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

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

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

1 Introduction

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

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

2   Research approach

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

3   Case Study: Clubfeet treatment

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

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

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

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

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

4   Philosophical theories

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

4.1   Mediation Theory

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

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

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

4.2   Product Impact Tool

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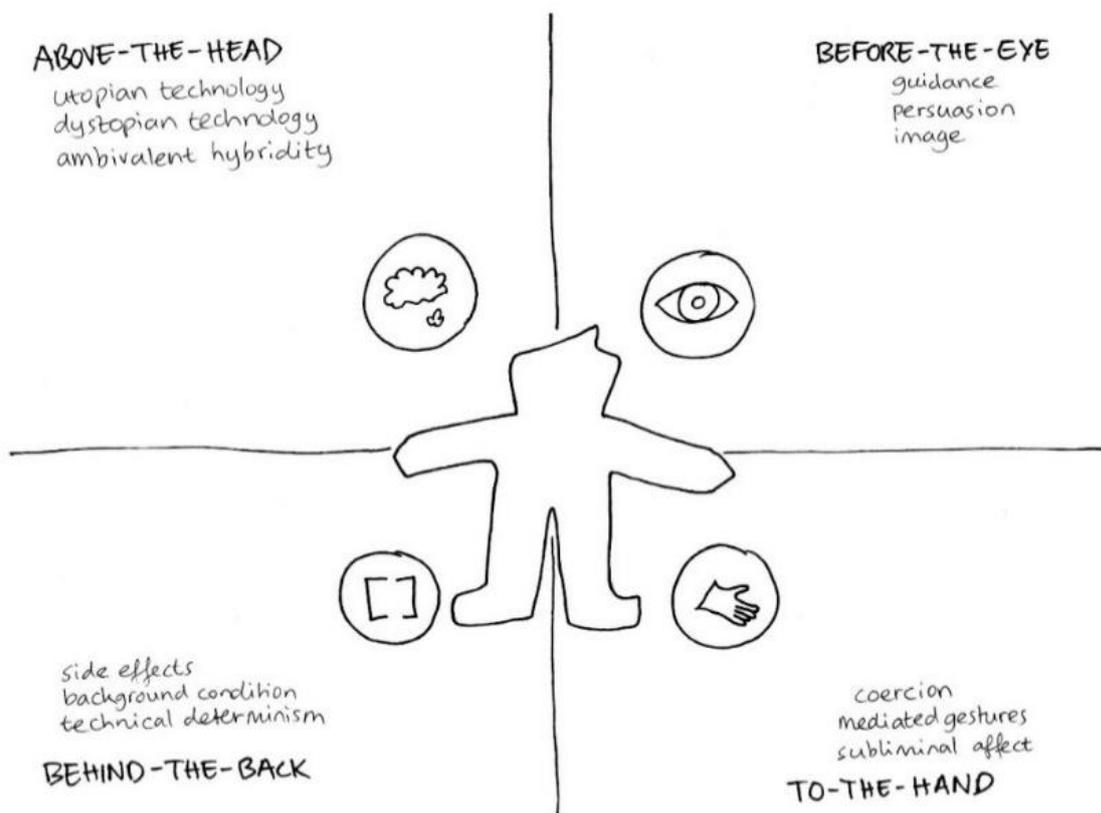

Figure 1: the Product Impact Tool (adapted from: http://stevendorrestijn.nl/tool/)

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

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

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

5   Design proposals

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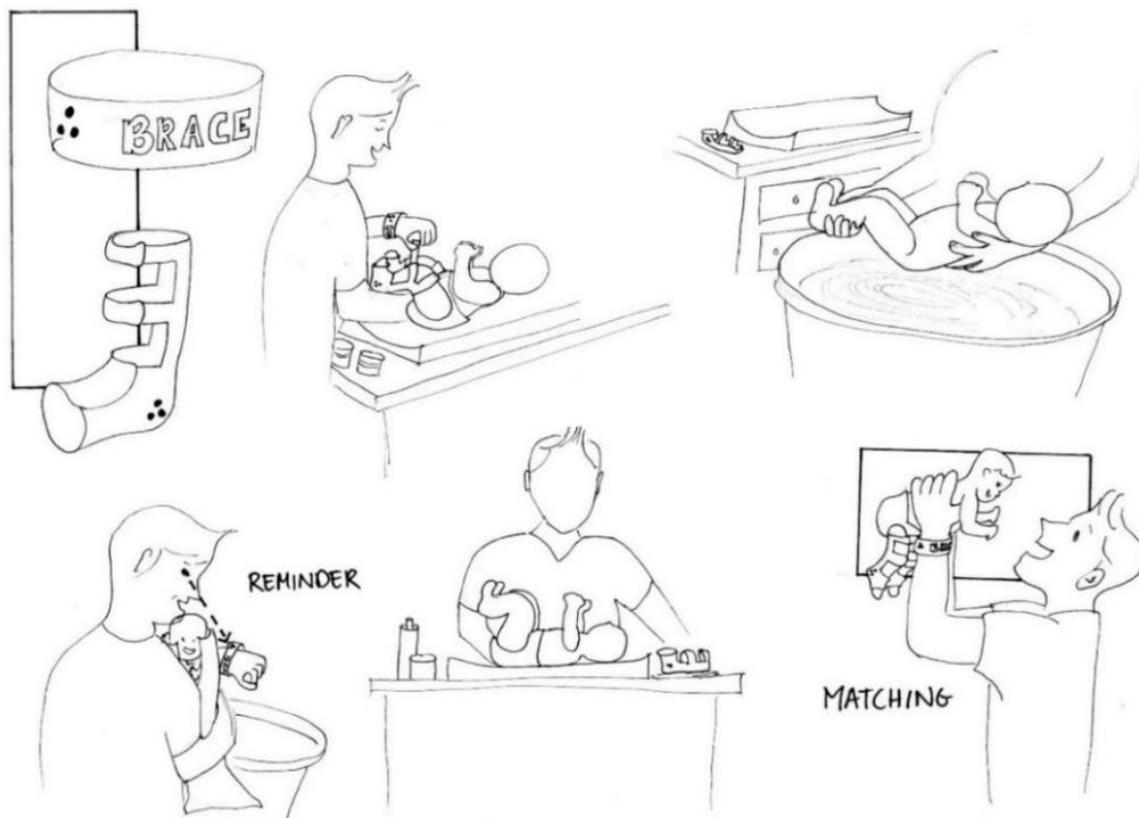
5.1   Parent-participation

Figure 2: description of the parent-participation design proposal

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

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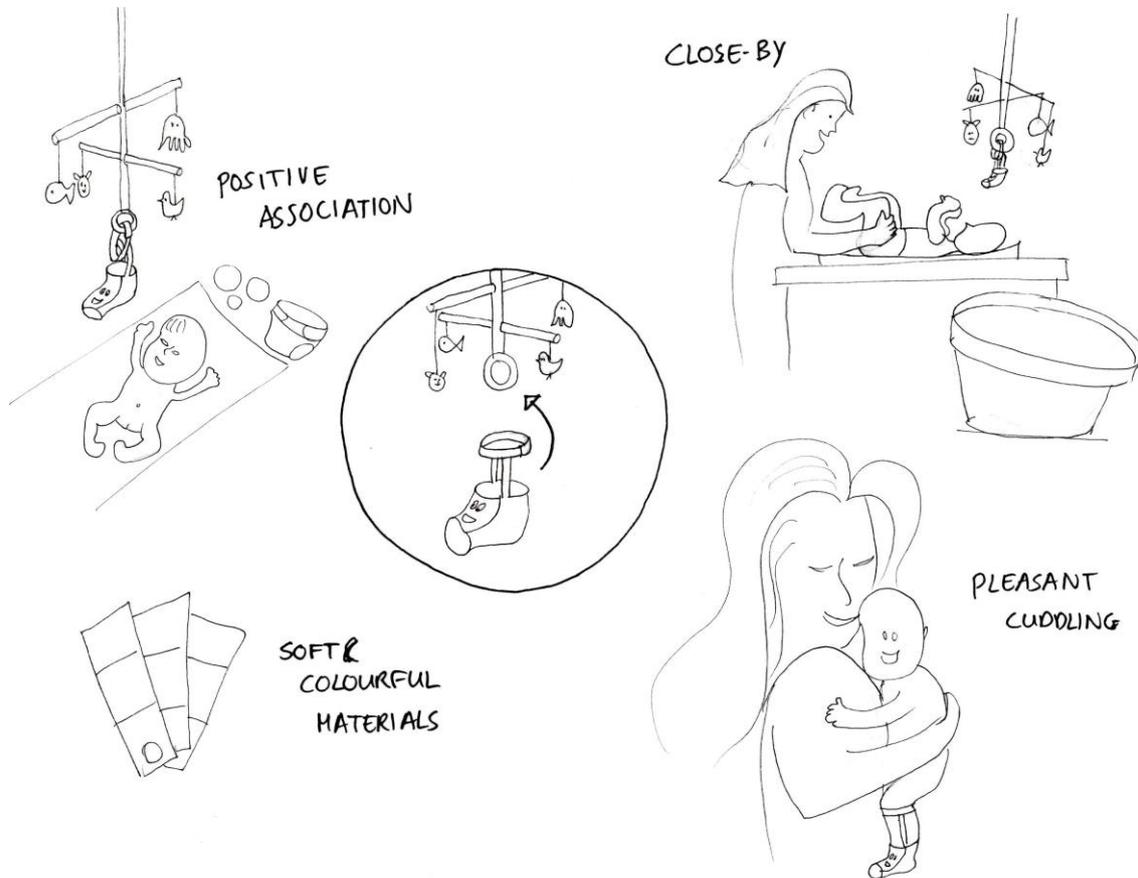
5.2 Baby-toy

Figure 3: description of the baby-toy design proposal

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

5.3 Keep-it-close

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

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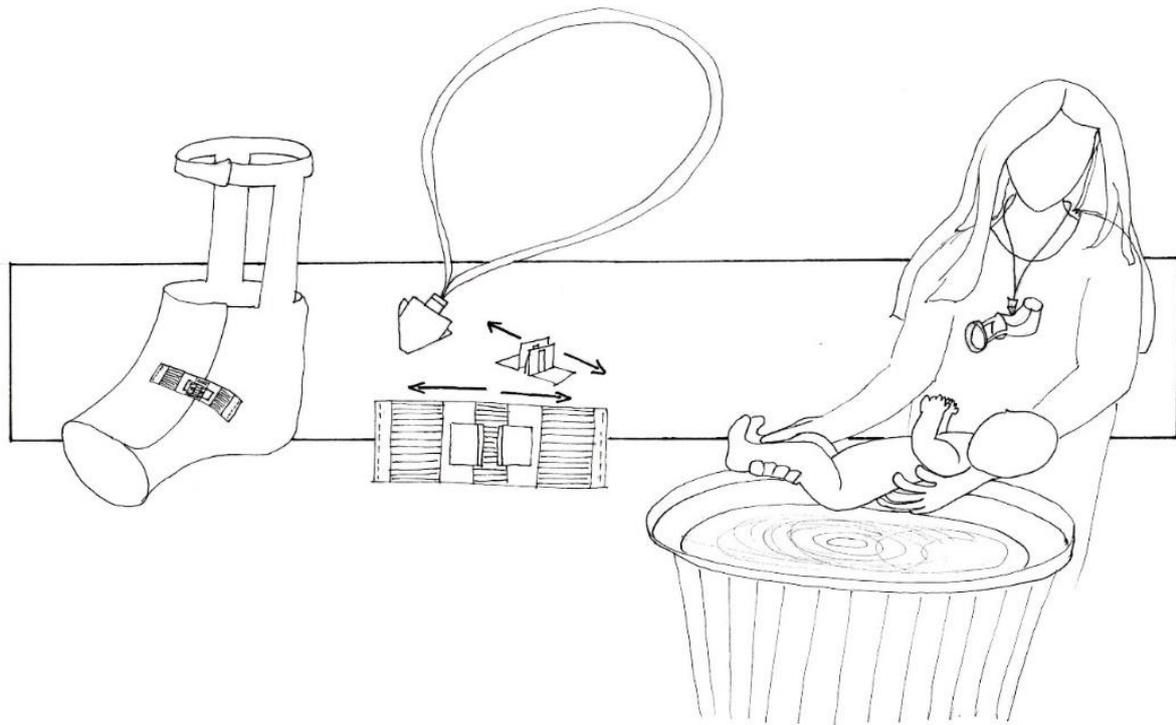

Figure 4: description of the keep-it-close design proposal

6   Evaluation of the proposals

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

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

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

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

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

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

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

7   Results

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

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

8   Discussion

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

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

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

9 Conclusion

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

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