, other hypotheses will also arise regarding the kind of theoretical approaches that are observed and also with respect to those that are not yet reflected in the DRS Conferences.

Finally, this research should address the relationships, influences and connections between the DRS Conferences and the beginning –and evolution– of theoretical reflection in Latin America, where the first design schools will emerge in the late 1960s, not so far from the first Conference.

The inquiry adventure is ongoing.

*Design Research is not equatable to scientific research.  
It is designerly enquiry, not Design Research.  
Bruce Archer (1980)*

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