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Responsibility in design: applying the philosophy of Gilbert Simondon

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Abstract: The notion of technical mentality and transductive reasoning described by the French philosopher Gilbert Simondon is applied on a concrete design case in order to investigate responsibility and design. The design case relates to the development of a portable artificial kidney. The historic invention of the artificial kidney is woven into the philosophy of Simondon in order to mobilize his work. For designers, the risk of reduction is at stake when applying the technical mentality to domains beyond the technical such as the psycho-social. This risk can be avoided by transductive reasoning, i.e. reasoning by means of analogy, but this is not sufficient as additional research is needed on responsibility and taking action. Correlating machines remains a human responsibility. Designers cannot hide behind the borders of their task or project when it comes to responsibility. Suggestions for further research are shared a.o. on aesthetics, ways of reasoning in design and design education.

Keywords: Responsibility, Gilbert Simondon, Design, Transduction, Way of Reasoning

Introduction

As a professional in the field of design I have been working on a design case where I had the opportunity to combine commercial work with a more inquisitive stance as a researcher. While working for a client on an issue with sound coming from a medical device, I realized that the reasoning I used to come to an advice for the client was hampered. What I suggested felt contradictory to the routines we thought would benefit the patient's relation with the machine.

After consulting team members from our design team and having raised the issue with the client, I still was dissatisfied. This paper is a search for how we can think responsibility of



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designers. Responsibility is not well thought of in terms of methodology or approaches.¹ The approach is not so much the search for a new method, but rather raise informed questions about responsibility and design from a philosophy rejecting the whole idea of general methods or principles. How do a specific kind of mentality and a way of reasoning relate to the responsibility of designers?

Why try to apply the philosophy of Simondon on design?

The contribution of this paper lies in the application of the philosophy of the late French philosopher Gilbert Simondon (1924-1989). His philosophy has had a strong influence in other (scientific) fields and has been applied in performative arts a.o.²

This paper also aims for finding a voice how to move away from a tradition of moral reflection during design work or moral reflection after design work has been finished. Simondon is ethical in his approach right from the beginning and so is the application of his philosophy.³ Technical objects, nature and the human race should be investigated in the same manner with a specific kind of attention.

His philosophy gains renewed attention, but, as of yet, is hardly used to rethink design approaches. Trying to bring his philosophy into operation within design practice is not an easy task. His work has hardly been translated from French into English making it difficult for me, let alone that Simondon rejects any overarching method or principle in his philosophy making it difficult to work towards a design method.

The paper called "Technical Mentality" has been translated into English recently (Simondon, 2009b). His paper serves as a crystallization point in my attempt to apply the philosophy of Simondon and let informed questions emerge regarding responsibility and design at the end of this paper. Before we 'immerse ourselves' in the philosophy of Simondon, some approaches towards responsibility and design are shared. Then the design case is introduced including some moral reflections. Having raised the research question in that reflection, the philosophy of Simondon is mobilized by means of a historic invention. As Simondon is using the successive development of technical objects, it makes sense to use a historical case.

After being informed by aspects of his philosophy, I will come back to the design case again where I try to apply his philosophy. This leads to implications about the responsibility of designers and their way of reasoning.

I will conclude that the application of the philosophy of Simondon to the question of responsibility of designers is worthwhile and requires further research.

¹ I took this bold opinion from the recently established Delft Design for Values (DD4V) Institute website <http://www.design4values.org> ("Design for Values | Methodology for Design for Values," 2016).

² Gilbert Simondon has been picked up mostly by way of the French philosopher Gilles Deleuze. Implications and resonations are shared recently from the fields of philosophy, gender studies, new media and culture studies, sociology (cf. De Boever, Murray, Roffe, & Woodward, 2012). In performative arts Erin Manning works with the philosophy of Simondon (cf. Manning, 2013). In the field of technology management and economics e.g. Alexander Styhre is rethinking entrepreneurship elaborating on transduction (Styhre, 2008, 2010).

³ The author thanks Tom Coggins for bringing this point to the fore.

A limitation of this paper is that it focuses on a way of reasoning, or a mentality in terms of Simondon. Taking this mentality into account is necessary to research the responsibility of designers, but it is not sufficient. Actions that designers take are an inherent part of their responsibility and this aspect will be covered in future research of the author.

Gilbert Simondon's philosophical project has something to contribute to our understanding of design and responsibility. His philosophical project is ethical right from the beginning.¹ We cannot make grand generalisations to understand the world. We should approach the world as processes and our knowledge is not advanced enough yet to understand how we can relate to technical objects. Furthermore technical objects develop in order to have an equal relation with man in the end, rather than one being servant and the other being master (Combes, 2013, p. 60). Below, a more detailed discussion is shared aiming to convey what technical objects are in the philosophy of Simondon and how we can relate to them.

His philosophy has a very distinct vocabulary e.g. using concepts from thermodynamics, using own punctuation, and relying on French conjugation. Given the lack of integral translation, I'll explain a number of notions in more detail to clarify how I take his philosophy. But first, let us look into responsibility and design from an approach as a reflective practitioner.

Responsibility in design: examples of contemporary approaches

Understanding design practice from within & the issue of responsibility

As a response to Herbert Simon's positivist perspective on design, Donald Schön introduced a constructivist perspective in order to describe the practice of design from within (Schön, 1983, 1984). The issue of responsibility was left to reflective practitioners themselves, either as individuals or institutionalized in companies, engineering societies or design schools.^{2 3}

A number of approaches have been developed since and they could be categorized under the term 'early engagement' where professionals try to include and engage those affected by a new development, either in science or more applied as an innovation (Doorn, Schuurbiens, van de Poel, & Gorman, 2013). The approaches Doorn et al. collected 'have a normative element and aim at encouraging ethical reflection'. The normative element is a future goal to work towards to that is better than the existing situation: e.g. "better technology in a better society" (Doorn et al., 2013, p. 9). An inherent element of these approaches is to anticipate future events and take them into account in decision making and strategies for action (Doorn et al., 2013, p. 246).

Van Doorn et al. consider the approach 'Value Based Design' (VBD) as being part of an early engagement approach. The Delft University of Technology recently established an institute called 'Design for Values' that wants to explore VBD further. The founders indicate the

¹ The author thanks Tom Coggins for bringing this point to the fore.

² The author wants to thank Kees Dorst for clarifying this.

³ A.o. Findeli rethinks design education taking responsibility into account (Findeli, 2001).

reason why they established the institute: for ‘basic values, such as responsibility, there are hardly any dedicated design methods or tools’ (Design for Values Institute, 2016).¹ A first handbook has been published (Van den Hoven, Vermaas, & Van de Poel, 2015).

Based on a very limited overview, there are indications that there’s room for research on responsibility and design.

From constructivism to ‘inventivism’

It is likely that there hardly are methods in the realm of design and responsibility. Design practice is now explained from two philosophical paradigms: ‘positivism’ and ‘constructivism’ (cf. Dorst, 1997) and methods aiming for design and responsibility should ‘work out’ in both paradigms. The duality that comes along is hard to resolve.

Simondon’s philosophical project contributed not so much by adding a third paradigm or by replacing the two existing paradigms, but rather by trying to reconcile paradigms. Brian Massumi describes the shift Simondon made as one from ‘constructivism’ towards ‘inventivism’ (De Boever et al., 2012).²

Before “unpacking” inventivism, I will start in Schön’s tradition of the reflective practitioner raising some research questions within a real design case. Then I will introduce Simondon and mobilize his philosophy by means of a historic invention. Then we’ll get more informed back to the design case again to finalize with implications and conclusions.

Design case: Portable Artificial Kidney

Background

The design case below revolves around the early engagement of those affected by a new and innovative medical device. At the time we started I had no methodology selected deliberately except an implicit notion of ‘early involvement’. I will now introduce the case.

The Dutch Kidney Foundation (DKF) is a Netherlands based non-profit organisation aiming for a higher quality of life for people with lethal kidney failure. The foundation collaborates with strategic development partners by means of a social enterprise called NeoKidney.

NeoKidney was founded by the DKF and aims to introduce an innovative medical product into the market in a few years from now: the Portable Artificial Kidney (PAK).³ The PAK will be developed in close collaboration with two medical device development companies. It will be designed to enable patients to do blood purification (by dialysis) at home without direct supervision of a health care professional. This gives patients more freedom and flexibility and increases their life quality.

¹ See <http://www.design4values.org> including an extensive list of publications on this approach.

² Massumi continues: “a move that “seeks to think the natural processes involved in any and all constructions” (De Boever, Murray, & Roffe, 2009)

³ NeoKidney commissioned our assignment. NeoKidney is a development company founded by the Dutch Kidney Foundation. NeoKidney is also a social enterprise, initially funded by the Dutch Kidney Foundation. NeoKidney holds the intellectual property rights on new invention. After the PAK is licensed to a third party that will introduce the PAK in the market, profits will be reinvested in development activities (revolving fund).

The management team of NeoKidney realized early 2015 that they were coping with a number of medical, technical and regulatory hurdles, but that the people in need of the PAK were so far underrepresented in the innovation process. The management team decided to commission a small team of professionals to explore the demands and wishes of future users of the PAK, derive functional requirements for the machine and convey advice for future steps in the development process in appropriate ways.¹ The assignment was finalized in February 2016 and presently an additional assignment is being negotiated.

Together with three professionals I became part of a team that worked on the questions that were ultimately issued by the Dutch Kidney Foundation. We collaborated from the Netherlands based design agency Design Innovation Group. The team conducted contextual interviews, took pictures and filmed at some points 'in situ', made audio recordings and introduced a dummy to discuss the size and shape of the PAK. Based on the contextual interviews, the team synthesized future scenario's envisioning future use. We have discussed those scenario's with people involved e.g. patients, their partners, health care professionals, our client (Dutch Kidney Foundation), NeoKidney and the collaborating partner responsible for the systems engineering and prototyping.

Soon after the start I identified opportunities for research as an external PhD-candidate. After sharing a research interest, and coming to an informed consent with NeoKidney, the author worked on this assignment from a research perspective in addition to a commercial advisory perspective.

Design Case: the sound of the portable artificial kidney²

Contemporary artificial kidney equipment is large and needs permanent connections to electricity and water lines in order to function properly as a renal therapy. There are many innovations related to the development of the portable artificial kidney, but in the light of this paper it suffices to mention that NeoKidney aims for miniaturization of the machine and aims for the implementation of advanced algorithms to regulate hard- and software. A person needs to regulate the machine during therapy varying from turning it on, adjusting parameters like the duration of the dialysis and so forth. In a domestic context the person in need of treatment also has to respond to deviations from a normal dialysis session. Alarms may go off and ideally there is a partner present or an alarm centre monitors remotely, as some exceptional situations can be life-threatening. The PAK can be used at different times e.g. during a daytime treatment or during the night while sleeping.

While conducting interviews our team of four professionals saw a wide variety of how people organized their relation with their current dialysis machine. Some people were

¹ How to convey the advice was left open at the start of the assignment. Examples mentioned in the proposal were e.g. a short film or a report. Ultimately the team chose for a report, a poster and interactive presentations with a lot of room for discussion a.o. with the governance structure of NeoKidney including the commissioning management team, the personnel of the involved organisations, patients in need of renal therapy, their partners and care professionals like nurse practitioners and nephrologists.

² Besides sound the design case covered a lot of other topics, thirteen at least. These will not be shared here for reasons of confidentiality and brevity.

connected to the machine and seemed to ignore it until an alarm would go off. Others were, both during day- and night-time, peripherally aware of the machine's status, for instance because they knew by heart the sequence of sounds made by bloodpumps, valves, etcetera. During a daytime dialysis session one person indicated that he deliberately adjusted the pre-programmed settings depending on how he perceived his own condition and the connection to his vascular system.

Reflection on the design case & exemplifying the research question

NeoKidney is planning for a machine that runs through a continuously varying scheme during a therapy session. From a medical point of view this facilitates optimal treatment. As a design team we anticipated that unpredictable changes in sound conflict with how people want to organize their relation with the machine. A machine that 'hums and buzzes' in a predictable and rhythmic way is perceived as a machine that is functioning properly. Any deviation is then associated with an exception, even peripherally being aware e.g. when performing another task and or when at sleep.

At present a requirement was stated to lower the sound to a certain level of decibels, yet with a varying scheme leading to continuously varying sounds. We discussed our concern that people may not be able to get used to the sound of the machine in case it would vary continuously. The NeoKidney management team was positively surprised. They had not considered the varying sound scheme from that perspective. Given the notion that the PAK will produce sounds from mechanical parts like a pump, we conveyed in our advice that the machine should make sounds with constant intervals and run through a standardized scheme.

Our reasoning about this issue was largely based on a surprise resulting from a careful examination of the current usage of artificial kidneys. As of yet, we did not test a machine with varying schemes to verify whether people would actually not get used to it during treatment. Obviously, we could advice our client to conduct studies in this realm. We could also advice to aim for a trajectory to diminish sound until one would not hear the machine at all.

The question is whether we can reason in a different way about the sound of the machine and tied to that, in what ways might we think responsibility of designers? How we can reason in a more responsible way as designers?

These questions have been raised from a constructivist perspective. The philosophy of Simondon is now introduced by 'unpacking' two lines of thought. 'Inventivism' in the next section and 'transduction' in the section thereafter. A historical case will be interwoven to mobilize the philosophy of Simondon. After these theoretical sections, I will go back to the design case of the artificial kidney being more informed and coming from a different philosophical tradition than constructivism (or positivism).

Unpacking ‘inventivism’ Part 1: Technical mentality

Introduction

To introduce the philosophy of Simondon a historic event will be interwoven with theory: the invention of the artificial kidney and the application in a working prototype. The invention took place between 1943 and 1945 in the Netherlands by the Dutch inventors Kolff and Berk.

This invention is illustrative as it serves to further understand the portable artificial kidney of the design case. The invention will also carry a vocabulary that resembles the one that Simondon uses as both deal with thermodynamics.¹ This paragraph is based on Drukker’s historical overview (Drukker, 1989).

People who suffer from kidney failure experience the problems that come with nourishment within a few days: the removal of toxics and water from their blood and tissue hampers.² Kidney failure leads to lethal levels of toxics in the body and the retaining of excess fluids in bodily tissue. An artificial kidney is able to remove toxics from the blood and extract excess water. In addition medicine is required.

To help patients who suffer from kidney failure, Kolff improved existing ideas about dialysis and artificial kidneys. In 1943 he built a first prototype of an artificial kidney together with Berk, leading to a working treatment and the first human survivor after therapy in 1945. Kolff’s invention made it possible for a part of the blood cycle to be filtered outside the body. An important part of his invention was the use of a semi-permeable membrane made of cellophane for sausages, which he obtained from a local butcher. The membrane allowed toxics to pass. By means of osmosis — a difference in concentration — the toxics diffuse into a saline solution on the other side of the membrane.

Kolff tested the speed of the osmotic process by filling ‘sausages’ with water and a concentration of urea and rocked them immersed in salted water. Later on he repeated comparable setups by filling the sausages with blood and urea. He needed to enlarge the surface of the membrane, so Kolff wound up the tubular cellophane on a drum while the lower half was immersed in a bath of dialysate. By copying a rotating coupling from a Ford automobile water pump Kolff was able to connect the bloodline from the body to the rotating drum. Berk suggested to place the drum horizontally “thereby making it possible to propel the blood along the cellophane tubing by rotation of the drum, eliminating the use of a bloodpump.” (Drukker, 1989), see Figure 1.

¹ Artificial kidneys make use of thermodynamics a.o. and this is vocabulary that is important in the philosophy of Simondon. Terms like ‘meta-stability’ for instance are shared in both fields.

² As Simondon phrased it ‘the nourishment of the living poses problems’ (Combes, 2013, p. 28; Read, 2015).



Figure 1 : Willem Kolff and his invention: the artificial kidney, artist impression. Image still from whiteboard animation, 1m41s. © 2014, Nierstichting.

I will introduce now the philosophy of Simondon and weave it together with the invention of the artificial kidney including the application of the invention. The paper called “Technical Mentality” is used to gain traction. I will start with two postulates that Simondon conveys in his paper.

Two postulates of technical mentality

The invention of the artificial kidney illustrates Simondon’s notion that “there exists a technical mentality, and that this mentality is developing, and therefore incomplete and at risk of being prematurely considered as monstrous and unbalanced” (Simondon, 2009b). Simondon’s philosophical project is to repair this risk by closely investigating it. Technical mentality has two conditions or postulates:

1. “The subsets are relatively detachable from the whole of which they are part.” (Simondon, 2009b). With this first condition Simondon means that “the technical object can be repaired” and that “at the moment of its very construction, the technical object is conceived as something that may need control, repair, and maintenance, through testing, and modification, or, if necessary, a complete change of one or several of the subsets that compose it” (Simondon, 2009b, emphasis removed).

This kind of mentality can be observed in the invention of the artificial kidney by Kolff and Berk. The tubular membrane is approached as a subset that was taken from the butcher and it was tested extensively in isolation, then it was wound up and modified in such a way that it could connect to the rotating coupling.

The second condition or postulate of the technical mentality is: 2. “if one wants to understand a being completely, one must study it by considering it in its entelechy, and not in its inactivity or its static state” (Simondon, 2009b).¹ Simondon further explains that most inventions tend towards fewer subsets “by reducing the number of primitive elements to a minimum, which is at the same time an optimum”. Simondon’s point here is that with many inventions, by thinking about them or drawing them on paper, we suppose “the conditions of their functioning realized” (Simondon, 2009b, emphasis removed). A leap is made, not so much while thinking or putting an idea on paper, but rather when assembling the invention. As Massumi explains, at the moment when two or more “sets of potentials click together” into one system it “has achieved a certain operational autonomy [...] to continue functioning independently without the intervention of an outside operator to run or repair it.” (Simondon, 2009b). “A ‘threshold’ has been crossed” and this led Massumi to coin that “the designer is a helpmate to emergence.” (De Boever et al., 2009).

The second postulate of the technical mentality can be seen in the invention of the artificial kidney as well. Kolff supposed that the tubular membrane from the butcher would work in a dynamic setting with blood flowing through it. Only when he tested it, the tubular sausage skin realized its potential as both a membrane and hose reducing the number of subsets (else he would have needed a hose and a membrane). The same technical mentality can be seen in Berk’s invention by suggesting that the tubular membrane could serve as a pump by tilting it. Berk supposed it and reduced the amount of subsets in his thought (leaving out a blood pump), but only when ‘clicking together’ of the tilted hose, the dialysate and the rotating drum were the potentials realized.

Simondon points out the potential of industrial production: “It is the standardization of the subsets, the industrial possibility of the production of separate pieces that are all alike that allows for the creation of networks.” (Simondon, 2009b). Simondon sketches an ideal type of network in the form of a ‘laboratory’ that brings together information and energy. As explained by Jean-Hugues Barthélémy, what Simondon means is that in the end the machine made within the factory and leaving the door converges — by means of knowledge — towards a machine that is as unique as a living being (Simondon, 2009b). Muriel Combes quotes Simondon’s secondary thesis: ‘the establishment of a new relation to machines, which would no longer consist only in serving them or commanding them. Above and beyond the role as assistant to or commander of machines, “the human can be coupled with the machine as equal to equal, as a being that participates in its regulation” (*MEOT*, 119-120)’ (Combes, 2013, p. 70).

¹ The notion of entelechy in Simondon’s philosophy is hard to convey briefly. It suffices here to take it as “the realization of potential” (Oxford Dictionary).

Technical mentality in domains that have to do with affect

The technical mentality has been used in many other domains besides the mere physical by means of “analogical interpretation”. Technical mentality allows that kind of transfer. E.g. the balancing between predator and prey is seen as a regulation problem (Simondon, 2009b). Simondon addresses here one of the main risks of technology, “that of the reduction of society to a machine of a particular type” (Simondon, 2009b). It is the risk of “reducing any crisis—even social crises—to a problem of regulation, and presenting as the only ideal, homeostasis, that is, stable equilibrium of attendant forces.” (Simondon, 2009b).

Simondon indicates that the technical mentality is problematic in those domains that have to do with affect, e.g. psycho-sociology, activity and so on. When inventors like Kolff and Berk crossed the aforementioned ‘threshold’ while the clicking together of subsets, they were working apart from “the social field of the usage of products” (Combes, 2013, p. 60). That moment was value free – or a “neutral field” as Simondon phrases it (Simondon, 2009b) – as this clicking was required for the invention to become autonomous. We do not have enough knowledge at present to make such advanced technical objects that they allow for every person in daily use a similar kind of value free moment – or ‘inventivism’.

Simondon saw design as “an external layer [...] which ‘materializes’ human values and fashions” on top of a functional internal layer (Simondon, 2009b). The internal layer cannot be altered without performance changes, the external layer can. The external layer disturbs the functioning of the internal layer.

Unpacking ‘inventivism’ Part 2: Transduction

Let’s focus now more closely on Simondon’s notion of information before elaborating on his approach, transduction, as a fundamental way of reasoning, that could work out in design labour and that deals with the aforementioned risk of reduction.

Information & transduction

Information in the philosophy of Simondon is far removed from the idea of transmission which implies a sender and receiver. He sees information first as an ordering process within a metastable milieu. This is an “amorphous milieu rich in energy but lacking structure” (Simondon, 2009b, fn12). As Pascal Chabot phrases it, this milieu is ‘not yet’ ordered, it can undergo “the passage from a metastable system to a stable system” (Chabot, 2013, p. 85). Information is seen by Simondon as an “operation of taking on form” (Simondon, 2009a). He uses an analogy from physics to explain this notion of information. In a metastable solution, after a shock (an information-event) or the insertion of a spec of dust, the ordering process starts, as an emerging crystal that serves as a ‘platform’ for further ordering. In this analogy, coming from physics, only a crystal grows irreversibly. Technical objects are different with respect to information. They could also suspend or delay information or “maintaining or continuing the process of formation, so that the ensemble remains information, as in the case of life.” (Combes, 2013, p. 5). So technical objects and the living are different because

“rather than being formed once, they are information. They are continuous, variable processes of matter-taking-form” (Mackenzie, 2002, p. 50).

The on-going structuring operation propagating on the limit of a metastable milieu and an ordered structure is called transduction in the philosophy of Simondon. Transduction operates in physics (e.g. the formation of a crystal), and in biology (e.g. an ant moving away from its existing colony to start a new one, ‘being information’ and structuring the milieu at the location where it starts a new colony).

In psycho-sociology transduction brings a new problem to the fore: how can we know about these operations as we are at the same time an on-going process and a result of this process? “Our knowledge of relations is itself a kind of relation between thought and existence, and this commonality frames Simondon’s approach.” (Hayward & Geoghegan, 2012). In the philosophy of Simondon, transductive reasoning deals with the problem of thinkability of relations.

Ways of reasoning, transduction versus abduction

Transductive reasoning could be seen as an argument by analogy, so a single process is similar to another single process (MacNeill, 2009). Simondon further developed transduction as “a method of proceeding through analogies” and this “analogical method turns out to be *constructive*” (Combes, 2013, p. 12, emphasis in original). As Jason Read paraphrases Combes:

“Simondon’s method of progressing is neither inductive, drawing from discrete phenomena to formulate general principles, nor deductive, proceeding from a general principle to specific cases, but transductive as it focuses on the operation, and the transformation of the operations, that individuate thinking and being.” (Read, 2015)

Simondon makes use of analogies as a stepping-stone from one domain to another, e.g. from physics to biology and from biology to the socio-psychic. He chose physics as a founding analogy as it has “a capacity for constituting the concrete from the abstract, for producing a concrete on which one may act” (Combes, 2013).¹ The aforementioned crystal is an example that Simondon uses from physics towards biology and the socio-psychic in a constructive way.

It is common to introduce abduction as the form of reasoning that is needed in design practice to account for new knowledge. Peirce explained abduction as “creating new rules to explain new observations” (MacNeill, 2009). A comparison of both forms of reasoning requires a different paper. I conclude for now that Simondon’s notion of information together with the structuring in a domain that was not yet ordered can account for the emergence of new knowledge as well. He reserves a role for operations within materiality in his notion of information.

¹ Combes refers here to Simondon’s use of a physical paradigm as his first analogy building further upon and his use of physics as it ‘has for some time shown its “capacity for progressively transforming theory into hypotheses and then into almost directly tangible realities” (IG, 256; IL, 554)’ (Combes, 2013, p. 13)

Application: Going more informed back to the design case

Now that I am more informed and may be able to come back to the design case from another philosophical approach, what should we do now with the sound of the portable artificial kidney?

We could try to make it as silent as possible, since sound has no technical function in the artificial kidney. As our client is aiming to miniaturize the machine, heat dissipation may form an issue (as this is a common problem when making things smaller).¹ Sound could be seen as losing energy, so reducing sound may be seen as supporting 'the solidarity' of the subsets.

If we make it silent, the machine still needs to generate alarms. But isn't there a quality in the artificial kidney making sounds as a reminder that it is still working fine for someone's health? Should we have the person experiment with the sound level that suits his or her need? As of now we think of constant intervals and running a standardized schedule, but aren't we heading towards the pitfall of reductionism with a sequence of sounds that is too regular? An advanced machine would not make constant sounds, but respond in a sensitive way, subtly varying according to the changing condition of the person in need of therapy.² If we want that kind of sound, we need to work on the sensing ability of the portable artificial kidney as it is now limited to vital signs like blood pressure, coagulation of blood, measuring levels of a few toxics and keeping track of the amount of extracted excess fluid.

Since I, as a member of the design team, am a transducer, together with the client and the target group, we decide with which other machines the PAK will communicate. We are responsible what correlations the machine will have with other machines. As transducers, we could correlate the PAK with a remote monitoring system combined with a skilled nurse practitioner to assist when in doubt or when a new alarm goes off.

How can we proceed in our studio with reasoning by means of analogies? While working on more insights about the machine, we have come up with some analogies, but we have not dived into this really.

Implications and future research

Having coming back to the design case, we can now derive some implications.

If we accept that technical mentality is present, then responsibility of designers would be to avoid the risk of reductionism in their work and to investigate it. Analogical reasoning is one approach that tries to avoid reductionism, thus addressing responsibility and design.

Simondon sees here a task for philosophers to bring this method of investigating the world further. So, designers and philosophers could further investigate and develop transductive reasoning as a method of proceeding and constructing through analogies and try to bridge

¹ A miniaturized machine is better suited to 'sense' according to Simondon, but this line of thought is not further discussed here.

² In line with Simondon's thinking the anthropologist Tim Ingold wrote on the difference between rhythmic and metronomic oscillation in relation to machines and human perception (Ingold, 2011).

that method towards design cases. Transduction is suggested as a way of reasoning while designing along or instead of abduction. Can this be done at all?

Designers are used to working with analogies, but should they start, like Simondon does, always in the physical domain and then move towards biology and the socio-psychic? Or can designers move back-and-forth? Can we proceed at all with transduction as a way of constructive reasoning in design?

Machines are not that advanced yet that they link themselves to other machines without human interference. Muriel Combes phrases it as follows: "It is as living beings that humans are declared responsible for technical beings" basically because we have a past and we are able to "modify the forms of problems to be resolved" [...] "Thus we might say that the human plays the role of transducer between machines" (Combes, 2013, p. 60). Until our knowledge is that elaborate that we built machines that can act as transducers and correlate other machines, designers, together with other stakeholders, are responsible for the linking together of machines.

Thinking technological progress in terms of evolution, as can be observed in Simondon's technical mentality, does not go without debate. Besides Simondon being normative from the beginning in his approach of the world, his normative stance towards progress and equality of man and machine must be investigated further. This paper did not elaborate on Simondon's notion of (immanent) ethics.¹ This could be a line for further investigation.

This paper did not build on Simondon's aesthetics. This may be an interesting line for further elaboration as he sees unifying qualities in aesthetics and it seems relevant for design.

The work of Muriel Combes may serve as a first step to explore the action's of designers as she investigates the significance of labor.² Why the labor of design exists in the first place is explained by Simondon as well when he discusses the historic separation of energy and information. Together with Simondon's demarcation of invention versus application, this is a line of investigation as well.

Simondon argues that materiality takes over and becomes 'autonomous' while inventing or producing a technical object. A 'threshold' is crossed during the moment of invention and that moment is value free according to Simondon. As designers we do not cross such a threshold, we work with a functional core, a 'nucleus' that is already invented in the past. Designers work on performance of that nucleus and relate it to affect. The division between a functional core and an external layer in the philosophy of Simondon seems problematic in researching design practice. Yet, the field of design thinking may need to take materiality more into account.

¹ Simondon's ethics is immanent. Immanent ethics could be phrased like "The fundamental question of ethics is not 'What must I do?' (which is the question of morality) but rather 'What can I do, what am I capable of doing (which is the proper question of an ethics without morality). [...]" (cf. O'Donnell, 2001)

² Combes underscores the political implications of Simondon's philosophy. Taken from the Preface written by Thomas Lamarre, who translated a.o. some of Combes' work (Combes, 2013, p. xiv).

In design education we should address and further develop responsibility, work with attention to dive into the machine and, as Simondon would like to do us: liberate machines.¹

Conclusion

Can we reason in a different and more responsible way as designers? The philosophy of Simondon, and especially his notion of technical mentality and transductive or analogical reasoning shed new light on these questions.

A responsibility of designers is to avoid reductionism in their thinking.

Within a design project you make many decisions on parts, but you cannot 'hide' behind the borders of your task or project.²

Designers cannot ignore that people will regulate machines themselves, but you are responsible for correlating machines together with other people.

The approach of this paper, diving into a design case and raising more informed questions by means of philosophy, is on the verge of being a reflective method itself within the constructivist tradition. That must be rethought as well.

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¹ The notion of "the education of attention" was inspired by Tim Ingold's work (Ingold, 2001).

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