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Editorial: Design Innovation and Philosophy of Technology, the Practical Turn

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Introduction

Human-technology relations are one of the key issues in design innovation and the shaping of our future. Also in the Philosophy of Technology human-technology relations are a central theme. New insights in the complex interplay between humans and technology can be gained from collaboration between Design and Philosophy of Technology, especially in the current of the so-called 'empirical turn' where the focus is on individual technologies and real-world contexts (Achterhuis, 2001; Verbeek, 2005). Design Innovation can use the frameworks of philosophers to theorize the findings from practice or to make sense of past developments. And designing actual things provides a powerful laboratory to test philosophical frameworks in practice. Through the collaboration between design innovation and philosophy these conceptual frameworks can become 'practical'. Therefore, in analogy with the empirical turn in philosophy of technology before, the further step of the present collaboration with design is termed a 'practical turn' (Eggink & Dorrestijn, 2018a).

Outlook

Philosophy of Technology has a substantial track record in thinking about the impacts of technology and innovations on our daily lives and social behaviours (Brey, 2012; Dorrestijn, 2012; Verbeek, 2014). Combining this conceptual toolkit with design innovation, with its capability of actually changing things, promises a powerful approach to developing critical future-making practices. This approach focuses on anticipating possibilities and consequences of innovations. As such, it is related to responsible innovation, social design and critical design, but also different in being more reflexive and explorative (Eggink & Dorrestijn, 2018b).

Using philosophy of technology frameworks to make sense of the world, we can also come to new insights and perspectives on the application of technology in innovations (Raub et al., 2018). In this sense it can also be a valuable addition to the Design Driven Innovation approach by Verganti (2009), where radical innovation is realized by changing the meaning of things (Eggink & Rompay, 2015). Especially when this approach is being criticized in the sense that "[t]here seems to be a need for more practice-based studies that connect Verganti's (2009) theoretical DDI framework […] with design practice." (Kristiansen & Gausdal, 2018, p. 2).

Papers

Under the notion of a practical turn in the philosophy of technology this track brings together papers in which either insights from philosophy of technology become concretely applied in design innovations; or the other way around, the practice of design and innovation becomes a way of philosophical enquiry into technology. These papers reflect such a practical turn in the philosophy of technology in a broad variety, from practical design cases to a theoretical inquiry into the nature of contemporary design problems.

The first paper *Changing Things: Innovation through Design Philosophy* by Johan Redström and Heather Wiltse is the most theoretical. Redström and Wiltse make a case for using a Philosophy of Technology approach to develop design theory. As design is of course always future oriented, design theory is also always about change. However, in this paper the authors convincingly show how change is no longer a matter of time and place but rather has become a central characteristic of the products itself. We are therefore in need of new concepts to understand these changing products, for which Redström and Wiltse propose some insightful examples.

The second paper *Towards a Tangible Philosophy through Design, Exploring the question of being-in-the-world in the digital* age by Jonne van Belle, Jelle van Dijk and Wouter Eggink is more towards the practical side, containing a design case about the use of mobile phones in everyday life. In fact, van Belle et al. are broadening the concept of the practical turn by adding the term *Philosophy through Design*. In analogy with the concept of Research through Design (Findeli, 2010; Frayling, 1993), they are exploring a Philosophical concept inspired by the work of Tim Ingold through the design of concrete artefacts.

The paper *Values that Matter: Mediation theory and Design for Values* by Merlijn Smits, Bas Bredie, Harry van Goor and Peter-Paul Verbeek is the most practical of this track. In this work the authors show how specific Philosophy of Technology theory – in this case mediation theory by Verbeek (2015) – can inform design practice and design methodology alongside a case for value sensitive design.

In the last paper *From Hype to Practice: Revealing the Effects of AI in Service Design* Titta Jylkäs, Andrea Augsten and Satu Miettinen literally take a step back and zoom out again when they philosophise about the consequences of new technology – in this case the development of Artificial Intelligence – on the lives of people in general and service designers in particular. Therefore, this contribution nicely suits as a conclusion to this track, not by elaborating yet another philosophical design tool, but by showing "reflection in design" in the context of design research.

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Changing Things: Innovation through Design Philosophy

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Digital networked technologies are currently at the forefront of contemporary innovation, driving changes in sociotechnical practices across industrial sectors and in everyday life. Yet technical innovation has been outpacing our capacity to make sense of these technologies and the fundamental changes associated with them. This sense-making enterprise is the focus of our current research in developing a design philosophy for changing things. We describe a conceptual framework developed around the concept of things as fluid assemblages to investigate and articulate what is going on with things, and how their development might be (re)directed toward preferable futures. Specifically, we here examine the important role of design philosophy in innovation, using the conceptual framework developed as a way to point toward potential sites for innovation in the current sociotechnical landscape. The line of investigation we pursue suggests that doing philosophy should become a central part of innovative design practices.

Keywords: Fluid assemblages, design philosophy, design theory, networked, computational

Introduction

New technological developments require new ways of making sense of them. We can draw on conceptual tools we already have, but also need to make new ones that are more precisely tuned to what we now have in front of us and need to account for.

In this paper, we describe a conceptual framework that evolved in our ongoing research on developing a design philosophy for *changing things*. With this design philosophy we aim to more adequately account for networked computational things that are more inherently changing and changeable than the things we have known, designed, and lived with before. This account of what is going on with things is a necessary first step for working to change the more pernicious developmental trajectories of networked computational things toward preferable futures.

If, as we believe, the true measure of innovation is its capacity to bring about positive transformation of human experience and practice, then it is crucially important to address foundational questions regarding the role of innovative technologies and systems in human affairs. One of the central issues for design and innovation with respect to the networked computational things that are now at the forefront of technological research and development is therefore that we develop an ability to match technological drive with the conceptual and methodological developments that are required to make sense of them—and their consequences—at human scale.

Beginning with the background of key technological developments and a brief overview of historical innovation through design philosophy, we move on to describe how the conceptual framework we have been developing around things as *fluid assemblages* opens up new sites and approaches for innovation in relation to digital, connected things. In the context of this paper, we use this work primarily as an illustration of why new

sociotechnical developments and corresponding increases in complexity can require making new theory, and how this can open up new vantage points from which to approach understanding and innovative action.

Background: Need for new perspectives

The networked computational things (embedded computers, tablets, smartphones, smartwatches, apps, 'smart' assistants, etc.) we now live with are inherently different from past everyday things. Software changes visual forms and functions dynamically over time and across contexts; information processing capabilities change the ways we relate to things and what we expect of them; connectivity changes the ways things relate to each other and their scope and scale of action; and all of this changes our everyday practices in relation to the things in our lives. Networked computational technologies and the forms they take in the world are, in many senses, *changing things*. Understanding the character and scope of these changes is an important challenge, arguably one of the next big challenges for design and related fields oriented toward human experience and society. Changing things in directions that are amenable to human flourishing and desirable forms of life is an associated challenge that we now face.

There is, then, both tremendous opportunity and responsibility when it comes to making sense of the landscape of changing things, as well as finding and articulating the foundations that can support responsible innovation, education, research, and practice in relation to them. This requires thinking in new ways – building on existing perspectives, but also recognizing when they break down and no longer adequately account for things that have become substantively different. In order to properly see and understand the new, it will not suffice to think only in terms of the old. We need new conceptual frames, new methodological approaches, and new representational and discursive strategies within design, philosophy, and the social sciences in order to do justice to what is at stake and urgently calls for our attention and care.

Of course, there is already interesting and promising work in this space: for example, in investigating "thing perspectives" (Wakkary et al. 2017, Giaccardi et al. 2016), exploring the experience of "network anxieties" and their possible design metaphors (Pierce and DiSalvo 2017), and drawing on philosophy in order to better understand connected things and their relations (Hauser, Oogjes, Wakkary, & Verbeek, 2018; Wakkary, Oogjes, Lin, & Hauser, 2018) (Wakkary et al. 2018; (Akmal & Coulton, 2018; Lindley, Coulton, & Akmal, 2018). There have also been larger shifts within interaction design and related areas toward looking at ecologies of artifacts and connected services rather than single things (Dubberly, 2017; Forlizzi, 2008; Janlert & Stolterman, 2017; Stolterman, Jung, Ryan, & Siegel, 2013). Our purpose here is to complement this often more empirical work by trying to get to the bottom of changes that are taking place through working at the level of theoretical foundations, orientations and assumptions; and to explore practices of *making theory* as vital components of contemporary design research able to grapple with increasing complexity.

While these are big and complex challenges, and theory might on the surface seem rather far removed from practical impact, there is actually an encouraging precedent of innovation through design philosophy.

Approach: Innovation through design philosophy

The current need and also ambition of our ongoing work is the development of a design philosophy that can form and inform contemporary design practice in the domain of digital, networked, and as a result hugely complex systems, media, and artefacts. Given design's inherent focus on practically solving problems, it may seem odd to seek significant innovation in the realm of the conceptual and philosophical. However, design philosophies have been crucially important for innovations in the field, considering how design has developed historically.

In the early 20th century industrialization had come to a point where the influence of mass-production in everyday life had become so significant that it was clear that new approaches to design were necessary. New materials and technologies, not to mention the production techniques as such, had up until this point primarily been used to reproduce existing designs; but as things evolved it became increasingly obvious that a new approach was needed. There came a realization that what in fact was needed was a different understanding of design, another way of relating to form and material that made better use of the new possibilities. Today, we refer to this change in the making of things as the emergence of industrial design, distinct from craft. It is perhaps difficult to see this today since we are so used to it, but at the time reframing the relation between art and technology was actually a significant innovation at the level of design conceptualization. This was done through using new ideas, such as that beauty resides in the usefulness of things – as expressed in the idiom

”form follows function.” Such ideas, or idioms, did not necessarily provide an answer to what designing should be in detail. However, they offered a way of thinking that opened up new perspectives on what could be done and how, when giving form to something had become separated from the actual making as the latter was industrialised. Indeed, it eventually provided the direction for an entire industrial sector engaged in the production of everyday things, and the field of industrial design.

Reflecting upon such historically important approaches to design, it could be said that the early industrial design philosophies were largely oriented toward *aesthetics* as a matter of resolving emerging complexities. Certainly, notions such as ’function’ place ideas about use at the center; but use at this point was largely seen as a matter of finding the most appropriate expression of such functions. In other words, it concerned the basic aesthetic design problem of how to make something present, to come forth. Over time, however, we can see a gradual shift towards methodology as a way of responding to complexity. Instead of seeking solutions in a particular kind of expression or aesthetics, solutions are sought by means of systematic design methods, as in the approaches developed at The Ulm School of Design, the design methods movement originating in the UK in the 1960’s, and in what came to be Scandinavian user-centered design. These were all responses to a kind of design complexity that design could not resolve by drawing. Instead, design had to become a multi-disciplinary effort. Attention thus turned to how information and ideas are obtained, shared and acted upon during the design process of moving from initial brief to final proposal.

Today we face a related change in design complexity, but one that neither form nor method can completely resolve. The basic reason is that our ordinary and, up until fairly recently, rather stable, categories are breaking down. For sure, design has for a long time worked with largely unknown possibilities that can only be grasped through iterative attempts at prototyping what that something could be, bringing it to presence in material form. But doing so we have still been able to rely on certain basics: such as that things remain largely the same over time in terms of their forms and functions; that it makes sense to distinguish between design and use, between production and consumption; and that designers in general, through design, control the actual outcome of the process. In fact, the point of structured design methodology is to do just that: to make design outcomes predictable. We believe, however, that there are strong reasons for not taking these basic assumptions for granted any longer.

The current sociotechnical context includes staggering and rapidly increasing complexity of current technologies and their systemic interconnections (both intentionally designed and emergent), dynamic networks, responsive things, and machine learning and artificial intelligence as new design materials. Facing this situation, there is a need for new *conceptual frameworks* that account for the consequences these changing things have in terms of human experience and society, both now and in the future. The new design philosophy that is now needed must respond to a networked, data-intensive society in which data about activity is the new basic resource generating economic growth (The Economist, 2017; Zuboff, 2015; 2016; 2019), and everyday connected things are the prime generators of this resource – and importantly, these are issues and aspects as ‘new’ to design as was once mass-production.

Just as design originally responded to the needs and dynamics of an industrial society, it must now figure out how to respond to a new and very different form of production and its social consequences. New technologies will always require new design methods, new development processes, new ideas about what services they make possible and so on and so forth – but they also require us to *think differently* about what it is that we are designing. When the car first came around it was called a ‘horseless’ carriage. Today we find this amusing – and yet, we talk about ‘mobile’ phones and ‘wireless’ networks. We understand the new in the terms of the old. And that is precisely why we need new conceptual frames and new design philosophies in order to also think and design in new ways that are more effective at grappling with our current reality. While recognizing the continuing importance of the aesthetic and role of designed things in human experience and society, they must also foreground the character of contemporary computational technologies in order to, in the end, adequately account for the role of these changing things in the world and in human experience.

While we have a significant toolbox of methods and methodology when it comes to solving problems, the more complex the problems become the less applicable become our tools. And as we approach the issue of design philosophies, it is far from obvious how to proceed. Fortunately, there is much to build on. From philosophy, we bring methodology regarding conceptual and argumentative precision, how discourse is created and challenged in forms such as texts and debates. From design research, we bring methodology pertaining to the materialization of complex ideas and issues through design experiments, prototypes and more, where these processes and outcomes of making also enable associated discourse. In our work, we aim

to combine the methods and methodologies of philosophy and design research, with the explicit purpose of crafting a design philosophy suitable for the conceptual, discursive, and practical intervention that is now needed. While it is not relevant to seek to direct practice by mere instruction, it is quite possible to influence it through catalyzing and scaffolding needed conversations in key spaces and discourses, and providing conceptual tools that can support thinking in new ways. This is the approach we take.

A conceptual framework: Fluid assemblages

Contemporary digital, computational, connected things are significantly different from the everyday things of even a couple decades ago, as well as these earlier objects of industrial design. They are constantly changing, both in response to specific contexts and users but also on the basis of software updates and multiple new versions tested against specific metrics (as in design by progressive optimization in agile development methodologies, using A/B testing methods and similar). They are also composed of a variety of physical and digital resources, both contained within things themselves and accessed via network and platform connections. Older things, too, have certainly been composed of a variety of elements, and it has been a primary task of design to intentionally compose these elements into unified wholes (Nelson & Stolterman, 2012). However, in the case of these newer connected things, there is a new scale of dynamism and scope entailed in these compositions. For these reasons, we have argued (Redström and Wiltse, 2015a; Redström and Wiltse, 2015b; Redström and Wiltse, 2019) that these things are better understood as *fluid assemblages* than as more traditional, stable things.

This notion of assemblages used here stems from the work of Deleuze and Guattari (Deleuze & Guattari, 1987). While it is not possible to do justice to the full richness of their conceptualization here, the concept deals with how something comes together. If we, in design, look at how different constituent parts can come together in a 'whole', an *assemblage* is different from both a collection and a totality. A *collection* does not gain any emergent properties, but can be taken apart with each part retaining its individual properties. A *totality* has emergent properties, but cannot be taken apart – in other words, the process of making it is not reversible. An *assemblage* both has emergent properties and can be taken apart. Further, its properties depend on the continuous interactions between the parts, and as soon as these stop the emergent properties disappear. This points to a crucial difference between the traditional industrial object and these new 'things': whereas the traditional object is a totality, where all the constituent parts are fused into a new and stable whole, our networked computational things are constantly 'made', configured in runtime. And just as fast as they are 'made', they 'fall apart' should, for example, the battery run out, the network connection drop, the authorization be revoked, or the server fail to respond.

Indeed, one of the key overarching aspects of fluid assemblages is that they entail dynamic and constitutive relations between the local and global. A thing that is made available as a thing for use (e.g., an app on a smartphone, a tabletop digital assistant, a wearable health and fitness tracker, or a web service) is actually made as a thing in nontrivial ways at runtime on the basis of both global settings (e.g., software version, current state of machine learning algorithms, etc.) and local customization (e.g., specific user account, location, history, time of day, preferences, etc.). In addition to functionality, there are also new business logics driving these relations. Things have become key sites for the production of data about people's everyday activities, and they are designed to maximize this production. Everyday activities are carried out and filtered through the transactional logic of these things and the platforms on which they operate that also render activities visible (Wiltse, 2014), comparable, and computable in data form (Alaimo & Kallinikos, 2017; Plantin, Lagoze, Edwards, & Sandvig, 2017). This data is the primary resource that is processed and metabolized within surveillance and platform capitalism, generating value mainly for the corporate actors operating or otherwise utilizing the platforms that things connect and feed into (Zuboff, 2015; Zuboff, 2016; Zuboff, 2019; Srnicek, 2017a ; Srnicek, 2017b). And in fact, Zuboff's (2019) monumental work in diagnosing and describing the mechanisms of "surveillance capitalism" and strategy of "naming in order to tame" is much in line with our approach and purpose here.

Telecommunications collapsed human notions of space, in some ways eliminating the importance of location in the sense we used to depend on it for communicating with each other; computation collapsed human notions of time, and the time it takes to compute something. The combination of these technologies and more in what we now call fluid assemblages implies a collapse also of scale. Whereas design used to be conditioned by the relationships forged between production and consumption, moving from models via prototypes to the one prototype to be mass manufactured, this chain is increasingly collapsing not just in terms of time and

space, but also with respect to the gradual scaling up towards production. Instead, what we have is code that adapts, each instance in some ways the same (we use the 'same' app) but at the same time always unique as customization happens in runtime (we all see slightly different things when using that app, depending on factors such as which user profile we are logged in as, where we are, what we have done before, etc.)

Fluid assemblages can be seen as the result of several trajectories of historical development, including computation and computationalism (Finn, 2017; Golumbia, 2009), marketing and the "attention economy" (Wu, 2016), information science, media, and interaction design. There are thus a number of associated perspectives that can be used in order to make sense of them. However, none of these is on its own able to adequately account for the more specific emergent properties and dynamics of fluid assemblages, both existing and potential (Wiltse, 2017). Investigating fluid assemblages also requires engagement in close quarters, revealing certain aspects from always strikingly partial and situated perspectives; and adequately accounting for them requires making appropriate conceptual tools.

We thus made a set of concepts to work with in bringing these aspects into focus, as an initial toolkit for exploring, working with, and (re)making fluid assemblages. We describe a few of them in what follows.

Tuning formations

One of the basic concepts that we need is one that helps us to identify and understand the basic 'what' it is that is designed when it comes to fluid assemblages, and ways of going about designing them. A concept that we developed for this purpose is *tuning formations*.

Fluid assemblages are not made in the traditional material sense, but are rather formed through algorithmic processes that rely on networked resources and connections. The object of design is thus not a final form, but the rules by which fluid assemblages come to take form as things capable of interaction through assembling a variety of components into temporarily stable formations and figurations. These things and the processes that create them are tuned[1] in relation to data generated through use. They are tuned when they are instantiated in order to respond to particular user profiles and contextual variables, but also at a more general level in relation to goals of the producers. Fluid assemblages entail ongoing relations and dynamic compositions, and they are made through practices of *tuning formations*: calibrating functional relations among elements and their collaborative evolution over time.

The shift from giving definitive form to continuous tuning of form, or formation, is already quite visible in the methodology developed to produce these kinds of 'things'. Whereas their physical presence still follows prevalent principles of industrial design form, the way their software is continuously updated does not. In particular, the extensive use of A/B testing and other ways of obtaining data to ground design decisions is of some importance here: instead of having to predict what design solution will be 'best', multiple versions of it are rolled out with specific sets of metrics being measured to obtain data regarding what solution most effectively achieves certain targets. In this way, what was previously a clear difference between the use that follows the release of a product and the 'user testing' of prototypes during the design process is here completely blurred. There is no telling where development ends and 'real' use starts. Another area where this turn towards tuning can be clearly seen is in the runtime adaptation to specific circumstances of use and user, such as tuning towards the account used and its history and a massive range of variables regarding context. Thus, what we have here are not things that are once and for all configured, or 'made', to be in and stay a certain way, but a kind of assemblage that is constantly in the making, constantly being tuned to achieve its objectives[2] as use unfolds.

[1] The conception of tuning developed here has been in some ways inspired by Richard Coyne's conception of the tuning of space (Coyne, 2010).

[2] The objectives of the thing, in terms of the purpose for which it is designed, align only partially with those of the humans formerly known as users. In fact, end users are at least as likely to be used by things that are fluid assemblages as they are to use them. This is the basic dynamic of surveillance capitalism, in which users are primarily raw material resources rather than customers (Zuboff, 2016).

Multiinstability

This dynamic customization is a key aspect of fluid assemblages, one we point to with the concept of *multiinstability*. This concept builds on "multistability" from postphenomenology, the idea that people are able to choose to relate to technologies in different ways and for different purposes (Ihde, 1990). For example, a hammer can be used to drive a nail into wood, but it can also be used as a doorstop, paper weight, weapon, art object, and any number of other creative purposes. Multistability emphasizes human agency and intention in human-technology relations. However, when it comes to fluid assemblages, agency in shaping these relations comes from not only the human side. While humans can always choose to some extent how to relate to things[3], fluid assemblages also actively adapt themselves to particular humans and other contextual variables. An app such as Spotify will show up differently for different user accounts, in different countries, at different times of day, and so on. The versions of things that show up are also frequently serving as tests being run on the users against specific metrics: multiple versions are deployed live and at a massive scale in order to gauge which version is 'best' according to some desired target. Users of Spotify choose how to relate to and use it, and it is this human-technology relation that is in focus in postphenomenology through its concept of multistability. But Spotify as a system also 'chooses' how to present itself and relate to particular users – even using them as unwitting testers and as precisely-specified products served to advertisers in particular moments when they are deemed to be most receptive to particular kinds of content (see, for example, https://spotifyforbrands.com). Human-technology relations in this case have multiple possible stabilities – which can also be seen as *in*stabilities – on both human and non-human sides. The concept of multiinstability adds this other non-human angle and expands the typical focus on human experience to consider the ways in which things, too, can relate to those who 'use' them. Again using the example of Spotify: we need to investigate not only how people choose to relate to and use Spotify, but also how Spotify presents itself in particular ways in relation to particular user profiles. Variations are expressed not only in and through human experience, but also in things themselves.

Multiintentionality

One of the most fundamental and significant differences between fluid assemblages and more traditional objects of industrial design is that they entail ongoing relations between 'producers' and 'consumers' (or 'users'), and this is in fact key for how they generate value. There is of course use value for end users in a traditional sense, but also value for producers in that they are able to use connected computational things to monitor, register, and encode people's everyday activities into data form. Aggregated data is extremely valuable for platform companies that now rely on it to generate real-time insights about use and users and how they might be able to ultimately generate a profit. Things that are fluid assemblages mediate everyday actions and interactions of the people who use them, and they mediate access to these people's everyday lives and attention for the companies that design and operate them. The concept we use to point to this phenomenon of multiple mediating relations and intentions is *multiintentionality*.

Building on the concept of "intentionality" from (post)phenomenology, *multiintentionality* brings into focus the multiple intentional relations that are at play simultaneously in and through things that are fluid assemblages. Intentionality in a phenomenological sense (in extremely basic terms) has to do with the directedness of a human toward whatever it is that is constituting her 'world' at a given moment (through sensations, perceptions, mental formations, etc.). In postphenomenology, technologies are added to this equation in a mediating role, such that the world that a person can perceive is made accessible through the mediation of technologies. One of the most-used tools from postphenomenology is the basic analytic schema *I—technology—world* and its variations to illustrate different patterns of intentional relations. While this is quite useful, it needs to be updated in order to adequately account for fluid assemblages. A 'technology' such as Facebook can be used to access one's mediated social 'world'. Yet it is also and at the same time used by the owner of that social media platform as a tool to access people's social activities and interconnections, by

[3] This possibility for choice is of course much more limited in situations where people are required to use certain technologies for work or to access educational or government services, or when there are, for example, surveillance technologies in public spaces (Kallinikos, 2004). These political aspects of the sociotechnical landscape are very important to keep in mind, but do not contradict the more basic point (countering technological determinism) that humans always have some degree of agency when choosing how to relate to technologies.

advertisers as a tool to deliver marketing campaigns and assess their effectiveness, and by malicious actors as a tool to spread disinformation in order to achieve particular social effects. In the case of Facebook at least, these multiple roles have become quite present in popular media coverage and discourse; but they exist in less prominent cases as well, as the new normal in the design and operation of connected things.

The postphenomenological schema of *I—technology—world* puts humans in the center and focuses on what is present to them as their world, even as it emphasizes the co-constitution of humans and technologies (Verbeek, 2005). Multiintentionality expands this framework to consider also how technologies can mediate access to humans as the 'world' that is revealed for other actors, and often through acts of use. In fact, this model of use of things providing the mechanism for access to people's everyday activities through production of behavioral data is one of the foundations of surveillance capitalism; but it is not easily brought into focus through the traditional postphenomenological framework that focuses on what is present to humans. This is especially significant in that mechanisms of surveillance and control are typically very intentionally not revealed in acts of use. For example, in order to understand what Facebook is and does, it is not enough to look at only how particular people perceive Facebook and the world that it mediates through use (intentionality) but also at how Facebook mediates access to these users for others (e.g., advertisers, political campaigns) through their platform (multiintentionality). Getting to grips with what contemporary connected things are actually doing demands serious attention to multiple simultaneous roles, relations, mediations, and intentionalities—not to mention intentions.

New sites for design innovation

The concepts we have briefly sketched out here are in no way comprehensive in terms of accounting for fluid assemblages and the dynamics surrounding them. However, they do at least give us a decent foothold in identifying what seem to be key characteristics, which also allow us to begin to identify corresponding sites and possible practices of design innovation in relation to them. Especially, and drawing on our continued commitment to human-centered design (and the new forms it must now take), we can use *multiinstability* to note that the customization of things for particular users and contexts is a significant dimension of the design and function of things that are fluid assemblages, and one in which people using them could be given more agency. Similarly, current practices tend to use interfaces to conceal what is really going on with and through things, particularly in terms of data being collected and used for particular purposes; there could be a design opportunity here to make this more meaningfully transparent (extensive terms of service agreements clearly not meeting this descriptor). This would undermine what have become typical business models, but also provide an opportunity for differentiation in a space where many people are increasingly concerned and wishing for alternatives. If data collection and use were transparent and could provide clear benefits, people might even be willing to provide more and *better* data in a model that is cooperative rather than shady and manipulative. And certainly more possibilities for exploration could be added to this initial list.

These possible sites for innovation require new types of design practices. Current sources of innovation in this space often come from sophisticated marketing efforts and engineering-oriented optimization, while design provides the user-facing shells. But these shells seem to be increasingly brittle, as awareness of "dark patterns" of interface design and rampant data collection indicate that things are not entirely what they seem. Rather than innovating through tuning the dialog boxes that discourage users from understanding or caring what is going on, there could be an opportunity in designing to actually reveal and manage all of these relations and processes and types of value head-on and in a good way. And while these are matters that can show up at the surface of things, we argue that we actually need to start much deeper.

Toward new design practices

If we take a closer look at the conceptual frameworks and methodologies of the disciplines that made it possible for fluid assemblages to emerge, such as object-oriented programming, massively parallel and networked computing, sensors, and increasingly technological developments such as machine learning and artificial intelligence, they all, to some extent at least, engage in issues pertaining to ontology. For instance, unless you decide and specify what the 'world' is made of, you cannot develop computational principles for dealing with it, and this ranges from having to precisely define what category and kind a given variable is, to defining exactly what set of variables to work with. As restricted or inventive as such matters may be, it still puts development in close contact with what we could call ontology, and thus the need to constantly pay attention to how categories work and behave, what they can and cannot do. Clearly, this also includes being

innovative with respect to such issues, to find new ways of defining and describing (just think of the conceptual work regarding 'relations' and 'relevance' grounding the algorithms used in search engines).

If we instead turn to design, our typical awareness of matters pertaining to ontology is much less explicit, if at all present. And while we certainly relate to categories, we typically do not have to be very explicit about how we do so. In fact, we can largely rely on this being a non-issue: when we are designing a vehicle we find comfort in the notion of 'cars'; when working with an office setting, we rely on notions such as 'chair', 'table', 'cabinet' etc. being there for us to navigate the design space. Much of what we traditionally do is to renew and refine – but not *replace* – such categories.

And so let us take a very brief look at what happened when we had to design for a new category that was not there before, and for forms of use we were not already used to: the personal computer. Transitioning from the programming environments that used to characterize what using a computer was like, the invention of the graphical user interface was an enormous breakthrough with respect to accessibility and ease of use. And to achieve this, the strategy was again to build on existing categories: the file and document, the folder and filing cabinet, the trash bin… Faced with the need to come up with an ontology, we persisted in our practice of renewing and refining, but not replacing. The notion of an 'information appliance', or now more commonly 'app', is unfortunately not much different: an application is "a program (such as a word processor or a spreadsheet) that performs a particular task or set of tasks" (https://www.merriam-webster.com/dictionary/application). It focuses our attention on that special purpose we intend to act upon as we pick it up, not its interconnectedness and its massive exchange of data across activities and areas we perhaps do not even see as related.

We believe this attitude of seeing new technologies in terms of old categories is approaching a breaking point in the context of fluid assemblages, much like industrial production eventually came to a point where one could not just continue to imitate what was previously made by hand. Certainly, much can still be achieved (or, more cynically, gotten away with) in terms of acceptance and ease of use by using familiar forms, but it is increasingly obvious that this approach also hides much of what is actually going on. To use the phrase coined by early industrial designers in their critique of mere imitation, this approach is not 'true' to the materials and forms of production we are now working with. This insight is motivated by a range of observations that can be made about current sociotechnical realities: from the simple but still far-reaching insight that 'deleting' something does not mean it is gone, to the uncanny feeling of a widening gap between what I think I'm doing with an app (e.g., using an app to check the weather) and what is actually going on that involves detailed tracking of my movements to harvest data that can be sold to other parties (Valentino-DeVries, Singer, Keller, & Krolik, 2018). Managing one's exposure to dataveillance (Raley, 2013) is also a relatively new category of 'task', and one that is typically (and intentionally) not well-supported by current applications.

Conclusion and future directions

To move on and find new ways of designing the continuous tuning of increasingly complex relations between us and the technologies we live with, we strongly believe design scholarship and practice must start to pay attention to ontology in ways they have not up until now. We also need to create a shared discourse between design and technology regarding algorithms as literally a new design material and design partner (Finn, 2017). Design researchers and practitioners have been working with 'conceptual design' for a long time, but this will now take on a partly new and much more central meaning and role. We depend on design philosophy to lead the way here: not as critical reflection from a distance after things have already been made, but as part of new ways of designing that consider doing philosophy part of a vital design practice, rather than its antithesis.

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Research Perspectives IN THE ERA OF Transformations

Towards a Tangible Philosophy through Design

Exploring the question of being-in-the-world in the digital age

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No.195

The combined philosophy and design approach called Philosophy-through-Design (PtD) is proposed using an exemplary project about being-in-the-world in the digital age. PtD is a practical way to do philosophy through designing interventions, and involves various people in the exploration of philosophical concepts. It stems from the overlapping questions found in philosophy and design regarding human-technology interaction. By intertwining both, they benefit from describing, understanding and proposing human-technology interactions to unfold new questions and perspectives. In the exemplary project, being-in-the-world refers to a way of being that is embodied, active, open-ended and situational, based on the phenomenological and embodied theories of Tim Ingold. This concept questions what it means to be human in the digital age and how our lives with technology are built. The first results show the process of weaving together observation, creation and reflection, which presents Philosophy-through-Design as a promising method for designers to practice a tangible philosophy.

Keywords: Philosophy through Design, Tim Ingold, Embodiment, Practical Turn, Interaction Design

Introduction

The aim of this paper is to elaborate the combined philosophy and design approach that we will call Philosophy-through-Design (PtD). Philosophy-through-Design, as developed in this project, is a practical way to do philosophy through the design of interventions, and aims at involving a range of different people in the process of exploring philosophical concepts that are of importance in their daily lives. The approach is a way of exploring a philosophical question from the everyday practice using the practice of design. It combines both qualities of philosophy and design in order to act as a tangible way of doing philosophy.

The development of PtD stems from the overlap in the kind of questions found in both philosophy (of technology) and design (Eggink & Dorrestijn, 2018; Hauser, Oogjes, Wakkary, & Verbeek, 2018). These questions are about how humans and technology relate to each other in the past, the present and the future. Designers might try to find solutions to the problems related to these questions and philosophers might try to understand why, but both can benefit from describing, understanding and proposing new ways in which technological solutions interact with the societies in which these solutions are used (Eggink & Dorrestijn, 2018; Findeli, 2010; Hauser et al., 2018; Ingold, 2011).

Starting from this overlap, in both philosophy and design a development can be found to make use of the knowledge and methods existing in the other field of inquiry (see figure 1). In philosophy, the empirical turn marked a shift to bring philosophy more into practice by taking part in and analysing real-world case studies (Achterhuis, 2001; Verbeek, 2005). In the design of interactive and use products, a trend can be found of

applying philosophical insights and taking the human being and society into account in the design process (Dorrestijn & Eggink, 2014; Hummels & Lévy, 2013, Tromp, Hekkert, & Verbeek, 2011). However, PtD differentiates itself from these two approaches by intertwining both processes into one approach guided by a philosophical research question. At the start of the approach there is no predefined perspective regarding the research question in the form of neither philosophy nor design. The questions, creations and reflections found during the approach will interact with each other to develop and contribute both to the field of philosophy and design, not by finding answers, but by unfolding new questions and new perspectives.

In this paper, we will elaborate Philosophy-through-Design by an exemplary project in which the philosophy of Tim Ingold is used to investigate his concept of being-in-the-world. Ingold's ideas pose interesting questions in a society in which digital products take up such a ubiquitous presence in everyday lives and experiences. As a starting point, we will focus on the iconic object that is omnipresent today: the smartphone. The aim of this project is, thus, to question what Ingold's philosophy means in the context of the digital age, using a project revolving the smartphone as a design case to understand our being-in-the-world in the digital age. First, we will offer some background to PtD by relating it to other methodologies, such as empirical philosophy and Research-through-Design. We will then move on to the philosophical background by introducing the philosophy of Tim Ingold and his conception of being-in-the-world. After that, we will introduce the case study of the smartphone and the digital age and elaborate on the focus points, questions and steps we have chosen to guide PtD. Finally, we will provide an overview of the first results and elaborate on them in the discussion and conclusion in light of the validity of Philosophy-through-Design as a method for doing philosophy hands-on.

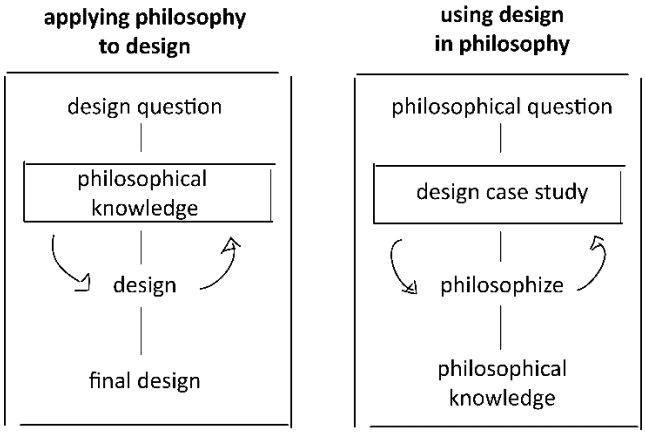

Figure 1: Schematic overview of applying philosophy to design and using design in philosophy

Philosophy-through-Design background

PtD could be considered as connected to the empirical turn and the developments in the field of Philosophy of Technology that came afterwards. PtD indeed acknowledges a similar beneficial relationship between philosophy and design, however, PtD differentiates itself from the empirical turn in a subtle, but substantial way. With the empirical turn, philosophy became more concrete by incorporating more case studies and collaborations with other disciplines (Achterhuis, 2001). This turn opened the way for philosophers to 'come down from their ivory towers' and create philosophical tools, methods and forms of assessment to use in practice and apply in other disciplines, such as design (Eggink & Dorrestijn, 2018). By making philosophy empirical, however, the new approaches are criticised for losing their critical and ethical qualities in the concreteness (Scharff, 2012; Winner, 1993).

A variety of initiatives to bring these qualities back after the empirical turn are proposed, together considered as an "ethical turn" (Brey, 2010; Verbeek, 2010). Eggink and Dorrestijn (2018), in line with Verbeek's (2010) proposal of philosophical accompaniment in technology development, go even further by proposing the "practical turn" in which philosophers and designers collaborate by applying philosophical theories and methods in a design context after which the design project can lead to a better understanding of Philosophy of Technology. In other words, the designer profits from a more reflexive perspective on their designs, while the philosopher uses the design of actual things as a way to test philosophical frameworks in practice (Eggink &

Dorrestijn, 2018). The difference with both the empirical turn and the practical turn is that in Philosophy-through-Design, it is not a philosopher doing the philosophy while watching a designer design, but a designer practicing a form of tangible philosophy through the design of things. The outcome of a PtD project is thus not necessarily an abstract philosophical concept, idea or question, but a tangible artefact. PtD aims not to analyse material things in a philosophical way, but PtD explicitly intends to materialise philosophy.

Philosophy-through-Design might sound familiar to the well-known design research methodology Research-through-Design (RtD) (Faste & Faste, 2012; Findeli, 2010; Frayling, 1993) in which it is acknowledged that designed artefacts can embody an answer to a research question (Biggs, 2002; Faste & Faste, 2012). PtD can be seen as a specific way of executing the 'design' part of an RtD project. RtD, as shown in figure 2, can be described as design activity that operates as research (Faste & Faste, 2012): a general research question is answered with a design project, which in turn can form a partial answer that reflects back on the research question (Findeli, 2010). Philosophy-through-Design has a similar aim but specified for a philosophical question and offers an approach in which philosophy can inspire the design process not only as starting point but throughout the whole project. The design informs, thus, the philosophy as much as the philosophy informs the design *simultaneously*. As shown in figure 3, the philosophy and design perspectives are *interwoven* to develop further, not to a final design answer or philosophical answer, but to new questions and new perspectives.

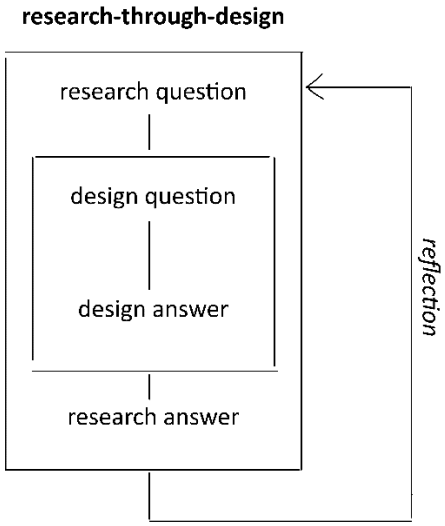

Figure 2: Schematic overview of Research-through-Design (adapted from Findeli, 2010)

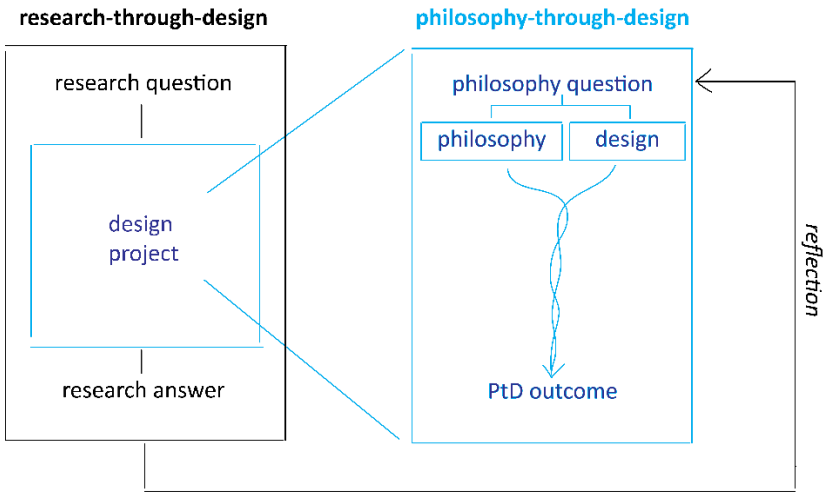

Figure 3: Schematic overview of Philosophy-through-Design in relation to RtD

Philosophical background

The design case, chosen for this PtD project, is about being-in-the-world in the digital age as inspired by the ideas of Tim Ingold (2011). Ingold is originally an anthropologist, but his thinking has transformed into a philosophy about art, architecture and anthropology, or rather a philosophy of what it means to be alive. He is influenced by many philosophers and thinkers that are associated with the idea of being-in-the-world. The term itself was introduced by the philosopher Martin Heidegger (1927), but has in different terms influenced others in the philosophical movement of phenomenology, such as Merleau-Ponty (1962), and other thinkers in the theories of embodiment (e.g. De Jaegher & Di Paolo, 2007; Suchman, 1987; Varela, Thompson, & Rosch, 1996). The ideas of phenomenology and embodiment have also spilled over to other disciplines such as human-computer interaction (e.g. Hollan, Hutchins, & Kirsh, 2000) and interaction design (e.g. van Dijk & Hummels, 2017; Van Dijk, van der Lugt, & Hummels, 2014). As a result, Ingold's theory about being, life and anthropology comes from concepts such as thinking through practice (Schön, 1983), the coupling of action and perception (Gibson, 1979), and skilled practice and situated actions (Suchman, 1987). Ingold then developed his own by using terms such as *wayfaring*, *weaving* and *the meshwork*.

According to Ingold, our being is a dynamic being that is always moving, learning and developing in the forcefields of its environment. The world is a *meshwork* of all the interwoven lines of life, growth and movement of all the beings and things occurring there (Ingold, 2011, pp. 63-94). It is not a platform on which beings live, rather beings emerge in a world-in-formation, along the lines of their relationships (ibid, pp. 63-75). Referring to phenomenology, consciousness is not confined in the head, but spills over into the environment along these pathways of sensory participation (ibid, pp. 51-62). In other words, Ingold talks about *weaving*: our being is woven together from all the different influences that occur in our lives (ibid, pp. 63-75). If every story would be a thread, being alive means weaving all the stories of your life together into one being. To know something, is to know its story. It is by this continuous process of following and creating stories that we acquire knowledge and live in the world. Ingold calls this trail-following *wayfaring*. Wayfaring requires an open attitude, improvisation, sensitivity to cues, and a capacity to respond with judgement and precision. The difference between an expert and a novice is not how much they know, but how well they are able to skilfully act in the meshwork of storied knowledge (ibid, pp. 141-175). From the concept of action-perception couplings, learning is accomplished by trying over and over again and following the stories of exemplars to copy their gestures (ibid, pp. 177-226). Therefore, the condition of being-in-the-world, to Ingold, calls for more than immersion and being involved: it calls for an openness to observe, to be active, and to be astonished by the world we inhabit (ibid, p. xii).

Based on these ideas, being-in-the-world, in this project, will refer to a way of being that is embodied, active, open-ended and situational. It is about the possession and mastery of skills to be able to react appropriately to all the influences within the flow of the process. Decisions are made unconsciously by following the traces without being paralyzed by possible consequences and having to make a decision. It means that the human is inseparable from the world in which it lives and is always moving in, reacting to and creating with the situations it is in. This conception raises an interesting question in the digital age, where new technologies shape an apparent division between online and offline practices and close off people's movements, reactions and creations from the bodily sphere. How can we understand this division? How do these two contexts relate to each other? Do they replace each other, do they augment each other or have they become so intertwined that we are alienated from and lost in understanding the world in which we live? What does the term being-in-the-world, our way of being human and our world, then mean?

Case study: being-in-the-world in the digital age

The digital age refers to a historical period in the 21st century characterized by a rapid shift to a society based on information and networks (Volti, 2014). Connection is a keyword, since anyone with any type of access to the digital world can potentially reach anyone who is similarly equipped almost instantaneously (Volti, 2014). As philosophers and designers, we may ask what the digital age actually means to the people who are living in it in their everyday lives and what an improvement or change of the digital age could, or perhaps even should, look like. In this context, the digital age points to the way people live and communicate with each other in a world that has been augmented by new digital technologies. With 'digital', we specifically refer to the invisible, complex and distributed processes that occur all around us, of which most of us can only perceive and understand small parts (Schiphorst, 2007). The hiddenness of much of the digital processes poses problems on our everyday lives such as a loss of privacy, misuse of data and jobs taken over by AI.

Nowadays, the digital world can be accessed through different interfaces, such as your smartphone, your laptop or tv. All of which have their own influence on how the world is experienced. The focus in this project will be specifically on such an interface, rather than focusing on a wide-ranging conceptual problem such as privacy or big data. The interface of the smartphone is chosen specifically, because the introduction of the smartphone marks the start of a new phase in the digital age. The smartphone is an interesting object as it is both a physical device that we carry around with us as well as an access point to what we call the digital world. In just a few years' time, it has become the dominant device with which we are digitally active (Deloitte, 2018; Kemp, 2017), changing how we go through our day to day lives, and changing the kind of digital content and digital activities that are available. In 2017, about 66% of the global population used a mobile phone and about 37% of people use social media at least once a month, of which more than 91% of them via mobile devices (Kemp, 2017). By being easy to use, small and portable, the smartphone is blurring the lines between our digital and physical practices. The average number of hours spend on the internet each day in the UK is 5h47 of which 1h48 on social media alone (Kemp, 2017). This makes the smartphone an interesting object to inspect more closely in relation to theories on embodied being-in-the-world, since it allows us to focus on the transition between the digital and non-digital and how the design influences in what manner this relation is experienced and understood.

There are many reasons why the smartphone could have become such a dominant device in society today. It carries all different kinds of tools; our clock, dictionary and more into one device. It makes it easier to stay in touch with friends and family from near and far and makes us more flexible in how we go through our daily lives. However, the extensive use of the smartphone is related to multiple negative effects regarding both mental health (e.g. Alhassan et al., 2018; Elhai, Dvorak, Levine, & Hall, 2017), and physical health (e.g. Jung, Lee, Kang, Kim, & Lee, 2016; Korpinen & Pääkkönen, 2009), affecting social skills and dependency (e.g. De-Sola Gutiérrez, Rodríguez de Fonseca, & Rubio, 2016), and influencing happiness, social connectedness and life satisfaction (e.g. Alter, 2017; Schnitzler, 2017). These problems pose an interesting problem for designers to look for solutions on how to improve the design of the smartphone to help people to be better equipped to move through a world that incorporates both digital as well as physical practices. This could be done for example by changing the physical design or adding new modes of interaction as done by Stienstra, Overbeeke and Wensvee (2011).

From the perspective of philosophy, the problems linked to smartphones pose different questions. Looking specifically from the ideas of Ingold (2011), the interface of the smartphone makes our experience of the world more ambiguous. Since the whole body is involved in our being (Ingold, 2011, pp. 15-62), how does that apply to the use of the smartphone which offers this immense non-bodily world to us? Ingold offers the example of using a saw to talk about (1) how tool use is not an operational sequence of small tasks, but of processional movements that inform the next move, (2) that using does not entail the attaching of an object to a body, but of joining a story to the appropriate gestures and (3) how the movement of tool use comes from feeling what you are doing by coupling perception and action with concentration (Ingold, 2011, pp.51-62). The question is, however, how the smartphone fits into this picture, when the design of the smartphone seems to have evolved into a more indistinguishable shape that leaves no variety in how we use and experience it. When the bodily gestures to talk to our friends, to follow the news and speak in public are all the same, and our concentration to feel the flows of movements around us, in both the physical and the digital world, is constantly challenged by notifications, sounds, vibrations, and moving images; how then, can we be in the world?

The philosophical question for this project is, thus, formulated as follows: '*What does being-in-the-world mean in a digital age dominated by smartphones?*' To translate this question into a design question, the question is reformulated so that it asks for a change in how users interact with their smartphones to understand their experience, and is posed the following: '*How to stimulate users to have more agency in being in a digital age dominated by smartphones?*' Agency in this case means, referring back to the conception of being-in-the-world by Ingold (2011): being able to make the right decision right away based on experience and skill. From these questions and the aim of PtD, the design goals in this project are to design three physical smartphone interventions that will:

- make clear the role of the smartphone in the daily lives of users
- stimulate agency in users to do what they really want to do and to be who they really want to be
- start a conversation about being, agency and the world in relation to the smartphone

The Philosophy-through-Design approach

In PtD, the design of interventions will function as both tools for thinking and traces of knowledge acquirement. Both the philosophical and design question will guide the exploration and work together through a few stages (see figure 4). The stages are (1) First Person Exploration, (2) Experience Conversations and (3) Design Conversations. In every stage, reflection plays a key role in guiding the next steps. The design researcher, to keep track of their ideas and reflections, will keep a notebook that will in the end serve as a visual trace of knowledge acquirement during the project.

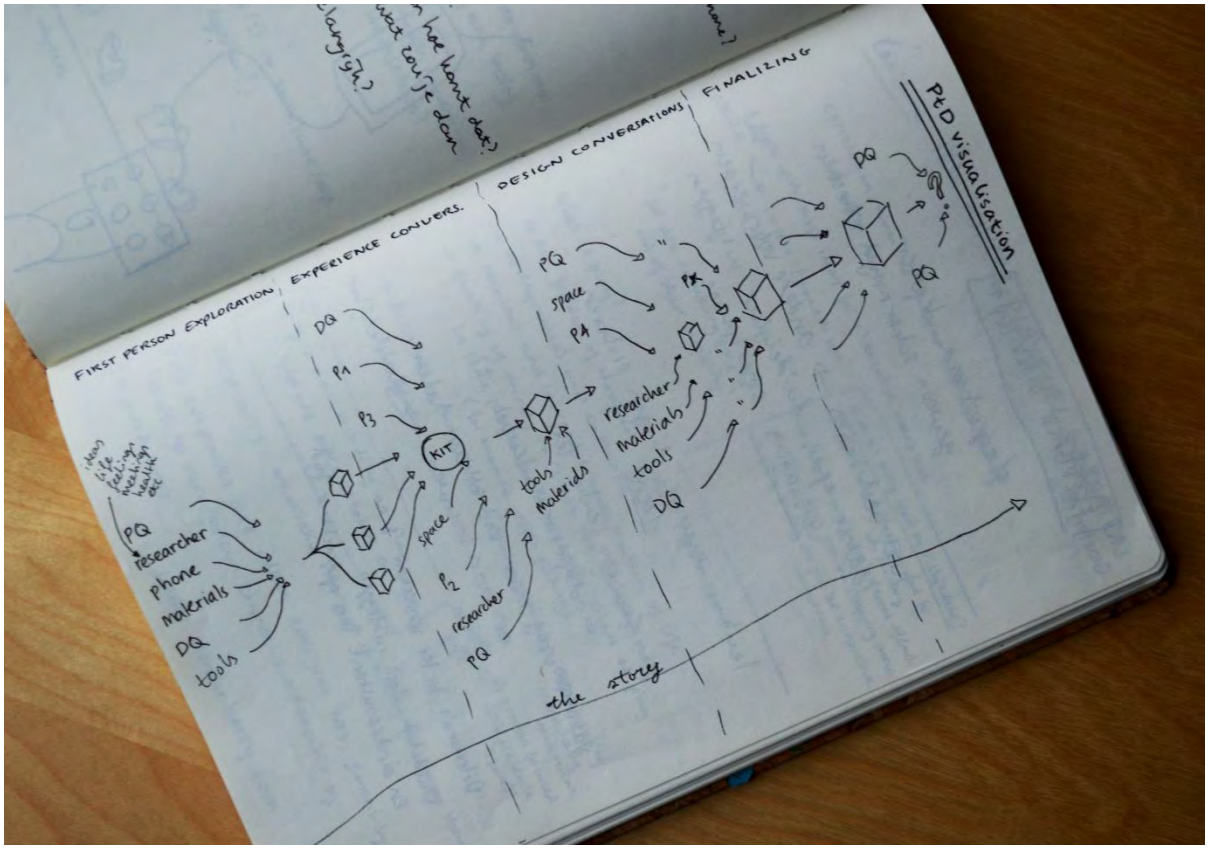

Figure 4: Schematic overview of the PtD process taken from the researchers' notebook

Stage 1: First Person Exploration

The process starts with the design researcher exploring and describing their personal felt-experiences about the philosophical question. This method is based on first person methodologies in embodied theory and somatics (Höök, 2010; Schiphorst, 2007). The method of these explorations consists of a few activities: (1) describing the personal experience, (2) designing and making interventions, (3) using the interventions, (4) describing and reflecting on the personal experience of using the interventions in regard to the design and philosophical question and (5) formulating a personal answer to the philosophical question.

The focus on individual experience is taken up specifically in first-person methodologies and somatics. In these methodologies, knowledge is accessed and constructed through the body and requires that experience be directed through awareness (Schiphorst, 2007). The body-in-motion and its felt-experience are the source for exploration and it can include an autoethnography in which the author provides a detailed description of their experience (Höök, 2010; Schiphorst, 2007). The idea is that we can learn from our own specific practices and use the qualities to transfer them into more general knowledge (Höök, 2010). In this specific project, the main design researcher will start with an autoethnography of their smartphone behaviour. The autoethnography will be supplemented with the making and using of interventions to make certain uses and aspects of the smartphone more obvious and conscious. From this autoethnography certain qualities about smartphone use can be distracted.

The *making* of artefacts, which intervene in our own habits, serves to engage the design researcher to explore their habits more in-depth. Making for exploration is a common method in the design process which is characterized by ambiguity and a lack of planning, but functions to engage the designer in a reflective dialogue to catalyse the decision process. It brings together the stories and materials to perform as incentive for understanding (Frens & Hengeveld, 2013). Hummels and Lévy (2013) reveal design not as a process of problem solving or organisation, but as a process of opening up, exploring new horizons and engaging in new situations. Through the embodied acts of making, building and experiencing prototypes, makers can exploratively facilitate access to and express meaning of the everyday to guide new directions to take. They share with Ingold (2011) that the act of making enables designers to explore the unknown, guided by their practiced intuition and sensory capabilities in a dialogue with the materials and the world around them. Thus, through describing, making and using the design researcher creates a personal answer to the questions to make certain qualities of the smartphone explicit.

Stage 2: Experience Conversations

In the second stage, the design researcher will take the third-person perspective by involving other participants by inviting them to use one intervention for a set amount of time. The interventions are handed over to the participants in a kit containing the intervention, small assignments and means to make notes. Inspiration is taken from Gaver, Dunne and Pacenti (1999), who used cultural probes to research the lives of elderly communities without dominating the conversation. They found that through the informal style of communicating and research, they were able to familiarize and connect with the communities in an appropriate manner that lead to both inspiration and grounded knowledge to base design decisions on (Gaver et al., 1999). Similarly, in Philosophy-through-Design the design researcher aims to engage with the participants to start a discussion about their smartphone use and the impact on their daily lives.

After using the kit, the design researcher will have a one-on-one conversation with the participant about the experience of using the intervention and their insights regarding their being-in-the-world in the digital age. The interventions serve in this conversation as a tool for thinking (Kirsh, 2013; van Dijk & van der Lugt, 2013) and joint sense-making (De Jaegher & Di Paolo, 2007). As recognized in the theory of distributed cognition, the body and its surroundings can be incorporated in the process of thinking (Hollan et al., 2000; Kirsh, 2013). The handling of the intervention as a 'cognitive scaffold' can lead in conversation to shared insights between participant and design researcher (Van Dijk & Van der Lugt, 2013). The interventions in the PtD process will in this way serve as objects to think, to build an understanding of their experience and start a discussion in which an answer to the philosophical question can be formed.

The reflection and analysis of the data is inspired by the Interpretative Phenomenological Analysis (IPA) approach (Smith, Flowers, & Larkin, 2009). IPA is a qualitative research approach that examines how people make sense of their personal life experiences. Offering a systematic way of analysing them makes this approach phenomenological and hermeneutic. The IPA approach is specifically interested in major life experiences that make people more aware and reflective of the significance and meaning of what is happening (Smith et al., 2009). In Philosophy-through-Design it is not a major life experience that will bring people out of their daily flow of (unconscious) experience, instead it will be an intervention that will disrupt their smartphone use leading to awareness and reflection, with which the design researcher can engage.

Stage 3: Design Conversations

In the third stage, the design researcher will iterate further on one intervention and improve it according to the results of the previous stages. Again, participants are invited to use the new intervention to fuel conversations about the design question and the philosophical ideas behind it. The discussion will guide the next step in the design process where the participants are also invited to help to improve the design together with the design researcher. In this stage, the first two stages will be brought together to create meaning through conversations, joint designing with regard to the question of being-in-the-world in the digital age.

Taken from participatory design (PD), PtD aims to use design as a method for mutual learning between participants and design researcher through reflection-in-action (Garde, 2013; Robertson & Simonsen, 2013). Important values in PD that are also applicable to PtD are (1) cooperative design, (2) equal and democratic (power)relations, (3) situation-based actions & design and (4) the use of tools and techniques to help participants (Garde, 2013). In one sentence these qualities ensure that in PtD human activity is examined in its context productively and ethically in cooperative and equal partnerships (Garde, 2013; Spinuzzi, 2005). The

difference between PD and PtD lies in the outcomes of the process, where participatory design desires to learn the aims, context and design ideas of the participants to design a solution, instead the PtD process desires to use the unfolded aims, context and design ideas to start a conversation and explore a philosophical concept.

The results of the design conversations will be discussed and reflected upon to come to an answer to the design question with a final intervention. The created interventions during the whole process together with the researchers' notebook serve as data to show the story of how the research has developed to new insights about being-in-the-world in the digital age. This story of things and insights will serve as the tangible philosophy with which philosophical ideas, questions and perspectives will be constructed for further research.

First results

At the point of writing this paper, the first stage 'First Person Exploration' has been completed by the main author. In the present and the subsequent section, the pronoun 'I' will be used to describe the subjective experiences of activities executed during PtD. During the first stage, the design researcher has analysed their own smartphone behaviour, designed three interventions (see figure 5a-c), used them and reflected on them. In figure 6, an overview of the process can be found including pictures of their researchers' notebook, an autoethnography booklet, the creation of the interventions and their use.

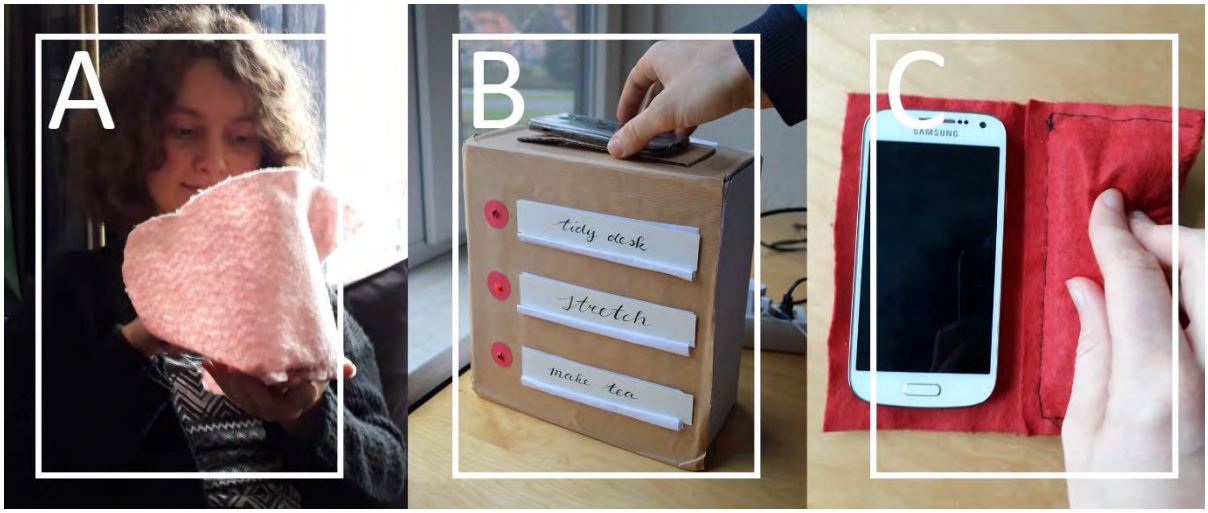

Figure 5a-c: The interventions, (a) Pink Screen, (b) De-distractionizer, (c) In-touch

The first intervention is the 'pink screen' (see figure 5a). This is a phone case made from pink felt that can be folded around the smartphone. When opening, the felt forms a screen that makes a clear division between the smartphone user and the situation they are in. It is designed to amplify the 'I am not here, but in my phone'-effect when using the smartphone, but turned out to be a message to bystanders to not disturb. The second intervention is the 'de-distractionizer' (see figure 5b). This is a machine that protects from unfiltered and distracting stimuli of the smartphone by simplifying the options of what to do without a smartphone. It uses the same casino effect as many applications to keep you interested by blinking and randomly picking a task when you put your smartphone on top of it. In the beginning it was new and funny and helped me to check my smartphone less, but I quickly found a way to hack the system, making me uncomfortably aware of my lack of agency in my smartphone use. The third and last intervention is the 'in-touch' (see figure 5c). This is a multisensory phone case that feels soft to the hands, makes sounds when you shake it and you can dig your fingers in it. It challenges the boring smartphone design by making your smartphone fun to play with in a bodily sense, and invites you to not only stay digitally in touch with others, but also to keep in touch with your different senses to build a more positive relationship to the smartphone itself. During the use of this intervention, I found, not to my dislike, a playful side of myself not only in how I played with the intervention, but also in how I engaged with my friends face-to-face.

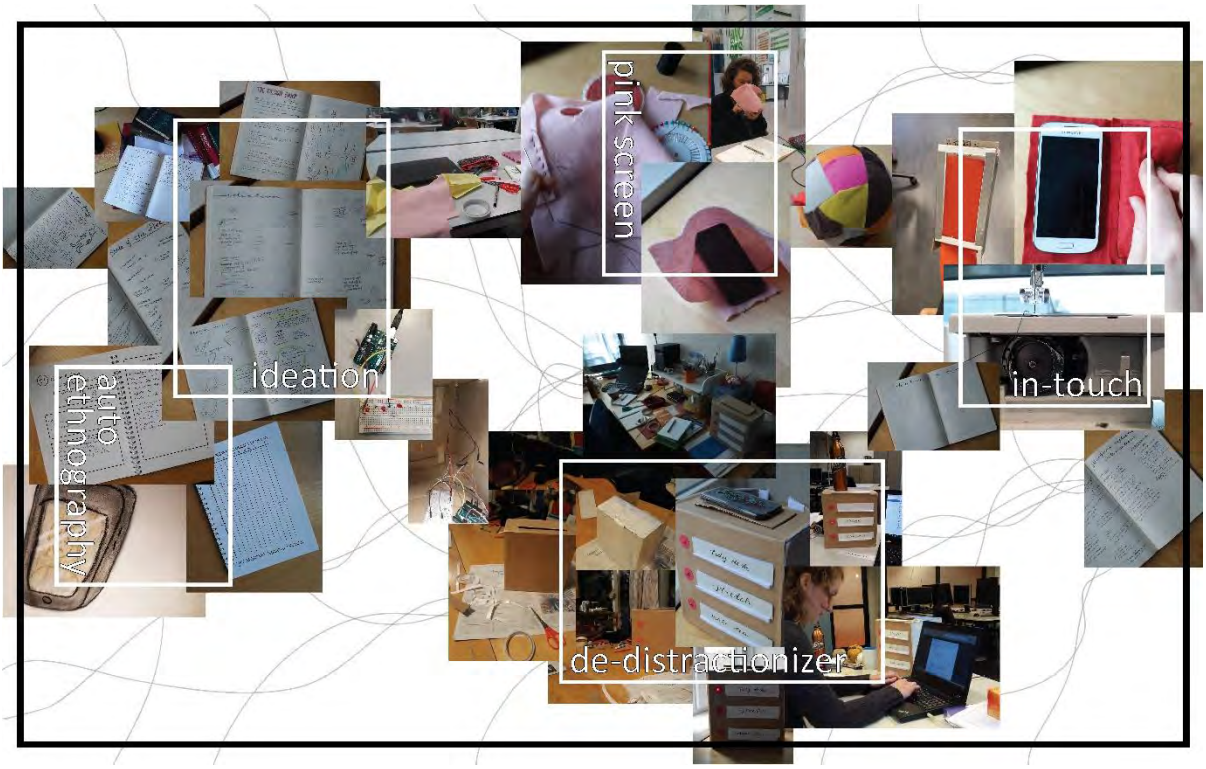

Figure 6: Overview of the process of stage 1, First Person Exploration

The personal experiences and reflections regarding the use of the interventions have been tracked in an autoethnography booklet. From this data, I found that, (1) regarding the design question, on the long term, an intervention that requires me to have self-discipline in using it, such as the de-distractionizer, will not help me to have more agency in my smartphone use. Old habits seem to take over quickly and hacking the system was a common occurrence. The intervention that actually made me feel to have more agency was the pink screen, because it helped me to focus better on the situation I was in, be it physical or digital. In light of Ingold's theory (2011), I was more tuned in to the current situation to be able to react appropriately to subtle cues to follow what is going on. Regarding the philosophical question (2), I realised that my being-in-the-world is a constant paradox. I am attentive of everything at the same time, but as a result do not have any real attention for the present moment. The digital seems to be embodied in me, while my being in the digital is disembodied. As a result, my online identity is filtered to what can be digitized and does not feel like me, but is at the same time shaped by the unfiltered stimuli and practices from the digital world. Overall, it seems that my world and my role in it are overwhelmingly vague, and making sense of it has become a full time job that distracts me from actually being attuned to the moment. My being-in-the-world, in opposition to what Ingold describes (2011), is in the digital age, thus, closed by an abundance of unfiltered cues and scattered attention, so I am less open to be astonished by the world.

Discussion

The first stage of Philosophy-through-Design showed how philosophy and design were interwoven to both inform the process simultaneously. By actually using and reflecting on the designs as first user, I found new problems, ideas and questions that made me return to philosophy. When I was using the pink screen, for example, with which I had intended to make a clear division between the online and the offline world, it turned out that many people asked me if it was designed to protect my privacy. These comments did not only make me realise that the design did indeed seem to make smartphone use secretive (a *design* reflection), but it also stimulated me to dive again into the *philosophical background* to see if a connection between privacy and being-in-the-world could be found to base further exploration on in the following design stages.

By designing and making the interventions, I came to understand the theory in another light. I noticed how the different ideas, materials and people were acting as different threads that weave together into this project. During the process, I started to create a meshwork of my project (see figure 7) to understand how my

development had travelled, or to use Ingoldian terms: *wayfared*. Ingold (2011, p. 240) would claim that a researcher is at any time following traces from the past and projects themselves into the future along lifelines, forming their own self along the way. An example is that the creations of the interventions were for a great part influenced by the available materials, tools and skills I had to learn. At some point, the sewing machine broke and I had to find another way to create an intervention, which changed the design and therefore also how I approached the question of being-in-the-world. In many design projects, however, the final design is often presented as the perfect embodiment of a function or idea, when in fact it came into being as a weaving pattern of different ideas, available materials, tools, experience, etc. Philosophy-through-Design makes this weaving of different influences more explicit, to be philosophized about, and is in that way also inspired by Ingold's ideas of being-in-the-world and knowledge acquirement based on exemplars, experience and mastery of skills.

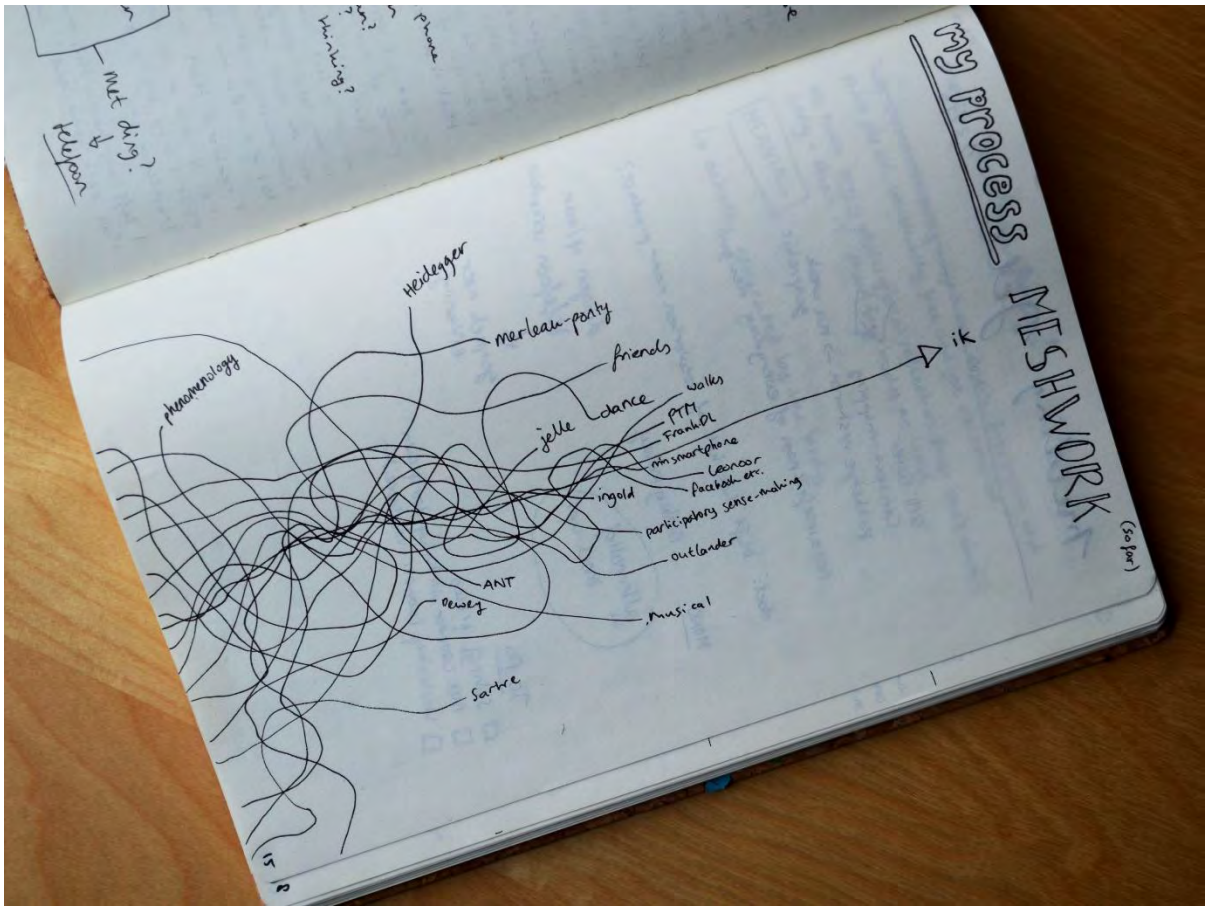

Figure 7: 'My process meshwork (so far)' taken from the researchers' notebook

Limitations

A limitation one could offer to PtD is how the design of the interventions, and with that the personal opinions and abilities of the designer, could determine the course of the philosophical exploration, alongside their already existing explicit influence and experience as a first user of the interventions. However, the idea that academic endeavours and science as a whole could be objective, is exactly the point that PtD, in accordance with Ingold's thesis (2011), tries to overcome. Science and knowledge building are more akin to a form of craftmanship, where the researcher joins the flows of materials, people and circumstances to compare, understand, describe and move with the different ways of being (Ingold, 2011, pp. 226-240). The specific design will always influence the course of the project, but that does not have to be a problem. The involvement of other people in PtD is, therefore, a way for the design researcher to engage with other opinions. It is, thus, of importance that the design researcher, independent of their own beliefs, opens themselves to the world they study.

Related to this point is the question if PtD can actually be called to be a form of philosophy. Philosophy is in this project, similarly, not seen as an objective academic endeavour, but as a personal philosophy, or in other words: a way of life that could be practiced by anyone. This view on philosophy refers back to the Hellenistic and Roman eras where philosophy meant a mode of existing-in-the-world (Hadot, 1995). An associated view can also be found in the ideas of Dewey (1917), the father of the philosophical school of pragmatism. Dewey acknowledged that one would never be able to realize complete wisdom as a definitive state or to find the real truth, and so philosophy should abandon the project of finding certainty and create theories, but instead to practice philosophy from the everyday so it can guide actions and ways of life at every moment with participation of the layman (Dewey, 1917). Philosophy as a way of life, in accordance with the ideas of Ingold (2011), is not about studying philosophy, but it is about living it (Hadot, 1995).

Looking back, however, at Ingold's presentations of what a study from within the world (Ingold, 2011, p. xi) would look like, it seems to remain limited to a number of examples (such as sawing through a plank (ibid, pp. 51-53)) and various drawings in between the lines of text. Philosophy-through-Design aims to be the first step into the direction where Ingold's ideas will be put to the test by working them out in a more considerable design project. Further research could look into the possibilities of philosophers using PtD, in their own way, to practice a tangible philosophy in the world. This project about being-in-the-world in the digital age is, however, an example of what such a project could look like from the perspective of a designer, by using the ideas of wayfaring, stories, weaving and embodied situational practices to *do* philosophy.

Conclusion

The Philosophy-through-Design approach, as developed during the case study about being-in-the-world in the digital age, proposes a relevant method in which design can function as a way to materialise philosophy. Or in other words, to bring abstract philosophical inquiries back into the everyday where an actual change can be made. By combining both philosophy and design into one approach, both can benefit from describing, understanding and proposing the ways in which technological solutions interact with the societies in which these are used. The results of the first stage of PtD show a promising process that weaves together observation, creation and reflection in the design and use of smartphone interventions. In the following stages, the approach will be taken into practice even more by involving various smartphone users to further explore the question of being-in-the-world in the digital age. In conclusion, Philosophy-through-Design seems promising as a method for designers to practice a tangible philosophy by design.

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Values that Matter: Mediation theory and Design for Values

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Philosophy of technology could bring new insights when applied to design practice. This paper brings together mediation theory and design for values. We present a new design for values methodology: Values that Matter. Via the four phases; explore, conceptualise, anticipate and test, VtM allows for anticipating value dynamics. It starts with the assumption that value expression and definition arise in the interplay between users and technology. An extensive mediation analysis then helps to provide insight in and allows for anticipation on potential effects of technology on users and value dynamics, something that current value sensitive design approaches cannot deliver. Those insights are tested with involved actors to bring about best values by design. VtM has been applied to the case study of ViSi Mobile, a medical device developed for continuous monitoring of vital signs in hospitalised patients. A redesign was proposed that better empowers these patients.

Keywords: Values that Matter, Design for Values, Design for Value Change, Mediation Theory, Responsible Design

Introduction

How to integrate ethics in design practices? Among the various approaches that have been developed at the interface of the ethics of technology and design research, the approach of Value Sensitive Design (VSD) (Friedman, 1996) emerged as a key. The main focus of this approach is the identification of the values that are at stake in relation to concrete technological innovations, in order to take these into account in design practices and to concretise these in a material design. Values refer to what a person or people consider important in life (Friedman, Kahn & Borning, 2006). Or, as described in more detail by Van de Poel and Royakkers: “lasting convictions or matters that people feel should be strived for in general and not just for themselves to be able to lead a good life or realize a good society” (Van de Poel & Royakker, 2011, p.72).

VSD’s methodology is threefold. First, the ‘conceptualise’ phase aims at identifying and ordering all values at stake. Consequently, ‘empirical investigations’ is for studying the ideas of stakeholders on values. Finally, existing technologies and their embodied values are studied as part of the ‘technical investigations’ followed by the design of the new product. One of the standard examples in the field – in which this methodology actually pioneered – is the development of interfaces to fine-tune the cookie settings of web browsers, integrating the value of privacy in the actual design of information technology (Friedman, Kahn & Borning, 2006).

VSD lacks a clear methodological framework despite the fact that it has been frequently used (Winkler & Spiekermann, 2018). VSD falls short especially with respect to its understanding and use of values. Namely,

VSD “seems to assume that values remain stable during adoption and use” (Van de Poel, 2018). We believe, however, that values only arise in the interplay between users and technologies and are far from stable. It is therefore impossible to design for values without considering the interaction between technology, users and resulting values.

Technologies are not neutral tools. They help to shape the behaviour, experiences and even frameworks of interpretations of their users: a smartphone is not just a tool to make phone calls and exchange information, but also has important implications for people’s attention and concentration, the character of friendships, the ways in which people listen to music and watch movies, et cetera (Verbeek, 2010). Users’ perception, behaviour and resulting values are not stable properties, but artefacts of the technologies used. Designing for values should, therefore, anticipate the user-technology-value dynamics.

We take the ‘safe cigarette’ as an example. The safe cigarette was an initiative of the American National Cancer Institute in the 1970s. By embodying ‘health’, as a value with stable properties, in the design of a cigarette, the institute developed a cigarette with a better filter containing lower levels of nicotine with the aim to decrease nicotine intake and a better health of the smoker (Warner & Slade, 1992). Yet, after introduction to the market, the nicotine intake of cigarette users only increased (Nakazawa, Shigeta & Ozasa, 2004). As smokers were so used to their normal levels of nicotine, the safe cigarette created unconscious behaviour changes; smokers smoked more often, inhaled deeper and broke off filters to be satisfied in their daily doses of nicotine. So, instead of positively influencing the health of people, the safe cigarette negatively affected it.

This example shows that designing for values as stable properties instead of anticipating the influence of technology on user behaviour and values could end in designs ‘biting back’; resulting in other and even opposite effects from the ones inscribed (Tenner, 1997). We can identify two types of value dynamics. First, there is a dynamic in value expression. The way in which technology affects a value depends on users’ perception and behaviour as a result of the technology. In the example, the value of health is not improved but threatened due to users’ behaviour changes. Second, there is a dynamic in value definition. The definition of a value is subject to the technologies that embody and express the value. With respect to the example, embodying ‘health’ in a ‘safe’ cigarette creates a shift from ‘healthy equals non-smoking’ towards ‘healthy equals safe cigarettes’. This change in value definition results in undesired behaviour. A major question then concerns how one can design for values when the content of what constitutes the values is subject to the design itself?

In summarising, we believe that VSD fails to adequately design for values as it considers values as stable properties instead of products of user-technology interactions. The user-technology interactions create two types of value dynamics: dynamics in value expression and value definition. This paper aims to go beyond the Value Sensitive Design approach, on the basis of the perspective of the philosophy of human-technology relations, and more specifically, from the approach of ‘technological mediation’. This approach analyses technologies as ‘mediators’ between users and their environment (Verbeek, 2010). From this perspective, the ambition to design values ‘into’ technologies needs to take into account that these technologies will always have mediating effects, by reorganising the behaviour and experiences of users, and sometimes even by affecting the value frameworks from which they can be evaluated.

We will report here an approach to ‘design for values’. It takes the phenomenon of technological mediation as the starting point to anticipate the effects of design on value expression and definition. First, we introduce the approach of technological mediation. Thereafter we propose the design methodology ‘Values that Matter’ (VtM). This four-phased methodology; explore, conceptualise, anticipate, test, provides a responsible way to design for values and value change. To illustrate the methodology, VtM is brought into practice with a case study of a medical wearable wrist device used to continuously measure vital signs of patients in the hospital; ViSi Mobile (VM) (Sotera Wireless, CA, USA). We will study the mediating effects of ViSi Mobile and propose an alternative design that better takes into account value dynamics.

Mediation theory

The approach of technological mediation is built on the idea that technologies are not neutral. Humans shape technologies and become simultaneously shaped by them. The mediation approach originates from the postphenomenological work of the North-American philosopher Don Ihde (Ihde, 1993). Postphenomenology studies the relations between humans and technologies and the implications technologies have for human

practices and perceptions (Rosenberger & Verbeek, 2015). Rather than being 'objects' opposed to human 'subjects', technologies should be seen as 'mediators' between human subjects and the world: when technologies are used, they help to establish relations between the person using the technology and her or his environment. For example, cars do not just move people from one place to another but give them a different experience of the world than when they would walk or ride a bike. A car, for example, may provide individuals with the value of autonomy as it opens up a new world unable to be reached before. Likewise, diagnostic devices in healthcare do not only help doctors to obtain a diagnosis but also greatly affect the value of responsibility, as it takes along new ones (Verbeek, 2008).

Technological mediation typically has two dimensions (Verbeek, 2010). There is first the 'hermeneutic' dimension, related to the impact of technology on perception and interpretation. Technologies can here amplify or reduce the perception of certain elements of the world. The other dimension of technological mediation is the 'existential' one. It focuses on how technologies help to shape actions and social practices. Technologies thereby can invite for or inhibit certain behaviour. MRI imaging is a good example of both types of mediation. Hermeneutically, MRI scanners help neuroscientists to understand the brain and to develop ideas about the human mind and human behaviour in relation to the brain, which also results in new societal frameworks of interpretation, like the idea that 'we are our brains'. At the same time, existentially, these scanners reorganise the actions of doctors and the interactions between doctors and patients, while also changing social practices, like marketing ('neuromarketing') and psychiatric care ('neuropsychiatry') (De Boer, Te Molder, & Verbeek, 2018).

A special category of mediations is the mediation of moral frameworks. Interestingly, technologies cannot only be evaluated ethically but also have an impact on the ethical frameworks for evaluating the technologies. An example is the birth control pill. While being a product of the sexual revolution, it also helped to shape that same revolution. By loosening the connection between sex and reproduction, the birth control pill has shifted normative frameworks regarding sexuality: what counts as 'normal' takes on a different meaning. An interesting example of this moral mediation is the impact of the birth control pill on the acceptance of homosexuality. As Mol has shown, the disconnection between sex and reproduction also resolved an often-used argument against homosexuality: the argument that it was unnatural to have sex with somebody of the same sex, since this sexual relation cannot result in reproduction (Mol, 1997). Since the introduction of the birth control pill, the norm that sex is connected to reproduction has lost its self-evident validity.

A more recent example of this moral mediation, which has been studied empirically, is the impact of Google Glass on definitions of the value of privacy. By analysing how people discussed Google Glass online, in comments on YouTube videos of Glass users, it appeared to be possible to investigate how the value of privacy gets redefined when people apply it to a new technology (Kudina & Verbeek, 2019). Technology and morality are intricately connected. This gives an extra dimension to the ethics of technology since it implies that the ethical frameworks with which we evaluate technologies are themselves co-shaped by these technologies.

Mediation theory provides a clear framework for understanding value dynamics; the impact of user-technology interaction on value expression and value definition. Therefore, it could help a design for values methodology to anticipate in a structured way the effects that design will bring about. Only a few other authors have introduced mediation to design (Swierstra & Waelbers, 2012; Verbeek, 2013), but none have proposed a way to do this systematically. We present a design methodology based on the approach of technological mediation and aiming to anticipate technological mediations of interpretations and actions at the individual and social level, as well as the technological mediation of normative frameworks. This methodology is called Values that Matter.

Values that Matter

The design for values methodology Values that Matter aims at developing designs that embody and anticipate important values. Its name is twofold. First, it refers to the important contribution of values to life. Second, it stresses the context-dependence of values as the type of values result and depend on user-technology interactions. The methodology consists of four phases, shown in figure 1. It starts with the exploration phase in which the important actors and values become identified. Based on that, the conceptualisation phase aims to develop a concept that does justice to the identified values for the identified actors. These two phases are quite similar to the VSD methodology. It is in the anticipation phase when value dynamics comes to play a role and where the difference starts with VSD. This phase aims, via mediation theory, to provide an anticipatory understanding of the interplay between users, technologies and values before actually implementing a

technology. The testing phase allows for testing actual mediations and value conflicts as an input for conceptualisation and helps understanding how the anticipated values become appreciated subjectively in real life. Together with the previous two phases, conceptualise and anticipate, this phase allows for multiple iterations to optimally improve values by design. All four phases and their intermediate steps are illustrated in detail.

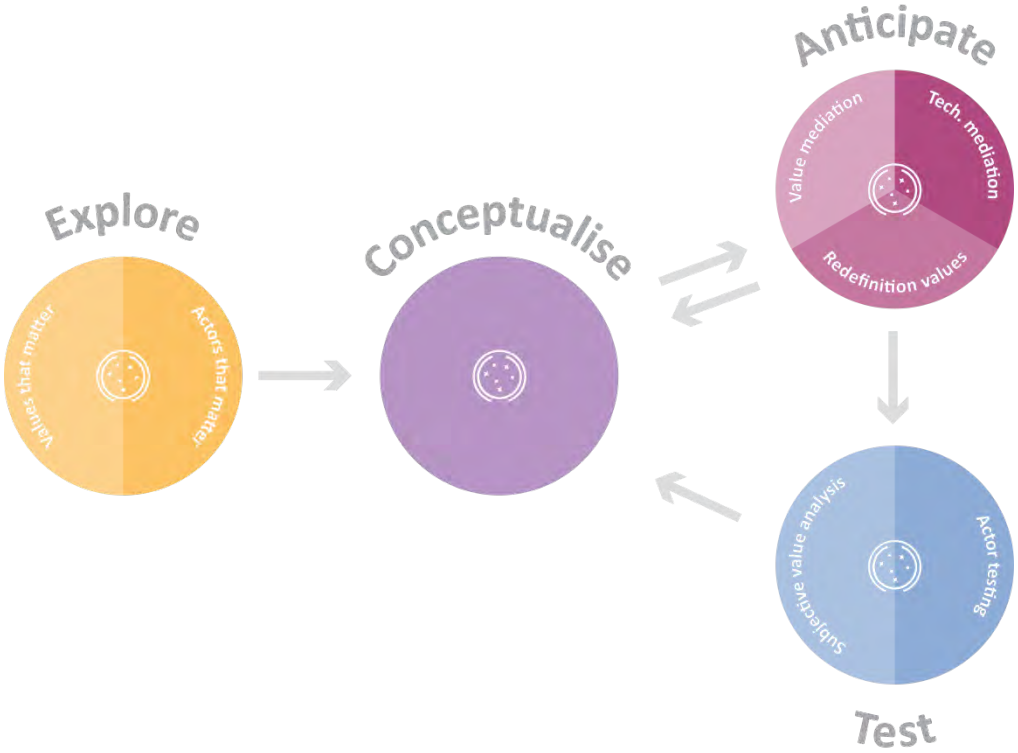

Figure 1. Framework Values that Matter

Explore

The exploration phase is for mapping out the context of the design problem. In this context, we focus on two important elements: actors and values.

Actors that matter

At first, the design team needs to identify all actors, (groups of) individuals, of importance in the design problem. Those actors need to be involved in one way or another with the design problem and will be in (in)direct interaction with the future design solution. Identification of actors could be facilitated by means of literature studies on the context of the design problem and interviews with certain actors to identify potential others.

Values that matter

Each actor has a different relationship to the design problem, resulting in different preferences, needs and values. The design team should identify per actor which values are important and to what extent. Some values might be important for all actors, whilst others could matter for just one. To understand which values matter and to define a hierarchy in values, the design team should first turn to the actors themselves by means of qualitative analyses (e.g. interviews, diaries, questionnaires...). Yet, actors reason from their current context. As values arise from the interplay between users and technologies, a new technology might change the context and introduce new values. Only the designer is able to anticipate these additional values. Brainstorming about values, literature reviews on the design problem and reviews of similar existing design solutions could help the designer to identify the additional values.

Conceptualise

The identified actors and belonging values together form the preliminary value framework. The design team starts ideation just after finishing this framework. This process of ideation should result in a concept. A concept can be anything from an abstract idea to a fully developed prototype. By means of iterations with the following phases, the concept will be developed every time with more detail up until its script solves the design problem whilst simultaneously embodying the important values for the different actors. As value conflicts could arise within a concept, the defined value hierarchy could help in decision making.

Anticipate

The anticipate phase aims via an anticipatory technology assessment at understanding the effects of the concept on value dynamics within the earlier defined value framework. Mediation theory provides the knowledge to do so. The anticipate phase consists of three steps, each described below. This phase can be executed in a multidisciplinary team including a range of actors involved in the design problem, to gain the greatest understanding of all possible ways of mediation.

Technological mediation

It is in this step that the actual mediation analysis will be executed. To systematically assess the mediating effects of the concept on all involved actors, we propose to create an actor-matrix, shown in figure 2. An actor-matrix is a matrix that lists all involved actors in both the first column and first row. This will result in a matrix with two types of crossings: a crossing between the same actor and a crossing between two different actors. All crossings of the first require an 'individual mediation' analysis. All crossings of the latter require a 'mediation of relations' analysis.

Mediation of individual: in the individual mediation analysis, the design team studies how the human-technology relationship between the actor and the concept forms the perception and actions of the actor. Mediation of perception entails the effect of the concept on the way the actor perceives himself and the way he perceives the world around him. Mediation of action entails the effect of the concept on the actions of this actor.

Mediation of relations: apart from individual perception and action, a technological concept affects the relationships between different actors. The design team should identify what kind of relationship the concept constitutes between the two actors. This should always be seen from the perspective of the actor on the left towards the actor on the right, as the relationship might be differently seen from the opposite perspective. A concept might influence how one actor perceives another actor and acts towards this other actor.

This systematic mediation analysis helps to gain a deep understanding of all the potential mediating effects of the developed concept on the different involved actors and relationships between those actors.

	Actor 1	**Actor 2**	**Actor n...**
Actor 1	**Human-technology relationship** *Mediation of perception and action towards the self and the world*	**Human-technology-human relationship** *Mediation of perception and action towards the other*	**Human-technology-human relationship** *Mediation of perception and action towards the other*
Actor 2	**Human-technology-human relationship** *Mediation of perception and action towards the other*	**Human-technology relationship** *Mediation of perception and action towards the self and the world*	**Human-technology-human relationship** *Mediation of perception and action towards the other*
Actor n...	**Human-technology-human relationship** *Mediation of perception and action towards the other*	**Human-technology-human relationship** *Mediation of perception and action towards the other*	**Human-technology relationship** *Mediation of perception and action towards the self and the world*

Figure 2. Actor-matrix for the Values that Matter methodology

Redefinition values that matter

A preliminary list of values that mattered per actor is developed during the exploration phase. Those values matter in the context of the design problem. When a concept becomes introduced to solve the design problem, it does not leave the list of values unaffected. The design team should, therefore, redefine their value framework. The mediation analysis is of help here. Some of the earlier defined values that were considered important might disappear, as the concept does not affect those values. New values might be added that become affected by the solution. For each value that disappears during redefinition, the design team should ask the key question: Does this matter? The answer to the question depends on the relevance of the value and the corresponding actor. When an important value has been lost, the design team should return to the conceptualise phase and reconceptualise their concept so that it will after all again embody the lost value.

Mediation of values

On the basis of the mediation analysis and the redefined list of values, the design team can now start the mediation of values analysis. They identify the effects of their concept on the different values that matter. Each identified value could get one of three labels: 'threaten', 'enhance' and 'transform' (Manders-Huits & Zimmer, 2009). A value gains the label threaten when it becomes affected negatively by the concept. A value with the label enhance will, on the contrary, become improved by the concept. Finally, the label transform is left. When a value gets this label, we deal with the mediation of moral frameworks. The concept then changes the content of what constitutes the value. Value transformations are not by default burdensome. Designers could even decide to consciously design for positive value transformations; design for value change.

After the value mediation analysis, the design team analyses their concept. How many values does it affect negatively (values labelled as 'threaten' or 'undesired transformation') and to whom do those values belong? Are there conflicting values? Are there values that cannot be given a label, as it is still unknown which type of technological mediation will be dominant? Based on the questions, the design team can either decide to return to the conceptualise phase or proceed to the test phase. Considering the first, they should redesign the source of the concept that creates the shortcomings of the design. Considering the latter, the design team can test with the actors questions brought up by the mediation analysis.

Test

In the previous phases, a concept has been developed that embodies an anticipated set of values. This phase is for testing the anticipated technological mediation. The design team should have clear questions at the start. Those could include which type of technological mediation will become dominant or how to deal with value conflicts. Moreover, it allows for studying how the anticipated set of values is actually experienced subjectively by the different actors.

Actor testing

The design team should bring their concept to the different actors and study its mediation. Via qualitative studies as, for example, interviews, observations or diaries, they can gain an idea about the real technological mediation of the concept, actors' appreciations of certain values over others or the effect of the concept on the values that matter.

Subjective value analysis

The study results of the previous step should now be analysed to answer all questions defined upfront. Answers to questions on most common type of mediation or value conflicts provide input for reconceptualisation. Answers to actors' experienced value mediation should be studied. Is the concept ready to be implemented in society or do actors experience a threat to the identified values? For each threatened value, there is an imbalance between the anticipated effect on values and the subjectively experienced effect on values. Designers should aim to find the best balance between 'what we think is good for the actor' and 'what the actor thinks is good for him'. When they conclude a value is threatened, the team should again identify the source of the concept causing the threat as input for reconceptualisation. The result of a few of those iterations between conceptualise, anticipate and test is a product that optimally improves both anticipated and subjective experienced values.

Case study: ViSi Mobile

As VtM makes the greatest difference in its anticipation phase, we will illustrate this phase by means of a case study. The case study comprises the medical device ViSi Mobile, shown in figure 3. ViSi Mobile is a wearable device that continuously measures five vital signs of hospitalised patients: arterial blood pressure, heart rate, respiration rate, oxygen saturation, and skin temperature. All data are displayed on a module on the wrist of the patient and sent to an external computer. A computer algorithm converts the vital signs into a Vital Risk Score (VRS). This score reflects the physiological state of a patient and is used as a warning for clinical deterioration. When the score is above certain predefined settings the medical staff is alarmed for extra checking on the patient (Sotera Wireless, 2018).

ViSi Mobile could create a paradigm shift in the wards of hospitals. Traditionally, nurses have to collect the vital signs of patients manually, three times a day. It takes approximately six minutes to measure, via several devices, the necessary data of a patient, write it down and insert the data in the electronic health record system. Nurses taking vitals may be less reliable and is subject to inter-observer variability. Furthermore, the large gap of eight hours between two subsequent manual measurements could result in missing data relevant for patient's care. ViSi Mobile is able to overcome these drawbacks and moreover can provide a detailed insight into the data of a patient with potential for prediction and prevention of disease course. Apart from a few minor and solvable technological problems such as a fast decay of its batteries, false-positive alarms and lost contacts between skin and sensors, ViSi Mobile has been reported a promising new device in hospital care (Weenk et al., 2017).

ViSi Mobile has been developed by the American company Sotera Wireless. In 2017, the Radboud University Medical Center in Nijmegen started a pilot study with the device to assess its potential in improving healthcare. The pilot study involved 60 patients at the internal medicine and surgery wards and showed the superiority of the device in measuring patients' vital signs in comparison to daily measurements of nurses (Weenk, Koeneman, et al., 2019).

In this setting, we studied the potential mediating effects of ViSi Mobile on their carriers: the patients. Via our Values that Matter methodology we aimed at finding mediating effects of ViSi Mobile, the potential for improvement and recommendations on actual implementation. First, we studied the mediating effects of ViSi Mobile without involving any actors. Consequently, mediating effects were discussed with patients wearing ViSi Mobile and with hospital staff. Moreover, mediating effects were derived from a first set of semi-structured interviews with 60 patients, 20 nurses, 3 physician assistances and 6 medical doctors on the positive and negative effects and perceived facilitators and barriers of the device (Weenk, Bredie, et al., 2019). We illustrate only the mediating effects of ViSi Mobile on the perception, action and values of patients that we anticipated and were simultaneously confirmed by the different actors themselves. We end with a few recommendations for the hospital on improving ViSi Mobile's design and way of implementation.

Figure 3. ViSi Mobile

Anticipate – technological mediation

Mediation of individual

Each patient is unique. Consequently, there is not one type of technological mediation. Below, we present potential mediating effects of ViSi Mobile that different types of patients can and have experienced. First, with respect to mediation towards the self, ViSi Mobile might affect patients' ideas of health. For patients, health is something intangible; invisible for the human eye, including mostly subjective feelings about one's own body. ViSi Mobile renders visible health. It quantifies health into a set of always the same objective qualities such as blood pressure, respiration rate and heart rate. ViSi Mobile is a material translation and construction of reality. Using ViSi Mobile changes patients' intentionality into a combination of original subjective feelings over own body with quantifiable data perceived on a screen.

This could have both positive and negative effects on the perceptions and actions of a patient. When patients feel similar as the device tells them they feel, patients could experience the same positive feelings as the reasons people have for using self-tracking devices at home (Gimpel & Nißen, 2013). ViSi Mobile could first provide self-entertainment: the enjoyment of data collection of own body. Second, it could contribute to self-association, in which ViSi Mobile provides the tools to understand the self in relation to others. Third, self-design might become affected. In that, patients can optimise their own bodies. It furthermore creates a ground for self-discipline: having a sense of purpose and motivation. Finally, it allows for self-healing: becoming more independent from regular healthcare, being able to leave their bed and walk around.

Yet, when the feelings of patients do not match with the data ViSi Mobile displays, which is when one feels bad or good and the data tells otherwise or when patients detect fluctuations in ViSi Mobile's data but do not understand those, ViSi Mobile mediates patients negatively. This mismatch between feelings and data could reintroduce Descartes' notorious mind-body dualism in which feelings are mind and data of ViSi Mobile body. Patients could then start to either lose trust in the data or in own feelings. In the first situation, patients could distrust ViSi Mobile and maybe even the surrounding healthcare of the hospital. In the second situation, patients could lose self-consciousness and self-confidence. They might feel anxious and suffer from feelings of alienation from themselves.

Apart from mediation towards the self, ViSi Mobile affects patients' perceptions and actions towards the world. The idea of continuous monitoring could, on the one hand, might make patients feel safe, being observed and looked after for. On the other hand, it might make patients feel exposed and objectified as a study object: unable to hide or simply opt-out.

Mediation of relations

ViSi Mobile does not only affect the patient as an individual but mediates the relationships between patients and other actors. Although many relationships between actors become affected by ViSi Mobile, we will here only consider the mediating effect of ViSi Mobile on the relationship between the patient and the nurse, seen from the perspective of the patient, summarised in the actor-matrix shown in figure 4. Due to ViSi Mobile, the patient might either see the nurse more or less often, depending on the behaviour of the nurse. ViSi Mobile provides nurses with time by replacing the time-consuming manual measurements. Nurses can now either decide to spend this gained time on socially interacting with the patient or on spending this time on other tasks. The first may lead to increased and possibly better patient-nurse contacts. This could result in an improved relationship with the nurse, feelings of trust, safety and being cared for. The latter would lead to decreased patient-nurse contacts. This might negatively affect patients' experiences. The relationship with the nurse might deteriorate, patients might feel alienated by hospital personnel, stressed for not knowing whether they are actually monitored or could experience feelings of exposure to an unknown monitoring 'eye'.

	Patient	**Nurse**
Patient	**Patient - ViSi Mobile relationship** *Patients might enjoy self-entertainment, self-association, self-design, self-discipline and self-healing.* *Patients might distrust VM's data or own feelings. They can lose self-consciousness and self-confidence.* *Patients might feel safe.* *Patients might feel exposed and objectified.*	**Patient - ViSi Mobile - Nurse relationship** *Patients might see nurses more often. This might result in feelings of trust and safety.* *Patients might see nurses less often. This might result in stress and feelings of alienation.*
Nurse		

Figure 4. A segment of the actor-matrix of ViSi Mobile

Anticipate – redefinition values that matter & mediation of values

Several values seem to become affected by ViSi Mobile based on the previous short mediation analysis. A selection of those values includes autonomy, bodily health, relations, bodily integrity, purpose, identity, safety and privacy. We report here the first three as these provide the opportunity for improving the design and implementation of the device.

At first glance, autonomy could be labelled 'enhanced', as ViSi Mobile seems to provide patients with the autonomy to look after their own health, understand own health and act based on that knowledge independently from the hospital staff. Yet, this label is debatable for two reasons. First, it requires that patients can interpret the displayed data and the meaning for healthier behaviour. However, from conversations with patients, we often found the opposite. Patients did not understand ViSi Mobile's data and when they did, they did not know how to act. Instead of enhancement, autonomy then may become threatened. Second, where patients gain autonomy in relation to the hospital personnel, they lose autonomy with regards to the medical device itself. Namely, ViSi Mobile takes away the autonomy to define health.

Bodily health is labelled 'transformed', as ViSi Mobile changes patient's definition of health from current and past subjective feelings into objective, current data only. ViSi Mobile excludes from the definition of health feelings and past healthcare records. This value transformation is burdensome as it might make patients feel confused, anxious and stressed, unable to relate their feelings to their bodily data.

Finally, with respect to the value relations, the relationship between patient and nurse becomes affected by the way ViSi Mobile is implemented in the care path. When the implementation of ViSi Mobile results in fewer visits of nurses, the value becomes threatened. Meanwhile, when nurses come by more often, the value will be enhanced.

Reconceptualise

Although ViSi Mobile provides benefits for the hospital, there are opportunities for improvement of the design and recommendations for implementation when the device is adopted on a larger scale. Some are discussed.

The device could benefit from a redesign with respect to the values of autonomy and bodily health. Those become negatively affected by the design of the display of ViSi Mobile on the wrist of patients. This display shows the data that can cause confusion by the patient. A redesign could target this display to improve both values. First, ViSi Mobile can help patients with the ability to be independent, converting the negative label of autonomy into a positive. Such may be done by providing patients with healthcare advice. On the basis of the physiological data of a patient, ViSi Mobile could provide this patient with tangible advice via pop-up notes on its display. For example, ViSi Mobile senses that the heart rate of a patient increases. The patient could be stressed. ViSi Mobile could advise him to find relaxation. Likewise, a patient with a low oxygen saturation could receive the advice to sit in bed and do breathing exercises. As well, when ViSi Mobile senses that a patient has not moved during the day, a pop-up note could recommend making a walk. These tangible goals allow patients to actually use ViSi Mobile's data to become autonomous by understanding how to independently improve their health.

To prevent the negative transformation of the concept of bodily health, ViSi Mobile should take into consideration the feelings of a patient and her or his healthcare records. It should include first the feelings of a patient, for example by allowing patients to report on their subjective well-being via pop-up notes. Furthermore, ViSi Mobile should provide patients with the opportunity to see their past healthcare records by, for example, entering a new screen on its display.

Finally, the double-sided mediating effect of ViSi Mobile on patient-nurse interactions shows the importance of involving nurses during the implementation of the technical device. Fostering close nurse-patient contacts would warrant for positive effects on their relations. With a few of those changes to the design and way of implementation of ViSi Mobile, the device will improve the values that matter and be able to positively reshape healthcare for both hospital staff and patients.

Discussion and conclusion

In this paper, we have developed Values that Matter, a design for values methodology inspired by the philosophy of technology. Value sensitive design approaches do, in their methodology, not greatly differ from more traditional design approaches. When we take, for example, the often used Double Diamond Model, it includes the phases discover, define, develop and deliver (Design Council, 2007) and follows thereby, just like any design methodology, a process with iterations between analysis, idea generation, prototyping, testing and implementation. The main difference between traditional design approaches and value sensitive design approaches lies in the focus on creating value for the company over creating –literally- value for the user. Yet, VtM is not like any other design approach. The main difference with other design (for values) methodologies, is the anticipatory approach and, in particular with respect to VSD, its understanding of values as a result of the interplay between users and technologies. The methodology of VtM is built around the 'anticipate' phase that makes the methodology unique. Other design methodologies could benefit from adopting such a phase to understand and anticipate design's effects in the real world.

As such an anticipatory phase requires guidance, VtM aims to provide this methodological guidance by proposing the phases 'explore', 'conceptualise' and 'test'. To optimally contribute to the 'anticipate' phase, all phases require follow-up research.

First and foremost, with respect to the exploration phase, questions still need to be answered concerning the actors and values. For example, what range of actors should become involved? Apart from actors present during the use of a design, should actors involved in the production and recycling of it be taken into consideration as well? And in case of conflicts, can certain actors become prioritised over others, and, when possible, is that ethical? Furthermore, with respect to values, is it possible to create a list of all potential values that could become embodied by design? What qualifies as a value? Are there values that matter in each situation compared to values that only matter in particular situations? And is it then possible to make a universal ranking of values, and if not, how to facilitate value ranking per context to solve conflicts in values?

Second, the conceptualisation phase needs a clear methodology. How to actually translate values into design requirements and embody values in design? Third, with respect to the anticipation phase itself, follow-up

research should define this phase's ability to guide each designer through the anticipating process. Is more guidance, for example, necessary with respect to what type of mediation is studied? The case study showed it might be necessary to demarcate between the mediation of different personas within the same actor (each patient is unique) and different periods of time over the adoption of a technology. Finally, with respect to the testing phase, a more detailed understanding is essential in the balance between the 'objective' anticipated and the subjective experienced values. Actors are not always aware of what (value) is best for them and might need little anticipated help of designers. Yet, that could result in conflicts between 'what we think is good for you' and 'what you think is good for you'. When that leads to actors unwilling to use products, even though they are good for them, the products are useless. A detailed understanding is therefore necessary in how to deal with those situations.

VtM has been applied to the case study of ViSi Mobile. We have only studied the 'anticipate' phase and involved only a few actors in the process. The case study has nevertheless shown the potential of VtM to identify recommendations for design and implementation. When we would have used the traditional Value Sensitive Design approach, we would not have been able to identify the great range of value dynamics resulting from the mediation of ViSi Mobile. We would first not have been able to identify the different anticipated ways of value expression of 'autonomy' and 'relations'. Moreover, we would not have been able to understand the change in the definition of 'health'. The used case confirms the applicability of the methodology and shows the necessity to proceed in the future with testing the entire design methodology, in greater collaboration with real design processes, companies and actors.

We have done a first attempt to provide a systematic philosophical framework for designing and anticipating value dynamics and piloted this in a relevant new technology for in hospital patient care. The preliminary results encourage the use of VtM to design more responsibly for values and even the potential to consciously design for positive value change.

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Research Perspectives IN THE ERA OF Transformations

From Hype to Practice: Revealing the Effects of AI in Service Design

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With the rise of artificial intelligence (AI) in the past decade, AI has become known in everyday products and services. One of its application forms is that of AI assistants, such as voice assistants and chatbots. While new types of customer service channels have been introduced through these assistants, until now, the intelligence of AI has mostly resided in the backend systems of services. Studying a service design process and practices focussing on AI-enabled services, the present research draws on a multi-method approach involving seven expert interviews and five use cases on AI assistant projects in industry. The authors evaluate the datasets through coding cycles aiming at identifying the shifts AI brings to service design. The results present and discuss the emerging fields of change in service design, namely, the application of AI, service design process with AI and role of the service designer in the creation of AI-enabled services.

Keywords: Service design, artificial intelligence, design process, role of a designer

Introduction

This article discusses the current and even hyped topic of artificial intelligence (AI) in the context of service design. It introduces the emerging fields of change in service design, namely, the application of AI, service design process with AI and role of the service designer in the creation of AI-enabled services. The paper discusses not only what AI enables for the front and back ends of service delivery but also the practical role of the service designer and service design process in the context of AI-enabled services.

Regardless of the rather long history of AI (Steels, 2007), its application in the fields of service design, design management and design research is still in the early stages. The full potential and implications of AI in service content and delivery may not yet have been fully discovered. The development indicates that AI is taking a role as an orchestrator for personalised service content (Reavie, 2018), and it is becoming an enabler for value creation in digital service channels (Vargo & Akaka, 2012). While user interactions are shifting away from single interfaces towards the widening range of possible user touchpoints, the variety of provided service functions is increasing the complexity of service systems. Services are increasingly built through networks and various channels. Thus, the interactions between humans and large-scale systems are increasing and need to be inquired further (Kile, 2013).

In the 1990s, Krippendorff (1997) already introduced design principles for the context of artificial artefacts that are produced and consumed in a multi-user context supported by virtual environments. In this work, he emphasises the interactivity of artefacts and suggests design becoming 'language-like'. With the shift towards the application of natural language processing (NLP) tools, services and products go beyond the conceptual

and semiotic language that Krippendorf (1997) refers to. Here, machine-generated spoken and written language becomes the means of providing content and creating service value for users. The *Design in Tech Report 2018* (Maeda, 2018) also suggests that conversational design is becoming one of the key areas in computational design. The Institute of Electrical and Electronics Engineers (IEEE, Global Initiative on Ethics of Autonomous and Intelligent Systems, 2017) also points out the relevance of the design, distribution and usage of AI-enabled systems in their standard for 'ethically aligned design' for autonomous and intelligent systems.

Through its application in everyday products and services, the visibility and awareness of AI have grown in society in recent years (Kile, 2013). Although AI often resides in the invisible backend systems, as one category of AI-enabled services, AI assistants are visible for users as a service channel. Divided into the two modalities of text-based interaction and voice interaction, AI assistants can take the forms, for example, of chatbots and voice assistants like Apple's Siri, Microsoft's Cortana, Amazon's Alexa or Google Assistant. In addition to the rise of AI-enabled interfaces in the consumer market, the topic of AI assistants has been increasingly addressed in academic research in different fields.

Recently, the research discourse focussed on AI assistants has shifted from the technical feasibility (Chen, Yu, & Fong, 2018; Yan & Zhao, 2018) and architecture (Hauswald et al., 2016) towards more value-oriented topics. While AI assistants introduce a shift of service interactions from graphical user interfaces (UIs) towards conversational interactions (Allen et al., 2001) and natural language, the research investigates the realm of assistant performance as it is connected to the real customer needs (Brandtzaeg & Følstad, 2018). To learn more about the acceptance of the new interaction form, research has been conducted to elucidate how AI assistants are perceived by human beings (Harris, 2004; Loi, 2018; Zamora, 2017).

Studies on the individual elements of AI assistants, such as character design (Arafa & Mamdani, 2000) and the representation of emotions, empathy (Shi, Yan, Ma, Lou, & Cao, 2018; Vögel et al., 2018; Yang, Ma, & Fung, 2017) and social awareness (Zhao, Sinha, Black, & Cassell, 2016), support the formation of a comprehensive understanding on the user experience with AI assistants (Moussawi, 2018). As AI assistants function through digital channels, it is easy to involve the user in early testing and feedback loops. The technical setup and widely available tools for creating AI assistants encourage the co-creation of solutions with users (Lee, Lee, & Lee, 2017). Beyond the design of functionality, content and representation, the creation of AI assistants also requires ethical considerations (Schlesinger, O'Hara, & Taylor, 2018) and reflection on their social impact (Følstad et al., 2018).

Explorations on design approaches for AI assistants have been presented in previous research and guidelines from various perspectives have been created, from the design (Shevat, 2017) and practical implementation of chatbots (Janarthanam, 2017) to the design of voice user interfaces (VUIs; Cohen, Giangola, & Balogh, 2004; Pearl, 2016). Previous research has also suggested solutions for specific design phases, such as ideation and prototyping (Moussawi, 2018) and introduced overall design principles (Chefitz, Austin-Breneman, & Melville, 2018) and strategies for examining the effects of the design solutions in AI assistants (Jain, Kumar, Kota, & Patel, 2018).

Based on systematic literature research, this paper discusses AI assistants as a form of AI application. The authors consider the implications that the use of AI brings to service design practice. We draw special attention to the current application of AI in services, phases of the service design process with AI-enabled services and work of a service designer. This research responds to the research gap and need to produce new knowledge about the changes AI brings for the practise of service design. It asks the following research question: What are the implications of the change AI brings to the practice of service design?

Theoretical Background

Service Design: History, Process and Activities

Service design is an interdisciplinary field with the goal of providing a comprehensive understanding of the challenges it focusses on, whether they are systems, products, processes or services (Stickdorn, Hormess, Lawrence, & Schneider, 2017). Starting with a human-centric view, service designers aim to build understanding and engagement with all the actors connected to a service system to find the real needs and expectations that should be addressed in the design process and solution (Buchanan, 2001; Miettinen & Koivisto, 2009). As service systems are varied, with multiple layers of complexity depending on the context, service designers aim to make the overall system visible and perceivable so that it can be addressed and taken

up in the development of new solutions (Patrício, Fisk, Falcão e Cunha, & Constantine, 2011). Through co-creation and the engagement of key stakeholders and users, service design facilitates collaboration and innovation (Steen, Manschot, & De Koning, 2011).

Although service design is still a young academic discipline and just recently evolving in industry, the changing interdependency between the role of a service designer and the application of service design practices is affecting its disciplinary understanding. Until now, service design practices have mainly been applied by professional service designers. After the rise of service design in industry and beyond, which has resulted in the growth of agencies in the intersection of service design and business (Maeda, 2018), designing services no longer solely belongs to service designers (Sangiorgi & Prendeville, 2017). With similar tendencies in design research, the concept of silent design, stated by Gorb and Dumas (1987) in the 1980s, needs to be considered for today's and tomorrow's understandings of service design. Gorb and Dumas (2011, p. 56) point out that products, services and systems are designed by so-called silent designers, meaning 'by individuals who are not called designers and would not consider themselves to be designers'. Especially in the adoption of service design in industry, where our case studies have been conducted, the role and practices of service design are still fragmented and blurred. This suggests the need for research at the intersection of service design and industry.

Some researchers already claim that the role of designers is becoming more diverse (Polaine, Løvlie, & Reason, 2013; Stickdorn, Hormess, Lawrence, & Schneider, 2018; Tan, 2012; Yee, 2013). Next to becoming a specialist in service design methods, tools and practices, the role of a service designer in industry is often associated with both the management and facilitation of projects (Miettinen, 2016; Minder, 2019) and the collaborative orchestration of different human perspectives in the design process of services.

Although embedding technologies and digital channels in service solutions is not new to service design (Rytilahti, Rontti, & Miettinen, 2015), AI-enabled services are bringing a new element to the design process via new forms of communication between humans and machines. However, with the new type of service channels that AI-enabled services bring to the market, the delivery of services needs to be rethought. On the one hand, the service systems are becoming broader, with additional data sources and connections to service networks. On the other, the provided service content and interaction through the voice or chat interface should remain intuitive and approachable. When content delivery no longer depends on one type of interface, a broader understanding of service systems is needed to successfully place interfaces to meet users' expectations and needs. This is where service design can bring knowledge and inform the ways of working (Følstad & Brandtzæg, 2017) for creating AI-enabled services, such as AI assistants.

AI: History, Forms and Application

Although AI has only become more known among consumers in the past decade, the development of AI technology had already begun in the 1950s in the field of computer science (Lungarella, Iida, Bongard, & Pfeifer, 2007). The aim of AI is developing technology and machines that can perform intelligent tasks that otherwise only humans would be able to do, such as making predictions, recognising patterns in data and behaviour, processing and producing natural language and carrying out optimisation and automation (Smith & Neupane, 2018). The advancement of technology, access to increased computer power and large amount of available data have made it possible to use AI in more meaningful ways in consumer products and services (McCarthy, 2017).

AI is a large field that can be divided into two main sub-areas, which are as follows: machine learning (ML) and deep learning (DL). ML employs algorithms that learn from data to carry out actions, such as predictions or decisions, and its performance improves over time as it accesses more data. DL has higher complexity in its systems; for instance, it can include neural networks that are employed for building algorithms that can perform tasks independently. Instead of writing code, data are fed to the generic algorithm, which then builds a logic based on the data (Russell & Norvig, 2016).

In the context of services, the application of AI can be divided between the front and back ends of a service. In the case of the back end, the actions occur behind the scenes, when, for example, ML and DL provide tools for analysis, prediction and optimisation, automation of mundane tasks and processes, personalising content and forming a loop of continuous learning and improvement. In the service front end, AI is commonly applied through NLP, which enables human–machine interaction, for example, as an intelligent assistant. In previous literature, intelligent assistants that utilise AI skills to provide service content and functions are mainly described according to their interaction forms. Assistants using text-based interfaces are defined as chatbots

(Paikari & van der Hoek, 2018), while assistants using voice can be characterised as VUIs (Cohen et al., 2004). In this article, the term 'AI assistants' is used for both chatbots and VUIs.

Broadly defined, AI assistants are computational systems that utilise natural language (Shawar & Atwell, 2007) to understand the input from users, either as written text or voice, and perform tasks based on the recognised intents of the user. The front end of an AI assistant, beyond the text or voice interface proper, is built through a character with the definition of personality, tone of voice and background story. In the context of digital customer services, an AI assistant can be considered a new form of customer interaction channel. Due to their rather wide appearance in current services, this paper considers AI assistants as an example for applying AI in services.

Research Approach

The presented inquiry was conducted as a practice-based study in industry between 2017 and 2018. The dataset consists of five use cases accompanied by seven expert interviews. As the use cases represent the application of AI in the form of AI assistants, the expert interviews contribute individual perspectives and future tendencies of AI in service design, as well as the status quo of AI application in design agencies. The cases and interviews complement each other to elucidate the connection between service design and the use of AI in the design and development of AI-enabled services. The research analysis has been done using a qualitative mapping methodology in three coding cycles.

Research Data

The five case studies result from one corporation under different functions and brands in Germany. They have been documented through project deliverables, reports, design outcomes and participant observations from one author acting as a design researcher in the firm. The length and scope of the projects vary, as does the composition of the project teams. The projects have been chosen to complement each other with different priority themes, project lengths and provided insights into the service design process.

Table 1: Description of Case Studies

Case Study	*Topic*	*Pursued Customer Value*	*Design Phases*	*Service Interface*	*Deliverable*
1	Service sales	Access to information, connection to retailer	Content definition, character design, conversation flows, UI design, prototyping, testing and implementation	Chatbot on website	Customer-facing pilot
2	Customer support	Find information quickly and easily	Content definition, conversation flows	Chatbot on website	Customer-facing pilot
3	Mobility services	Find the right service solution for current need and situation	Content definition, UI design, prototyping	Smartphone application	Prototype
4	Product support	Find information quickly and easily	Content definition, conversation flows, UI design	Chatbot on smartphone	Proof of concept
5	Service orchestration	Proactive personalised services	Content definition, conversation flows, UI design, prototyping	Smartphone application	Prototype

The case study approach was identified to be the most adequate research strategy, as it allows for investigating 'a contemporary phenomenon within its real-life context, when the boundaries between the phenomenon and the context are not evident' (Yin, 2011, p. 23). A purposeful sample of cases was selected to provide material rich in information and diversity, focussing on the role of AI in (service) design processes of innovation projects. The selection criteria were as follows:

- Specific application forms of AI (e.g. AI assistants, chatbots, VUIs);
- The inclusion of designers, AI experts and data scientists in the process;
- The flexible role of the designer in the project; and
- The project representing different group sizes and applications of design methods.

The semi-structured expert interviews aimed to gather opinions, experiences and reflections on service design and AI through predefined themes (Flick, 2009). All seven experts were selected due to their knowledge level at the intersection of design and AI and their work experience of more than 10 years at a design agency. The interviewees act as designers, data scientists and directors in Germany, Finland or the United States (Table 2). The interviews were conducted face to face except for one, which was conducted via Skype; each interview lasted 60 minutes, and it was recorded and later transcribed word by word.

Table 2: List of Interviewees

Interviewee	*Role*	*Country*
1	Chief digital officer	Finland
2	Data science lead	Finland
3	Creative director	Finland
4	Service architect	Finland
5	Senior consultant	Germany
6	Service designer	Germany
7	Senior service designer	United States

Analysis Methodology

The research analysis consisted of a three-stage (visual) mapping process inspired by different coding stages (Saldaña & Omasta, 2017) and pattern-matching approach introduced by Yin (2011). The authors collaboratively applied open coding for the first cycle, followed by versus coding in the second coding cycle to define the occurring fields of tension. This was done using the Atlas.ti program. The last cycle defined thematic clustering of the main themes and formed implications around the research questions; this was done non-digitally. Both datasets were approached using the following questions for the first and second cycles:

First cycle:

- How is the role of a service designer described and perceived by the interviewees and in the projects?
- How do the interviewees perceive AI? How is it connected to their daily work?
- What are the future opportunities and challenges when involving AI in service design?

Second cycle:

- Where is AI changing the existing practices in the design process?
- Where is AI adding something new?
- How is the add-on affecting its direct context in projects and beyond?

From the third coding cycle, three main topic areas emerged, which were as follows:

- The application of AI in service design;
- The effect of AI in the service design process; and
- The role of a service designer within an AI-inclusive service design process.

Empirical Findings for Revealing the Role of AI in Service Design

The analysis of research data revealed three main topic areas of insight, which are as follows: the application of AI in service design, effect of AI in the service design process and role of the service designer in the AI-inclusive service design process. The empirical findings are discussed under these three topics in the following sections, combining the results from expert interviews and use cases. The interviewees are referenced in the text by their identifying numbers (see Table 2).

The Application of AI in Service Design

The analysis demonstrated that the application of AI in service design is still in its early stages. In 2018, many application forms of AI, including AI assistants, were still at the peak of inflated expectations in terms of Gartner's hype cycle (Panetta, 2018). This also affects consumers' expectations of the applications of AI in everyday products and services. Behind all the hype, often, the real results are not yet appropriately addressing the user's expectations and real needs (2). Design agencies investing in AI first explore where AI adds value to the service design process. While doing so, they are also aware of the challenges and gaps between the status quo and the effective use of AI (3). Aspects like access to good quality data and useful technological tools are some of the challenges faced when considering AI in designing services. So far, the application of AI has mainly been decided case by case according to the goals of the service, user needs, available resources, knowledge, tools and data. None of the interviewees mention an already established process that they can conduct, iterate and adjust when designing AI-enabled services.

Concerning the potential value AI could add to service design, the dataset shows consistent results. The interviewees claim that using AI in service design should start from the purpose and user needs instead of a technology-first attitude: *'Not every possibility is a good possibility, and it needs to be evaluated before it is established in a service. We shouldn't implement AI in a service simply because we can'* (5). When AI is taken as a part of a service design solution, it is important to manage the user expectations and remain realistic about what can be done with good quality (4). As interviewee 6 noted, *'An AI-enabled service has to be based on a business model. It has to have an economic purpose. Then there has to be user need, and of course, it has to be technically feasible'.*

According to interviewee 4, currently, AI is mostly used in the back end of services. For example, AI is doing analytics and providing quantitative information about the use of a service. This type of information can be used, for example, in the personalisation of service content by proactively recognising the needs and behavioural tendencies of users. Such self-learning systems are becoming more common and increase the accuracy and usefulness of the content to users without engaging AI in the service interaction (5). By collecting and analysing quantitative data, AI can fill the knowledge gap on user behaviour that otherwise would only be learned about through qualitative data, such as interviews and user studies (1,4).

In the front end of services, the current application of NLP has shown most potential in the form of AI assistants by providing new forms of service channels through voice and text. Herein, AI technology is already advanced enough to prove its benefit in language-based interfaces. However, according to the interviewees, the crucial aspect of the frontend application is still its situational adaptation. The fit of technology to the changing human behaviour depends on the time and context of usage. Through proactive data analysis, detection of user behaviour and profiles and prediction of user actions, AI can reveal the user behaviour patterns and adjust the service output accordingly (4).

The interviewees expect that, in the future, AI will take a bigger role as support for the service design process proper through data analysis, as well as in the form of new tools for automating some of the tasks using generative models. In service interactions, AI already offers possibilities for improving human–machine interaction, but the interviewees still draw on the importance of real human-to-human interaction in the services. They point out that, in cases that are either urgent or complex, users still often prefer interacting directly with a human service agent. According to the interviewees, it is not really a question of either human or machine, but instead, providing multichannel services where both possibilities are available.

The Effect of AI in the Service Design Process

The service design process model introduced in this research draws on the analysis from the use cases and is reflected through the interview results (Figure 1). The use cases showed regular patterns in two areas, namely, in terms of the activities performed in creating AI assistants and regarding the definition of the service scope.

The double diamond model was used as a reference for pattern matching. It was observed that the four common phases of 'discover', 'define', 'design' and 'develop' are insufficient for communicating the main activities in designing AI assistants. Jylkäs and Borek (in press) propose a seven-phase model for the design of AI assistants. In this paper, the authors extend the process to 10 phases identified through the present analysis.

The 10 process phases—'discover', 'define', 'ideate', 'design', 'prototype', test', 'develop', 'implement', 'operate' and 'scale'—form five diamonds representing the diverging and converging thinking inspired by the original double diamond model (Figure 1). Between each pair of diamonds, a deliverable is produced as a base for the next phase. Although the service design process is rather iterative and can be made to go back to a previous phase at any time, a general structure for the process phases can be identified through the analysis of use cases. In addition to looking at the usual targets of service design in the service content and service front end, the model includes the perspectives of business and technology as essential parts of the process.

Using AI in a service design process also requires knowledge and expertise about AI in the team (4). The involvement of data engineers (DE), data scientists (DS) and information technology experts (IT), such as developers, is also shown in the model in each of the process phases. Since many DS, DE and IT teams are working on an agile workflow (Abrahamsson, Salo, Ronkainen, & Warsta, 2017) that supports short cycles and iteration, having shorter cycles in the service design process also makes the connection to other organisational processes easier.

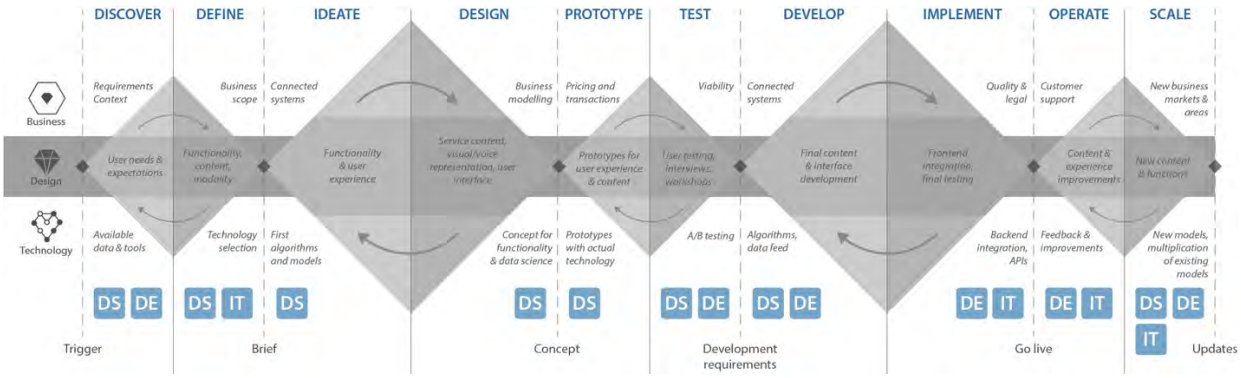

Figure 1: Service design process for AI-enabled services. Created by T. Jylkäs.

Discover and Define

The phase of discovery consists of understanding the customer needs and expectations, exploring the technical possibilities for realising the service, discovering the available data sources for training the service and understanding the business requirements and context. Here, AI provides a way of collecting large amounts of quantitative data and analysing them rapidly (1). Analysis of the quantitative data through algorithms gives a new channel to the service design process to obtain user information without human bias. Through consistent analysis, AI can reveal the needs and expectations of users and find patterns and connections that are otherwise difficult to identify from a large amount of data (2). Data mining and data analytics can also be used for scouting high-level trends in the beginning of the process to give an overall direction and validation for the design challenge.

In the definition phase, the scope of the service is defined in terms of functionality, service content and interface requirements. It also includes the selection of technological tools and the set of data used for designing and developing the service. In the use of AI, it is important that a human understanding is combined with the technological approach to ensure that the results will fit the user expectations, fulfil the purpose of

the service and create concrete value (2,4,5). According to the interviewees, in the beginning of the process, the produced ideas may often become too broad, fuzzy and unfocused to be realised due to still existing technical or data-related limitations. On such an occasion, dividing the ideas into a long-term plan and smaller short-term solutions is helpful. Focussing on solutions with a narrow scope and lower complexity first will lay the foundation for the future solution by building on knowledge, collecting data and improving the solution over time.

Ideate and Design

In the ideation phase, the functionality's scope is converted to a list of concrete actions and tasks that the service carries out. The separation of 'ideation' from 'design' in this model lies in the recognition that ideation is still open for exploration and generation of a large number of ideas, while the design phase focusses the work into creating design elements that fit into the defined design brief. In the design phase, AI may have a greater role in automating mundane tasks, such as translating hand-drawn sketches into interface designs or analysing existing services and data to give suggestions on design decisions (2,3) in the future. A common trait for the design of AI-enabled services is the inclusion of technology in the process in an early phase. During the ideation and design phases, first versions of algorithms are already generated to give an idea of the possibilities and boundaries of the solution. The concept description resulting after the design phase includes a technical description and requirements that can be used as a guide in the prototyping phase.

Prototype and Test

Prototypes have an essential role in creating AI-enabled services. They not only help in determining the technical possibilities, but they also display the functionality and value of the service (5,6) in a concrete form. Although the tasks and actions where AI is involved may be intangible and complex, concrete prototypes make it possible to present and test the service features with users and stakeholders. The test phase also reveals the gaps that may have been overlooked during earlier phases in terms of the identified user intentions. Using real technology already in the prototyping phase differentiates the approach from today's service design processes, where prototypes represent the look and feel of an interface without the real functionality behind it. The use of real technology provides an emotional experience about how AI is involved in the final service interaction.

Develop and Implement

The development phase focusses on the realisation of the final version of the service at a level of quality acceptable for go-live and usable for users. In this phase, the service content and interface are finalised, and the final algorithms are developed. The development phase continues as implementation. Although these two phases often occur in parallel, they have been separated in the process model to illustrate the importance of the role of implementation in the process. As an AI-enabled service like an AI assistant often combines several service functions and orchestrates a large range of content for the user, it may be connected to many existing services and platforms in the backend system. Therefore, the implementation and integration effort may be extensive and may include the official approvals for quality and legal matters set by the business context.

Operate and Scale

When the implementation is completed, the service can go live, and the phase of operation starts. AI assistant projects typically start with a small scope of functions and content. They collect feedback using qualitative and quantitative data to improve the service over time. Establishing a continuous learning and improvement loop is part of the operational effort. The data collected from user interactions serve as a valuable source of information for the service design process. For instance, they can be used to identify possible areas for scaling the service functions, which becomes relevant after the first version is functioning steadily. The team can consider adding further functionality to the service, or alternatively, adding further languages and market areas to increase the service coverage.

The Role of a Service Designer in an AI-inclusive Service Design Process

AI evolves the changing role of a service designer in two respects. It nudges the application of technology in the service interface and to the service design process; in addition, the roles and tasks related to the process face some changes when AI-enabled services are co-designed. Experts like DS, DE and IT provide technical knowledge to the process. A substance expert from a business unit contributes knowledge about business requirements. A service designer remains the voice of the user and translates those requirements into the

design solutions (4). In an AI-inclusive service design process, the tasks of a service designer may include user research, ideation, creating design concepts, UI and user experience (UX) design, prototyping, and testing the solutions with users. In the case of designing AI assistants, language plays a relevant role in the communication between the user and service. Thus, the tasks of screenwriting and copywriting may also partially be taken by a service designer.

In the researched use cases, the team constructs vary, but all the cases are united through the role of a service designer as an interdisciplinary facilitator. Interviewee 6 states, '[B]eing a service designer means that you always have to understand the requirements and the possibilities that are there, and then you have to include them in designing a solution'. Interviewee 5 would 'see the role of a service designer to consider the perspective of [the] customer and business, and to translate them into something tangible'. Collecting the requirements, needs and possibilities of users, business and technology positions the service designer as the connection point among team members and stakeholders. This may also be one reason why, in several use cases, the service designer also had a role as an overall project manager.

The role of technology is significant in designing AI-enabled services. This leads to an earlier inclusion of technology in the process, taking different roles throughout; further, it requires a certain level of understanding about the technology among all the team members, including the service designer. A facilitating service designer should also have basic knowledge about the AI technology used in the service to succeed in meeting all the requirements and needs through a solution that is realistic to develop and implement. This allows a service designer to interpret the technical possibilities and boundaries in the design solution, as well as to communicate user requirements to the technical team members appropriately.

According to the interviewees, one of the most prominent and challenging aspects of embedding AI in the work of service designers is the possibility of including quantitative data and numeric tools in a meaningful way in the design toolbox. Through AI, service designers access larger amounts of data in an efficient way when parts of the analysis are done by a machine. The automation of data collection and analysis is an asset that can support the design decisions by adding a second opinion next to the qualitatively gathered insights. The combination of qualitative and quantitative data may also affect how the process of designing services is structured in the future, especially in terms of forming the understanding around the design challenge, user needs and affecting circumstances around the service.

Although AI can provide information and suggestions for the direction of the design work, it lacks the ability to interpret the information. Therefore, the service designer retains the role of a sensemaker (Weick, 1995; 2). Herein, the numeric methods from AI are combined with the creative reasoning of the designer (3). With access to information from various sources, in a sense, service designers become curators that utilise the results of computational models to form design outcomes that fulfil the user needs, fit into technical boundaries and create business value.

In addition to the previous aspect of information, automation through AI may also take over some of the tasks that otherwise would be done by a (service) designer. This may concern, for example, the tasks in UI and UX design when ideas are translated into prototypes and final designs. The reduced amount of tasks for designers enables them to focus on the more complex questions around the service, such as its purpose, value creation or ethical implications (3). While everything becomes measurable through AI, it makes standardisation, optimisation and automation of services easier, leaving out the frictions that make the products and services unique. The differences that define the identity of the service are those where the service designers' informed intuition is needed, both today and in the future.

Discussion

This paper discussed several aspects of service design for AI-enabled services. It introduced both the role of service designer and the service design process proper. It is already clear that the context of AI changes the paradigm in service design; however, this needs further research. The introduction of AI changes the role of the service designer, facilitating more diverse skills and capacities throughout the design process. AI-enabled services demand a service designer's broader technological orientation and ability to adapt.

AI-enabled services add a concrete technological design perspective to the service design process, differentiating it from the typical frontend-oriented processes (Miettinen & Koivisto, 2009; Sanders & Stappers, 2008). Further, the question of service scalability needs to be addressed in a systematic way. The research indicates that there is a need for more study on how service design can contribute to the scalability

of not only manufacturing and product service systems (Koren, Wang, & Gu, 2017) but also AI-enabled service delivery systems.

Since the research is drawn from one type of application of AI, namely AI assistants, further research needs to validate the findings in various application forms and design processes of AI-enabled services. As the number of real-life use cases and expertise for the use of service design expand, the knowledge base for the use of service design in the AI context increases. The limitation of this study is constructed through the selection of use cases and number of interviews. As the body of data increases, the role of the service designer and the service design process model will become more precise. Yet, the research already shows the first implications of possible changes AI may bring to the practice of service designers and the discipline of service design through new ways of working. In this way, this paper already responds to the need to know more about AI in service design.

Conclusions

The research introduced three main areas in service design that are affected by the involvement of AI—the application of AI in service design, effect of AI in the service design process and role of the designer in an AI-inclusive service design process. Although the application of AI technology is in the early stages in practice, the research shows the two following main areas of current application: in the back end of service as a new channel for quantitative data supporting the analysis and in the front end of services as a language-based interface for users in the form of AI assistants. In the future, the automation of tasks, standardisation, personalisation and support for decision making may bring further value out of AI to the service design field.

The change AI brings to the service design process comes through the use of technology early in the design phases, starting from data collection and analysis, exploration of algorithms in the ideation and design phases and prototyping and testing the solution with real technology. The inclusion of AI in the service design process implies several short iterations that can easily be connected to the agile workflow of DS, DE and IT.

The changing role of a service designer comes through the access to larger amounts of information combining qualitative and quantitative data. This allows the designer to act as a curator of content, making sense of the information and translating it into a design solution that simultaneously meets the user needs, business requirements and technical possibilities. The research analysis has shown that the service designer remains a facilitator in the design and development of AI-enabled services, requiring a holistic understanding of all fields connected to the service design process.

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