

Changing Things: Innovation through Design Philosophy

REDSTRÖM Johan and WILTSE Heather*

Umeå Institute of Design, Umeå University, Sweden

*heather.wiltse@umu.se

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



This work is licensed under a [Creative Commons Attribution-NonCommercial-Share Alike 4.0 International License](https://creativecommons.org/licenses/by-nc-sa/4.0/).

<https://creativecommons.org/licenses/by-nc-sa/4.0/>

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 tuned¹ 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 objectives² 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 things³, 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 *instabilities* – 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.

Acknowledgements

We would like to thank Sabrina Hauser for detailed comments on an earlier version of this paper, and the anonymous reviewers for their helpful comments. This work was funded in part by Marianne and Marcus Wallenberg Foundation project grant 2017.0058.

References

Akmal, H., & Coulton, P. (2018). Using Heterotopias to Characterise Interactions in Physical/Digital Spaces. In *Proceedings of Design Research Society 2018: Catalyst* (pp. 270–279).

- Alaimo, C., & Kallinikos, J. (2017). Computing the everyday: Social media as data platforms. *The Information Society*, 33(4), 175–191. <http://doi.org/10.1080/01972243.2017.1318327>
- Coyne, R. (2010). *The Tuning of Place: Sociable Spaces and Pervasive Digital Media*. Cambridge, Massachusetts: The MIT Press.
- Deleuze, G., & Guattari, F. E. L. (1987). *A Thousand Plateaus: Capitalism and Schizophrenia*. (B. Massumi, Trans.). Minneapolis and London: University of Minnesota Press.
- Dubberly, H. (2017). Connecting Things: Broadening Design to Include Systems, Platforms, and Product-Service Ecologies. In L. Atzmon and P. Boradkar (Eds.) *Encountering Things: Design and Theories of Things* (pp. 153.165). London: Bloomsbury.
- Finn, E. (2017). *What Algorithms Want: Imagination in the Age of Computing*. Cambridge, Massachusetts and London, England: The MIT Press.
- Forlizzi, J. (2007). The product ecology: Understanding social product use and supporting design culture. *International Journal of Design*, 2(1), 11-20.
- Giaccardi, E., Cila, N., Speed, C., & Caldwell, M. (2016). Thing Ethnography: Doing Design Research with Non-Humans. In *Proceedings of the 2016 ACM Conference on Designing Interactive Systems (DIS '16)*. ACM, New York, NY, USA, 377-387. DOI: <https://doi.org/10.1145/2901790.2901905>
- Golumbia, D. (2009). *The Cultural Logic of Computation*. Cambridge, Massachusetts and London, England: Harvard University Press.
- Hauser, S., Oogjes, D., Wakkary, R. & Verbeek, P-P. (2018). An Annotated Portfolio on Doing Postphenomenology Through Research Products. In *Proceedings of the 2018 Designing Interactive Systems Conference (DIS '18)*. ACM, New York, NY, USA, 459-471. <https://doi.org/10.1145/3196709.3196745>
- Ihde, D. (1990). *Technology and the Lifeworld: From Garden to Earth*. Bloomington: Indiana University Press.
- Janlert, L.-E., & Stolterman, E. (2017). *Things That Keep Us Busy: The Elements of Interaction*. Cambridge, MA: The MIT Press.
- Kallinikos, J. (2004). Farewell to Constructivism: Technology and Context-Embedded Action. In C. Avgerou, C. Ciborra, & F. Land (Eds.), *The Social Study of Information and Communication Technology* (pp. 140–161). Oxford.
- Lindley, J., Coulton, P., & Akmal, H. (2018). Turning Philosophy with a Speculative Lathe: Object-Oriented Ontology, Carpentry, and Design Fiction. In *Proceedings of Design Research Society 2018: Catalyst* (pp. 230–244).
- Nelson, H. G., & Stolterman, E. (2012). *The Design Way: Intentional Change in an Unpredictable World* (second). Cambridge, Massachusetts; London, England: The MIT Press.
- Pierce, J., & DiSalvo, C. 2017. “Dark Clouds, lo&#!+, and [Crystal Ball Emoji]: Projecting Network Anxieties with Alternative Design Metaphors.” In *Proceedings of the 2017 Conference on Designing Interactive Systems (DIS '17)*. ACM, New York, NY, USA, 1383-1393.
- Plantin, J.-C., Lagoze, C., Edwards, P. N., & Sandvig, C. (2017). Infrastructure studies meet platform studies in the age of Google and Facebook. *New Media & Society*, 20(1), 293–310. <http://doi.org/10.1177/1461444816661553>
- Raley, R. (2013). Dataveillance and countervailance. In L. Gitelman (Ed.), *“Raw data” is an oxymoron* (pp. 121–145). Cambridge, Massachusetts; London, England: The MIT Press.
- Redström, J. and Wiltse, H. (2015a). Press play: Acts of defining (in) fluid assemblages. In *Proceedings of Nordes 2015: Design Ecologies*. <http://www.nordes.org/opj/index.php/n13/article/view/432/407>
- Redström, J. and Wiltse, H. (2015b). On the multi-instabilities of assembled things. Paper presented at 4S 2015, the annual meeting of the Society for Social Studies of Science in the panel session Postphenomenological Research 3: Theoretical Perspectives. <http://dx.doi.org/10.13140/RG.2.1.2649.1924>
- Redström, J. and Wiltse, H. (2019). *Changing Things: The Future of Objects in a Digital World*. London: Bloomsbury.

- Srnicek, N. (2017a). *Platform Capitalism*. Cambridge, UK and Malden, MA, USA: Polity.
- Srnicek, N. (2017b). The challenges of platform capitalism: Understanding the logic of a new business model. *Juncture*, 23(4), 254–257. <http://doi.org/10.1111/newe.12023>
- Stolterman, E., Jung, H., Ryan, W., & Siegel, M. A. (2013). Device Landscapes: A New Challenge to Interaction Design and HCI Research. *Archives of Design Research* 26(2), 7–33.
- The Economist. (2017). The world's most valuable resource is no longer oil, but data. Retrieved from <https://www.economist.com/news/leaders/21721656-data-economy-demands-new-approach-antitrust-rules-worlds-most-valuable-resource>
- Valentino-DeVries, J., Singer, N., Keller, M. H., & Krolik, A. (2018, December 10). Your Apps Know Where You Were Last Night, and They're Not Keeping It Secret. *The New York Times*. Retrieved from <https://nyti.ms/2G6l9XC>
- Wakkary, R., Oogjes, D., Hauser, S., Lin, H., Cao, C., Ma, L., & Duel, T. (2017). Morse Things: A Design Inquiry into the Gap Between Things and Us. In *Proceedings of the 2017 Conference on Designing Interactive Systems (DIS '17)*. ACM, New York, NY, USA, 503-514. DOI: <https://doi.org/10.1145/3064663.3064734>
- Wakkary, R., Oogjes, D., Lin, H. W. J., & Hauser, S. (2018). "Philosophers Living with the Tilting Bowl. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (CHI '18)*. ACM, New York, NY, USA. <https://doi.org/10.1145/3173574.3173668>
- Wiltse, H. (2014). Unpacking Digital Material Mediation. *Techne: Research in Philosophy and Technology*, 18(3), 154–182. <http://doi.org/10.5840/techne201411322>
- Wiltse, H. (2017). Mediating (Infra)structures: Technology, Media, Environment. In Y. Van Den Eede, S. O'Neal Irwin, & G. Wellner (Eds.), *Postphenomenology and Media: Essays on Human-Media-World Relations* (pp. 3-25). Lanham, Maryland: Lexington Books.
- Wu, T. (2016). *The Attention Merchants*. New York: Knopf.
- Zuboff, S. (2015). Big other: surveillance capitalism and the prospects of an information civilization. *Journal of Information Technology*, 30(1), 75–89. <http://doi.org/10.1057/jit.2015.5>
- Zuboff, S. (2016, March 5). Google as a Fortune Teller: The Secrets of Surveillance Capitalism. *Frankfurter Allgemeine Zeitung*. <http://www.faz.net/aktuell/feuilleton/debatten/the-digital-debate/shoshana-zuboff-secrets-of-surveillance-capitalism-14103616.html>
- Zuboff, S. (2019). *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*. London: Profile Books.