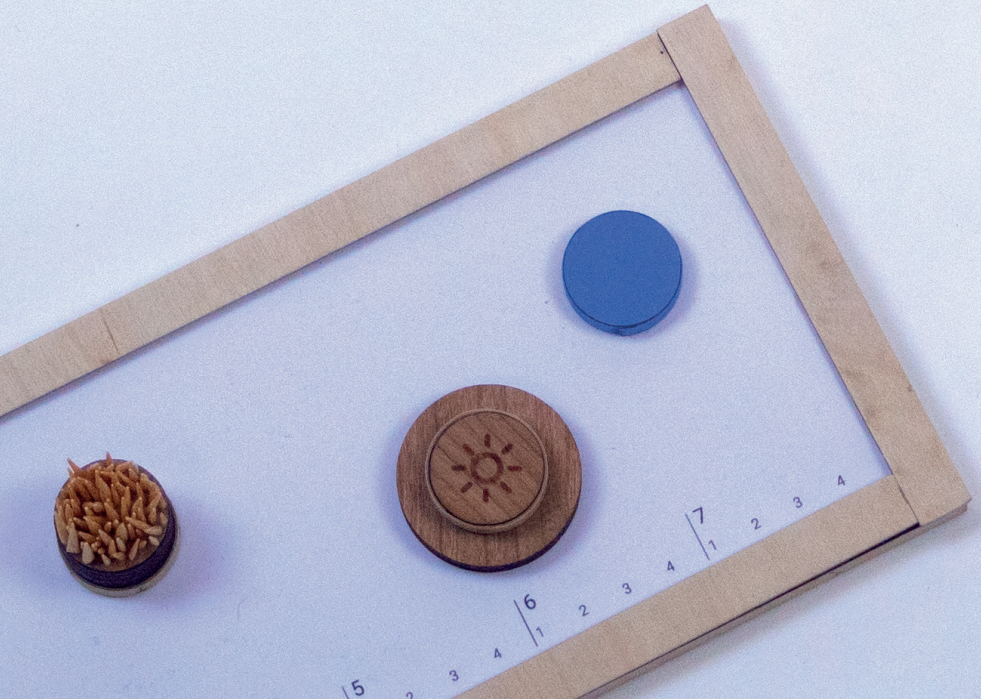
PAROLI

THE EXPLORATION OF A COMMUNICATION TOOL FOR THE PERINATAL HEALTH CONTEXT AS AN APPROACH TO DESIGNING FOR SYSTEMIC CHANGE



IN COLLABORATION WITH
PHILIPS DESIGN

COACH
CAROLINE HUMMELS

FINAL MASTER THESIS
MINERVA LOOS

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TO DESIGNING FOR SYSTEMIC CHANGE

FINAL MASTER THESIS

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IN COLLABORATION WITH PHILIPS DESIGN

UNIVERSITY OF TECHNOLOGY EINDHOVEN
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INDEX

INTRODUCTION

We live in a globalised and ever more connected world. This opens up opportunities, but doesn't come without challenges. We are facing major environmental problems, decreasing availability of resources, increasing social disparity and many more societal challenges. Albeit the technological and scientific developments which have been achieved in the past years, problems within the health care area also remain an prevalent challenge.

This becomes visible when looking for example at the worldwide perinatal health state. Even though the perinatal death rate is regressive, in the year 2006 around 6,3 million perinatal deaths per year have been reported (WHO, 2006). The biggest part of this happens in developing countries (WHO, 2006), however this nevertheless affects other states as well. When comparing the fetal mortality rate of different European countries, the Netherlands ranks relatively low (with a fetal death rate of 5,7 per 1000 births, and only 5 countries having a higher rate in 2010) (Zeitin et al., 2013). A study has furthermore shown that the probability of being affected by health-damaging factors is not the same for every member of the society, but depends on race, ethnicity and gender (WHO, 2004). So when talking about societal problems such as perinatal health disparities, special attention should be paid to women who differ in some way from the social norm, by their economic status, income, level of education or ethnic background. In the Netherlands for example, migrants still show a 16% higher risk of pre-term birth delivery, as well as a 41% higher risk of perinatal mortality compared to native women (Bollini et al., 2009).

This gains importance against the background of steadily increasing migration to the Netherlands (235 thousand people coming to the Netherlands in 2017, which led the netto migration to the record number of 81 thousand) (CBS, 2018). In order to guarantee a functional and balanced society, the requirements for a successful integration, also into the health care system, have to be met.

These developments lead to a multi-cultural society in which each member is ever more likely to come in contact with such challenges. Moreover, we can observe that the almost ubiquitous availability of information and communication technologies increases people's awareness and interest in societal issues (Brand and Rocchi, 2011). This shifts public attention towards meaningful and value-oriented solutions. Hence companies need to rethink and reframe their activities and business model. This step will be a challenging one, as it demands companies to develop a completely new way of thinking (Gardien et al., 2014).

Brand and Rocchi identified some of the current developments as signs for a shift in economy paradigms, towards the so-called transformation economy. They pointed out that the challenges we are facing at the moment can't be solved by one player only, but need the collaboration of several stakeholders, which have to adopt a global approach for solving local problems. However, they noted that because of a lack of experience, solution methods need to be found through testing and evaluating (Brand and Rocchi, 2011). This, and the emerging global challenges we are currently facing do not only change the economy and business models, but also the role of designers.

> **"The transformation economy requires designers – in collaboration with other partners – to envision and explore a 'new' society."** – *Gardien et al., 2014.*

In order to tackle the local effects of societal challenges, designers have to address the problem on a systemic level, taking into consideration the different stakeholders involved. However, the ever stronger link between people, governments and institutions across national borders furthermore creates a new net of interdependencies. This makes the cause-effect relations of actions less predictable, as an action in a certain situation can have unexpected outcomes in another one. For those working on societal challenges it means that, as the problems are ill-defined, a rethinking of the whole design process is necessary. It asks for probably different research, design and evaluation methods.

In this report, I illustrate my approach to the societal challenge which is posed by the perinatal health state disparities in the Netherlands, which I tackled in the context of my final master project in collaboration with Philips Design. I describe the information I gained about users and the system, my design explorations and the insights I gained.

ME

I believe that we as designers have a social responsibility we have to meet with our work. Don Norman says that designers deal with how things and the interaction with these things work and that, if this isn't done correctly, it can lead to frustration or an unwanted behaviour change (Norman, 2013). That is why, I believe that designers not only have to think about how they can technically solve a problem, but also about the importance of a certain issue, the moral and ethic aspects of their design and the consequences for society and environment.

Hence the task of designers is to identify the needs of people and to meet them with their work. Only products that are thoroughly designed, coherent in their purpose, their design and the way they work and consider ethic aspects of it, can successfully contribute to society in a positive way.

In order to identify the opportunities that arise with new developments, designers have to be aware of the existing technological possibilities. It is important for them to know not only how developments on the technological field can be used for a successful development, but also how these can be steered in a direction that is meaningful for society. Only this way will designers have the ability to create the link between different fields of expertise, thus finding innovative solutions that truly provide added value. This approach then is applicable to a wide range of problems, of which social inclusion shows to be a current issue of growing urgency.

During my Bachelor in Architecture I learned about the design of the space we live in, from the urban to the residential context. In my Master studies, I'm now going further in scale and exploring the world of products and systems. Both studies relate to my interest in the design of our daily live environment, how it is shaped, how we interact with it and how it influences us. I believe that the work on all scales is characterized by a high need for a collaborative design process, across areas of expertise, professional fields and cultural sectors.
Through my studies and internships in different countries I could experience how ideas and projects develop when different people with different backgrounds come together. I enjoy the interdisciplinary exchange with others and think that this is a catalyst for novel developments.

I believe that founded knowledge about the things that surround us, from daily life objects to the city we live in, allows us to put them in a wider context, make new connections and thus find new ideas. Being able to change perspective and switch in scale during the design process is one of the essential skills designers will have to possess to deal with emerging societal challenges.

In order to change perspective, designers have to be able to understand and empathize with people with different points of view. That's why, I believe it is important to get to know and try to understand their perspectives better.
This project gives me the opportunity to explore how many stakeholders can, first of all, be identified, understood and then brought together.

My focus of interest lies in the moment when these different people meet and interact. With my work I aim to explore how we can support the exchange, possibly making underlying problems visible and providing tools to overcome them. I believe that a positive exchange can be mutually beneficial and valuable and that therefore, we need to explore how we can create meaningful inter-personal interactions.

When looking at recent technological developments on the field of human-computer and human-material interaction, it can be seen that their focus has shifted from serving merely practical purposes to aiming for a meaningful presence in our everyday life. When looking at computational things for example, for Redstörm this means that they become an instrument by which we can express ourselves, thus moving aesthetics into the centre of consideration of design (Redstörm, 2001). Following the theory of pragmatic aesthetics, the possibility of expressing themselves is what defines users' interaction with an object or a system as aesthetic, next to including all human senses in the interaction (Petersen et al., 2004).
Against the background of the growing number of societal challenges and shifts in economy paradigms we are currently facing, I think that we have to think about how we can create not only meaningful, or aesthetic, human-object / human-system interactions, but also meaningful inter-personal interactions. In my opinion, this is characterized by promoting shifts in perspective, hence striving for a mutual understanding and empathy. I want to explore how we can use objects and systems, and the learning from this field, to create value in the interaction between people.

PHILIPS DESIGN

The mission of Philips is to make the world healthier and more sustainable through innovation, with the goal of improving the lives of 3 billion people a year by 2025 (Philips, 2018). This strategic focus of the business is in the areas of personal health, diagnosis & treatment and connected care & health informatics. Philips sees a shift in healthcare towards healthy living and prevention, which means more and more people are looking for new ways to proactively monitor and manage their health, also in home and community settings. Philips sees value in more integrated healthcare to optimize care delivery across the health continuum. This includes putting increased emphasis on both primary and secondary prevention and population health management programs. Philips is engaged in a number of initiatives to make this happen. One example is a development project to build Community Life Centres in Africa. These centres make primary care accessible and affordable to local communities, and actively engage communities towards participation and healthier living. In the CLCs, they have deployed CLC Outreach Kits, which consist of a backpack with diagnostic tools that can be used by care providers and Community Healthcare Volunteers to bring much needed healthcare services to people in remote locations.

"The designers that work in innovation projects, always consistently bring in the people aspect. That's what I see as the most important role of design."
– *Christiaansen, 2015.*

As these type of societal challenges do not affect a small group of isolated people but rather involve a network of differently linked stakeholders, they ask for an approach on a systemic level. For this, designers have to develop a new apparatchik and process, including methods and tools which are applicable to large scale societal challenges and their local effects. Hence, the outcomes of this kind of projects will not be stand-alone objects, but have to be seen the bigger picture they are interlaced with.

"All product and services will get connected over time, so what I think will change for everybody is that these solutions can not be seen any more in splendid isolation, they will be part of an eco system, in one way or the other"
– *Christiaansen, 2015.*

Philips gains deep insights and learnings from initiatives and experiments in local contexts. Some of these insights may also have validity in different contexts. For example, some insights and challenges related to the pregnancy journey of women in African contexts may also be relevant and can be adapted to migrant women in the context of the Netherlands. Similar to experiences of vulnerable women in Africa, there is a lack of understanding amongst migrant women of the local healthcare system, and uncertainty of how to find trusted information.

These learnings can then be quickly evaluated by designing probes, which could provide in-situ insights and instant feedback, allowing to identify 'weak signs' of value developments (Gardien in Brand and Rocchi, 2011) and fine tune the design accordingly along the process. This can allow to develop meaningful interventions to address societal challenges.

The need to improve the access to healthcare in vulnerable target groups is not limited to emerging market contexts such as Africa. Despite a high level of socio-economic development, there are still vulnerable groups in Europe that experience challenges in accessing health services.

A current joint initiative between Philips Design and the TU/e is now looking into approaches of improving access to healthcare of vulnerable pregnant women in the Netherlands. Vulnerable pregnant women in the Netherlands were defined in the context of this project as follows: "Women with low-socio-economic status, low education, migrants with low level of social integration, living in deprived areas and/or affected by language barriers". Communication is often a stumbling block that can hamper effective access to healthcare amongst vulnerable pregnant women. My project was framed to explore the use of novel research tools and approaches to generate insights that may support the innovation process to address the communication gap impacting on access to healthcare amongst vulnerable pregnant women.

PROJECT OUTLINE

The challenge

Issues in perinatal health are not only problematic because their unequal distribution in society, but also because they can entail further disparities. It has been shown that the emotional state of mothers has an impact not only on the physical and functional, but also the neurobehavioural development of their children (Mulder et al., 2002; Monk et al., 2000). While the exposure to stress even before birth has generally shown to have negative consequences on a baby's development (v. d. Hulst et al., 2018), general disturbances during this time are seen as a possible cause for, amongst others, obesity, diabetes, cardiovascular diseases and other development disorders (Denktas et al., 2011). This shows that social and health inequities during the time of a pregnancy do not only affect the expecting mothers themselves, but also their babies. To combat tese disparities an early intervention is hence necessary.

An example for a project addressing this problem is "Moeders of Rotterdam" (MoR) (De Verre Bergen Foundation, 2015). This program aims at providing medical and non-medical support for vulnerable women until the third birthday of the child. The goal is to find out if such a guidance and support structure can help to achieve a higher compliance with the system, as well as a stronger sense of empowerment within the system and if it can eventually lead to a higher effectiveness of the care paths. The study of the MoR program is supervised by the Erasmus University Medical Centre and is running until 2021, so no results could be published yet. However the feedback of an involved researcher was highly positive and further demonstrates the need for similar studies and programs.

In the joint initiative between Philips Design and TU/e to improve access to healthcare for vulnerable pregnant women, one of the work streams focuses on improving the experience of the pregnancy journey. Throughout the pregnancy journey, a pregnant women encounters many different stakeholders, which can include midwives, general practitioners, genealogists, obstetricians, etc. This can present challenges to vulnerable women with low socio-economic status, lack of education, low level of social integration and women living in deprived areas. Language barriers are also common. Especially meetings with the midwife, who typically play a key guiding role in pregnancies in the Netherlands, offers an opportunity for intervention to improve the pregnancy journey. There are challenges to building trust and address the language barrier to ensure that communication becomes more seamless, leading to better interaction and more effective guidance. This is where I see the need and opportunity to explore how we can create value by supporting meaningful interpersonal interactions.

Levels of complexity

In order to be able to adequately tackle inequities in perinatal health care, the complex nature of the problem needs to be taken into consideration and addressed. In the first approach to the topic, the big number of stakeholders involved became evident. In my research semester, I tried to map the different stakeholders and their connections (an overview can be found in the appendix I, fig.1) (Loos, 2017). Furthermore, the different care paths in the system and the various levels of interactions of the people involved are some of the factors which add to the levels of complexity. These impose additional challenges when addressing such problems, as they call for a previous and continuous evaluation of the sources of problems, their interdependencies and the temporal and spatial occurrence of the issues. For designers this means that they have to gain an understanding of the situation and be aware of the dynamic structure, only thus being able to provide added value with their work. In the process of my project I confronted several shifting moments as well. I reflect on them and their consequences for the project direction in this report.

> "By understanding the transformations in the models of society, industry and economy, and understanding the implications for people and our business, we can better identify new opportunities and create innovative solutions for sustainable growth and business leadership while addressing social and environmental issues – bringing true value to people." – *Stefano Marzano.*

Scope of this project

The complexity and dynamic structure of the addressed challenge can't be met following the traditional design process. That's why it was clear from the start that the outcome of this project would probably be different from the common results within this faculty. An additional challenge of designing for system change is that it is still in its initial phase and hence the adequate tools and methodologies have not been developed yet. Against this background, aiming for the design of a solution would hardly do justice to the scope of the challenge. That's why the outcome of this project lies rather in the insight that are won with the design than in the design itself. Thus, by strongly focusing on the users and openly evaluating the design result with them, the dynamic exchange and inclusion of users in the design process was strived for, which can be seen as a requirement for achieving sustainable societal change (Peeters et al., 2013).

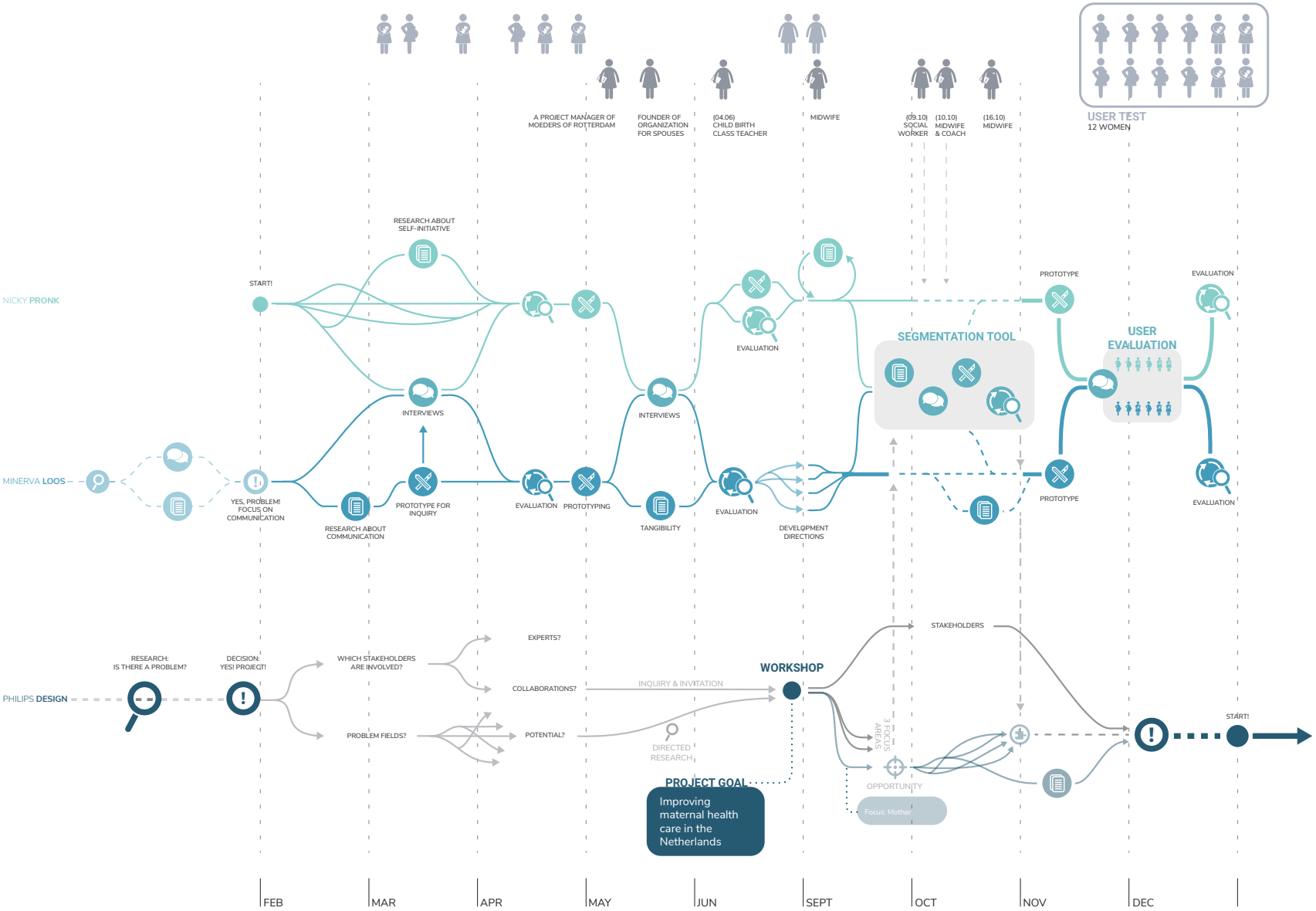

Fig. 1. Project process overview.

Because this approach is fostered by and benefits from the constant exchange also with other designers, and due to the high complexity of this challenge, Nicky Pronk, another final master student, joined the project. We both focused on different topics within the same overall challenge. Furthermore, we constantly exchanged and evaluated our individual decisions together. However, our individual projects were always seen as two separate works, which could also stand alone. An overview of our process can be seen in fig. 1. It was agreed that Nicky and I focused our work on migrant women, who is a subset of the broader target of “vulnerable pregnant women”, addressed by the joint initiative between Philips Design and the TU/e. This was done on the one hand because it would have been impossible to analyse the complete target group within the scope of this project and on the other hand because it showed to be very complicated to gain access to women with other backgrounds.

While Nicky looked into how to encourage self-initiative during the first weeks of the pregnancy, I decided to focus on the communication between expecting mothers and their health care representatives in the weeks after their first meeting. I did this because I had identified this topic as a source of problems in my previous research (Loos, 2017) and because this gave me the chance to explore the possibilities of designing for interpersonal interaction. We focused specifically on first time mothers, as they confronted a completely new situation and had no prior experience.

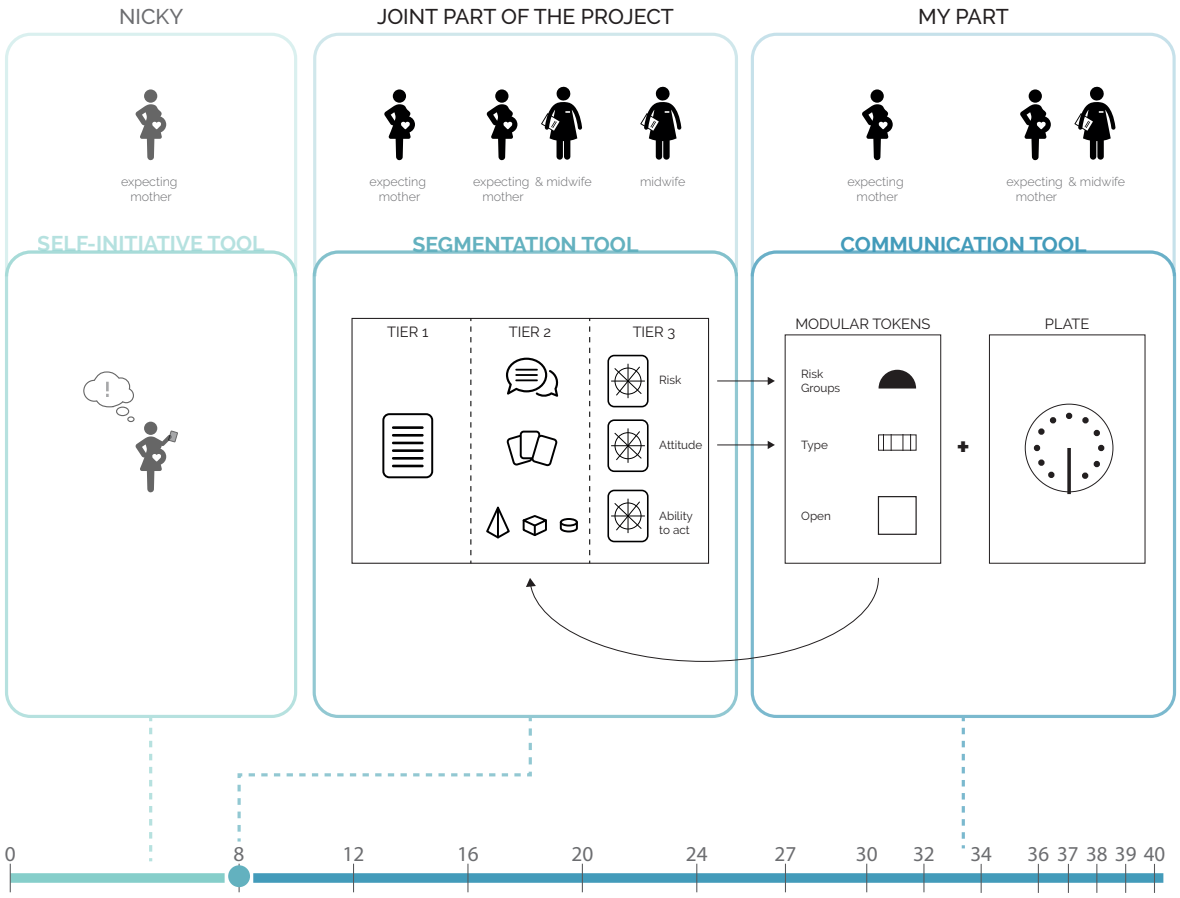

Fig. 2. Overview of target areas of projects.

The issue of guidance and empowerment of vulnerable women through the pregnancy journey was identified as a key intervention area, that could make a significant contribution to the overall umbrella topic of the joint initiative: “Improving Care of Vulnerable Women in the Netherlands by early identification of perinatal and maternal risks”. It was observed that in order to provide the adequate support and level of guidance, it was essential to identify the specific needs of different women. That’s why during the process of the project, we decided to develop a “segmentation tool”, which was an exploration into how different risk and need types of expecting mothers could be differentiated. As this was furthermore beneficial for the development of both our individual projects, Nicky and me decided to do this together. Figure 2 shows which moments in the pregnancy the different projects target. The description of the segmentation tool can be found in the section ‘Segmentation Tool’ and was developed, tested and described by both of us together.

Overview of pregnancy process

Figure 3 shows the main characteristics of a pregnancy process in the Netherlands. After discovering the pregnancy, a woman waits for around eight weeks until she first meets a primary-care midwife. This midwife, or the team of midwives in the practice, is who the expecting mother meets regularly throughout the pregnancy. Unlike in other countries, a pregnant woman normally doesn’t come in contact with a gynaecologist or obstetrician and is only referred to the hospital (to the secondary-care path) if complications arise.

Expecting mothers can choose between home birth and a birth in the hospital, in which they are referred to the medical team of the hospital in the last weeks of the pregnancy. In this report, I will mainly refer to midwives, meaning primary care midwives. This is not done to exclude other health care representatives, but because the midwife is the main contact person in most pregnancies and the experts we had contact with, and lastly because of reasons of simplicity for this report.

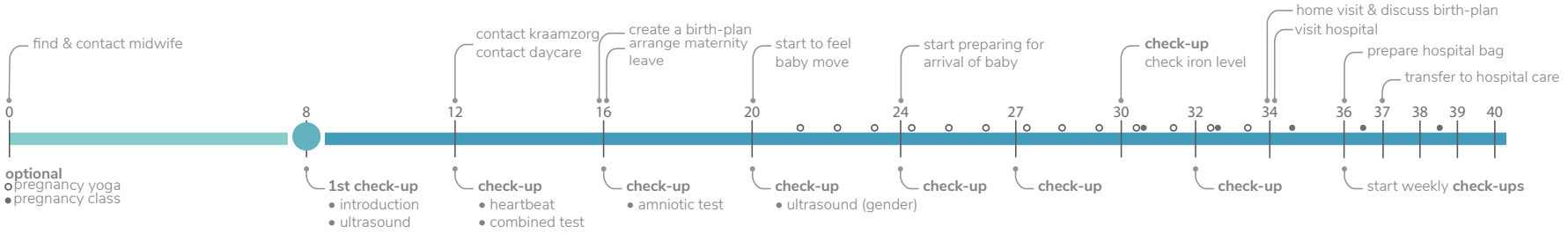

Fig. 3. Overview of pregnancy journey.

THEORETICAL BACKGROUND

As the interaction between expecting mothers and their health care representatives evolves and focuses on the health state, I started by looking into the general interaction between doctors and their patients. In the following I described this more general research and furthermore my more specific findings regarding communication and the concept of embodied interaction.

Interaction of patient and health care practitioner

Medical issues are often not seen as the main problem in the interaction between health care professionals and their patients. Simpson et al. for example state that the practice of health care practitioners can be perceived as problematic because of communication errors mainly, and not because of medical reasons (Simpson et al., 1991). These errors can be based either on the lack of communication or on misunderstandings, which can have different sources. Harmsen et al. for example say that different explanatory models of practitioner and patient about how the reality looks like can lead to these type of misunderstandings and that thus, an effective communication is needed to make these differences clear. Furthermore, they state that the communication is influenced by cultural background, language proficiency and education (Harmsen et al., 2003). Kleinman et al. see the differences in mental models based on the fact that physicians often focus on the disease (physical problem), while the patients have the illness (problem regarding the state of being) in mind. They say that the "patient-doctor interactions are transactions between explanatory models, transactions often involving major discrepancies in cognitive content as well as therapeutic values, expectations, and goals" (Kleinman et al., 1978). While physician provide technical explanations of symptoms, patients often show to be more interested in meaningful explanations (Kleinman, 1978). As a possibility to overcome these discrepancies, Kleinman et al. suggest making the differences in mental models elicit, comparing them and negotiating between the models (Kleinman et al., 1978). Van Wieringen et al. state that the differences are often the biggest when physician and patient don't share the same cultural background (Van Wieringen et al., 2002).
The differences in the perception of the same situation are in my opinion fundamental as they underlie and influence all interactions. These are also affected by the different interests of both parties (focus on physical aspects opposed to emotional interest). These factors, as well as the cultural background of people, have shown to significantly, and often unnoticed, influence the interpersonal interactions. I believe that this is why we should explore different modes of interaction, in addition to the purely verbal communication, to allow for these differences to be uncovered and thus not negatively affect the relation between women and their health care providers. Moreover, I think that also the way in which the exploration is done needs special attention, as the goal is not to introduce an intervention which new dependency for users, but one that helps to uncover the needs of people in, as Crabtree et al. put it, sensitive settings (Crabtree et al., 2003).

Communication

When looking at communication in a wider context, the different cultural backgrounds can lead to issues in the interaction between people. Bowe for example et al. named the "inherent speech practices", the way these vary depending on the context that the interaction takes place and the different expectations the interlocutors have in the use of language, as possible sources of problems in inter-cultural communication (Bowe et al, 2014). Hall sees the source of miscommunication in the differences between people from "high-context cultures" and those from "low-context cultures" (Hall 1976, in Bowe et al., 2014). He argues that in contrast to low-context cultures, where the messages are more direct and detailed, high-context cultures tend to use more subtle and less verbal modes of communication. He sees the problems arising when people with two different cultural backgrounds communicate. These differences often stay invisible and thus are not addressed adequately. But even if the people interacting share similar cultural norms, when the necessary information is not provided at the right time, this can also cause problems in the interaction.

Embodied interaction

With the development of technology, a new form of interaction on a digital level evolved next to the physical interaction. The approach of tangible interaction tried to combine both domains by connecting them. However, it was noted that this happened mainly through mapping, creating no real connection between both levels, instead of, what the embodied approach aims for, combining both elements in one experience (Hummels and van Dijk, 2015, van Dijk and Hummels, 2017). According to this theory, 'embodied sensemaking' is seen as the creation of shared insights in an improvised and creative process. An example case in which this was employed is Studio Blue (Jaasma et al., 2017). Studio Blue is a meeting room, which was iteratively designed and which aimed at encouraging the embodied ideation process between different stakeholders. One of the elements which was developed on the basis of the theory of embodied sensemaking and used in the Studio Blue project was the Embodied Ideation Toolkit (EIT). This toolkit consists of different objects that aimed at supporting the co-design process between different stakeholders by providing them

with a physical means to help them express their thoughts (Smit et al., 2016). It showed that these objects served as “anchors for building a narrative” and allowed participants to dynamically shift from a verbal communication level to a physical one (Jaasma et al., 2017). Furthermore the different objects placed in the meeting room were open-ended, with no fixed meaning and thus achieved to trigger the imagination of users. Lastly, they also fostered a common understanding among people, or, as the authors put it: “the use of these other materials helped them to create shared understanding by overcoming the limitations of language and jargon” (Jaasma et al., 2017).

Interesting about this example is in my opinion the potential of physical objects to act as mediator between several users, triggering a process of “participatory sense-making”, in which the interlocutors achieve a new level of joint interpretation through their interaction (De Jaegher and Di Paolo, 2007). This could help to overcome language barriers for example. Their deliberately openness in meaning or purpose can furthermore trigger imagination and gain new meaning in the interaction in the specific social context. This is not only useful for professionals, which can make use of the shift between divergent generative and analytical thinking to increase creativity (Armen, 2015), but it can also be helpful to enhance the interaction between users by serving e.g. as scaffolds of the thoughts of the different interlocutors in a conversation. That is why I believe the principle mentioned above can be interesting guidelines when tackling the interaction between expecting international mothers and their health care professionals, who can be seen as two parties with different backgrounds (possibly culturally, but also regarding their knowledge about the medical system etc.).

Question

The ideas described previously lead to the question if, and how, physical objects can, with their tangible properties and social situatedness, act as a mediator in the interaction between expecting mothers and their health care representatives, in this case their midwives. This topic was explored by addressing different levels of interaction and the underlying values found to be prevalent on them (an explanation of their finding can be found in the following section, ‘Context Inquiry’).
When looking at the communication between pregnant women and their midwives, the following levels were identified: first of all, the actual interaction between the woman and the introduced tool (1, woman <> tool) and the influence on the exchange of both sides (2. woman-midwife). Furthermore important for this situation are the woman’s perception of her own situation, her pregnancy, (3, woman<> woman) and her relation to her context (4, woman <> world).

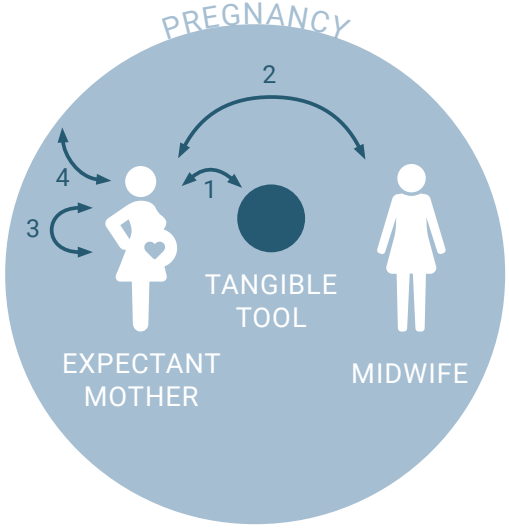

Fig. 4. Levels of interactions in communication between expecting mother and her midwife.

This resulted in the following question which lead the design process:

Can a tangible tool have a possible positive impact on the (experienced) communication between expecting mothers and their midwives, specifically looking at
(1) the general potential of tangibility and the possible impact such a tangible tool can potentially have on following topics:
(2) perception of safety,
(3) perception of own control and
(4) the feeling of being heard.

In the following I describe, firstly the identification process of the important values prevalent in such situations, then the design process of the tool and lastly the insights gained through in-context testing.

RELATIONS / INTERACTIONS
THROUGH TOOL

1 woman ‹› tool
2 woman ‹› midwife
3 woman ‹› woman
4 woman ‹› world

CONTEXT INQUIRY

The user-centred focus of this project entails the presence of different subjective and context-dependent perspective and views on the same situation. This, and the before mentioned complexity of the challenge demanded further research. That's why, additionally to the literature studies and guided by these, I started the project with a context inquiry by means of interviews, and simultaneous and complementary desk research. In the following, I describe the setup, execution and insights gained from these interviews.

Setup

Based on the points of interested identified in the before mentioned literature research, a set of topics and possible questions was developed. Nicky and me shared our personal insights and points of interests and joined them in one set of questions. These guided the semi-structured interviews, but didn't limit them, to allow for possible insights we didn't think of before to be uncovered. Furthermore, interesting topics which were found in the first interviews were used for later ones. The interviews were conducted by Nicky and me together, and in two cases by just one of us. They were recorded and transcribed jointly, after which we conducted the analysis process separately and focused on our individual topic of interest.
To gain insights about how women experienced they pregnancy in the Netherlands, we contacted international women that are currently pregnant and who already gave birth. We did this through contacts the midwife practice, as well as through posts on facebook. This way, six interviews with expecting / or already mothers (see fig. 5 for overview) were arranged. In order to gain additional insights, we also approached other people engaged in the topic. Therefore we spoke to a project manager of 'Moeders van Rotterdam', and the founder of an organization which organizes weekly meetings for international spouses in Eindhoven.

Interviewee Nr.	Position	Country of origin
1	Mother, recently gave birth in NL, before that first child in GER	Germany
2	Expecting mother, pregnant with second child	Portugal
3	Mother, Gave birth to first child	Colombia
4	Expecting mother, pregnant (last weeks)	Greece
5	Mother, gave birth to first child	Ecuador
6	Mother (and father), gave birth to second child, both in NL but in different cities (very different experiences)	Colombia
7	Researcher an project manager at 'Moeders van Rotterdam'	Netherlands
8	Founder of organization for international spouses in Eindhoven	Netherlands

Fig. 5. Overview of interviewees.

Prototype for inquiry

As a tool to provide an overview of the pregnancy process as structure for the conversation and possibly uncovering unknown aspects, a simple prototype was made (see fig. 6-8). It consisted of three magnetic boards, each one representing one trimester of the pregnancy, which were organized in the single weeks of pregnancy (top plane) and different categories, like meetings with midwives (side plane). These categories were placed on the side of the board in order to provide guidance for organization, but leaving enough freedom to include personal categories in the planning. Different magnetic tokens could be placed on the board, to mark meetings for example. Some of these tokens had icons representing their meaning (midwife for example), while others didn't have icons, but

Fig. 6. Prototype for inquiry, top view.

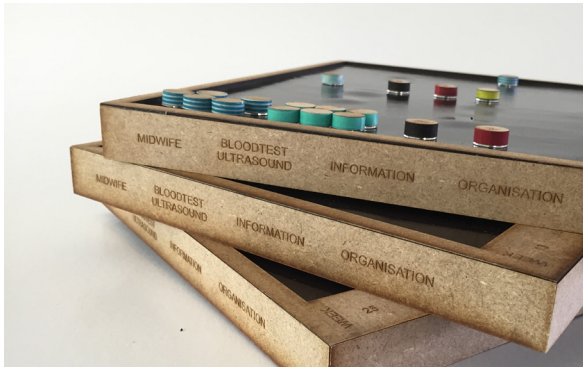

Fig. 7. Prototype for inquiry, view on side panel.

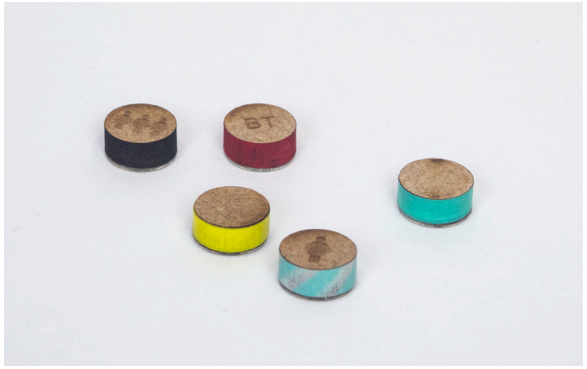

Fig. 8. Prototype for inquiry, detail of tokens.

different colours. This should allow people give the tokens an own meaning and using them to communicate their personal interests. Unfortunately, the midwives we contacted didn't have time to provide an expert evaluation.

Analysis

After conducting the interviews, they were intermediately transcribed. During the process of transcription, we noted the aspects we thought were interesting or important. This was done alternately by Nicky and me. All further steps were done individually.
As a next step, I went through all interviews another time, using the open coding of grounded theory method to identify interesting topics (Bryman, 2012). Subsequently, I used a list of topics to select quotes from the interviews, which were then printed. These were organized and clustered in groups, which I gave a title each (overview in appendix I, fig. 2-3). After doing this, another coder looked over my structure. She identified two categories which weren't differentiated in my structure and suggested to divide one into two subcategories.

Outcomes

When first of all looking at already existing programs which are aimed at supporting specifically vulnerable, or migrant women in the Netherlands, a few things are interesting. MoR for example is based on regular meetings between the expecting mother and the same team of people, which put a lot of attention into staying well informed. Furthermore, the program aims at empowering women by providing them structure (through meetings and a book) and the meetings take place in a known and comfortable environment.

The organization 'Indigo Wereld' established the support program 'Get in Touch', which consists of weekly meetings for international spouses in Eindhoven. It aims at making them familiar with the city and thus help them to feel more at home. It acknowledges the fact that moving to another country (with or for somebody else) changes the balance in a relationship and aims at empowering these women by an increased independence.

Furthermore, the analysis of the interviews made it possible to evaluate some of the initial hypotheses and revealed some values which seem to be important in this context.
First, it was noted that, different than expected, the planning and information about the process are not a mayor problem. Women seem to generally be well informed by their midwives and not to miss important knowledge.
Secondly, as the health care system of the Netherlands is differently structured than in many other countries, it was assumed that the challenge was to recognize and understand this difference. However what seemed problematic instead is to adapt to the role that one feels is expected and change the own expectations, which are influenced mainly by the own country of origin (e.g. when C-sections are common in home country while in the Netherlands they are not an option for normal births). This appropriation phase demands the women, and their loved ones, to mentally adapt to the circumstances, which can take some time. Furthermore, a pregnancy is a highly personal experience which is perceived differently by each woman. An interesting metaphor that was used was of the pregnancy as a "completely new universe" through which women have to "navigate" (interviewee 3). This can already be challenging when being used to the environment and the health care system, but can become more difficult when these things are unknown too.

The most important value which was detected in the analysis and which seems to be connecting and overarching the others is the one of being heard / respected.
Being heard relates to the own wishes and thoughts and if they are included in the process. Regarding own needs, interviewee 3 said: "To a certain extend I think they (own wishes) were heard, but they were not acted upon". When this happens, it can lead to frustration or, as interviewee 6 describes it: "I just got really upset that first they don't take me seriously and then, second of all, they are rushing him (newborn son) and nobody comes and tells me."
Feeling respected doesn't only relate to whether personal wishes are taken into consideration, but also to the way the communication works. When talking about the differences in the way of giving birth (while the C-section is the normal procedure in her home country, here she had to do a natural birth), interviewee 5 said: "You know, tell it nicely, I come from a totally different situation, it is something that is like this for generations. (...) So for me it is totally new, knowing that I will have pain". If the communication functions in a positive way, it can make it easier for the expecting mothers to accept and adapt the differences in systems and contribute to a positive experience. Interviewee 6, who had two very different pregnancy experiences in the Netherlands, described the second one as follows: "I always felt like they heard my concerns and that they were really polite, even if they disagreed with me, they would argue, counter argue me in a ways that I didn't feel disrespected". So in order to assure a positive interaction and experience, it has to be made sure that the concerns of the expecting mothers are recognized – and that they are aware of it. Furthermore, if there is a reason for them not to be taken into consideration, it should be made clear, so that everybody involved in the process understands it.

If the communication between expecting mothers and health care representatives works well, it can also promote the feeling of safety. This is not based exclusively on medical factors. Additional difficulty adds the fact that the factors which promote, or weaken the feeling of safety, can shift during the process of a pregnancy. It can be related to the feeling of having to ask for medical measures ("because if you don't ask they will not give you. And it can also be a little bit scary to think", interviewee 2). The feeling was also related to the possibilities of midwives as health care professionals ("my own concern is, I don't know how fast they could see if there are any complications, that's the only thing", interviewee 4, and: "The midwives are great, but of course, they are like: 'The baby is a good size' – What is a good size?", interviewee 3). This shows that despite they personally like the midwives (they were "great"), women didn't feel assured by them. A way of changing this would be to give midwives more possibilities as health care professionals (to conduct tests e.g.), or to introduce more standard tests for example. However, assuming that systemic changes take time in implementation, it is necessary to target the topic in another way. That this task is a difficult one shows the quote of interviewee 3, who said: "So, I think maybe it is how it is organized that it makes it hard for one to feel truly reassured".

Significantly contributing to the feeling of safety is also the perceived control over the own situation. This is shown for example in the fact that the women we talked to preferred to give birth in the hospital, as they felt that they would be safer there if anything would happen ("one has everything, if something goes wrong, then you are there", interviewee 1; "there is nothing here (home)", interviewee 5). In order to adapt to new situations, expecting mothers need to mentally get used to unknown things ("so I started to wrap my head around the natural birth", interviewee 3 for example). Once this is done, they feel more in control of their situation ("...and finally I got contractions, and we were incredibly prepared", interviewee 6). However, if something unexpected happens, they quickly loose this feeling. Interviewee 6 said "We were not ready, we were unprepared to go to the hospital. We were not expecting that (...). It didn't fo the way we had planned I guess, so that causes already some frustration". Feeling the own baby furthermore increases the perceived control ("You feel a bit more in control, you feel comfort in the fact that your baby is moving and that you know things are going well", interviewee 6). However, before the women feel their babies, they rely on their health care providers. Many expressed the wish for more medical test, which could possibly serve as a means to reassure ("if you have something, you can't really tell", interviewee 4; "because there is no use of technology", interviewee 6). Especially for first time mothers, this is particularly strong, as they feel "not in control of the process, there is nothing (...) [they] can do" (interviewee 6).

A very essential aspect when talking about international expecting mothers in the Netherlands is the one of support. Coming from another country, these women often don't have their families close by and thus lack the direct support of their relatives ("And I really wanted to have my mum to help me out. Because you're feeling so sick, you don't have any energy and you're so emotional. Skype doesn't fix everything", interviewee 6). The partner is an important person who has to be integrated in the process (interviewee 6 said repeatedly "we gave birth"). When they don't feel supported by their health care providers, they can feel "completely alone" (interviewee 3 and 5) and "frustrated" (interviewee 5). Interviewee 5 expressed that she "needed a little bit more support. (...) They should be a little bit more, just present". Positive effects have shown the connections to a group of people in the same situation ("you feel like you belong to a group", interviewee 4) or of the same cultural background ("it could be that people from your own culture could be useful in moments where you are emotionally and physically in a place you have never been before", interviewee 3). This connection to others who share a common base of experiences and expectations can thus promote a positive experience.

Closely related to this is also the relation the women have to their health care providers. Many women coming from other countries are used to having one gynaecologist to which they regularly go and who knows them personally. Thus, they built a relation and trust over time ("I could speak to someone that knows me, understand my story, can relate to it and can do something about it (...) they can connect the dots in quicker ways", interviewee 3). When being pregnant in the Netherlands, the women meet with midwives – mostly not only one but several – which they didn't know before. This makes it impossible for them to feel the same kind of connection, leading them to experience the interaction as "impersonal" (interviewee 5), "cold-hearted" (interviewee 6) or "totally not connected" (interviewee 5). As the health care state of people doesn't depends only on their medical results, it is an important topic to take into consideration. Interviewee 3 describes it as follows: "Because I do feel that the health care is to a great extent about trust. It is about a relationship, a human element that would make you feel: 'Yes, this is it, let's move on!' ".

EXPLORATIONS

In order to explore how the relevant values could be supported, I tried to identify factors which could promote them and translated them into physical explorations. The factors are the following:

Overview

While information about the process itself is not the problem, having an overview of it can allow doubts to be identified earlier and promote the feeling of being in control. Making this overview physical and tangible can furthermore encourage an exchange, providing a tool to assure both sides are on the same page.

De-verbalize communication

A physical object as mediator between people provides another level of communication, which can enrich the interaction, promote new ideas and help overcoming challenges due to language barriers for example. The physical presence of objects can furthermore support the feeling of being heard.

Ease of use

As a first time pregnancy is a completely new experience, it is a challenge for every woman. Her attention focuses on the changing situation and how she adapts to it, so the design shouldn't demand for too much mental or physical effort, in order to support and not to disrupt the interaction. The design should hence be easy to understand and manipulate, so that it can invite for exploration and allow for an easy expression of personal concerns.

Open for personalization

Pregnancy is a very personal experience and thus different for everybody. That's why the design should possess some openness, allowing for a personal connotation. The possibility of (to some degree) free manipulation would make it possible for the design to react to and include the subjectivity of the situation, possibly increasing the experienced support.

If the tool achieves to provide the feeling of being heard and supported by the other side, and being in control of the own situation, I think it contributes to increasing the feeling of safety.

Explorations

Based on these insights and ideas, I developed several low fidelity prototypes (see fig. 9) to explore the expression possibilities of the different factors and their design directions. They all showed a representation of the pregnancy process, allowed to track the progression and allowed for markers to be placed on them. These tokens not only served to visualize elements, but also as "stoppers", which would impede the progression bar from moving on. This should encourage reflection about their meaning. In order to evaluate their potential, I discussed and evaluated them with fellow designers.

The shapes of the explorations afforded for different movements. While the round plates and the bar (idea 1, 2, 3, as well as 6) allowed for a smooth movement with progression, idea 4 and 5 demanded for being turned every trimester. While this could give more structure to the process (additional organization in trimesters), they provided lower fidelity and less intuitive interaction possibilities for the placement of tokens. As the design aims at improving the interaction between expecting mothers and their midwives, it is furthermore important that the object is easy to transport. For this reason, idea 6 wasn't explored further as its size limited the movement possibilities.

Because of its intuitiveness and clear overview, I chose to focus on the ideas 1 and 2. They mainly differed in one aspect: While idea 2 symbolized a process with an end, idea 1 represented something that would continue in the same loop. As this doesn't correspond with the represented process, I chose to proceed with idea 2.

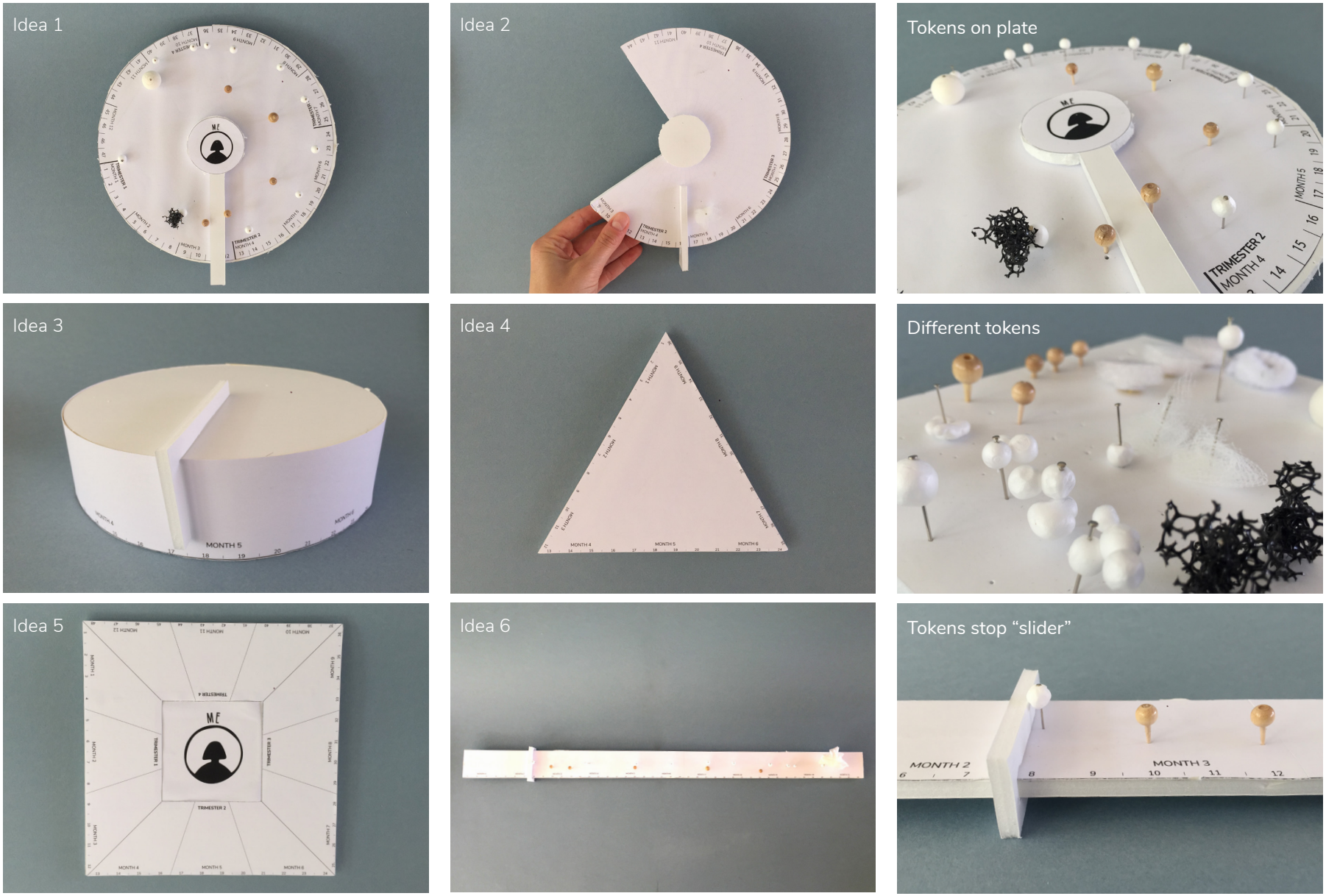

Fig. 9. Overview low-fidelity prototypes for exploration.

ITERATION 1

As a next step, I developed the first iteration of a design artefact that aims at enhancing the communication between expecting mothers and their midwives. An overview illustration is shown in fig. 10. It consists of a circular plate which can be rotated around a middle axis. A handle indicates the current state in the pregnancy. Different tokens can be placed freely on the magnetic surface. These tokens posses different tactile qualities, allowing for a personal association and attribution of meaning. The tool is supposed to accompany women in their process, providing a physical overview of what will happen. Expecting mothers have the tool at home and rotate it further. In case they have a doubt, or something they want to talk about at their next meeting with their midwives, they can place a token on the surface. They then take it to their meeting with the midwife. Here, the midwife can immediately see how the expecting mother is feeling and use the tokens to talk about is feeling, and use others to mark future events, like ultra sounds for example.

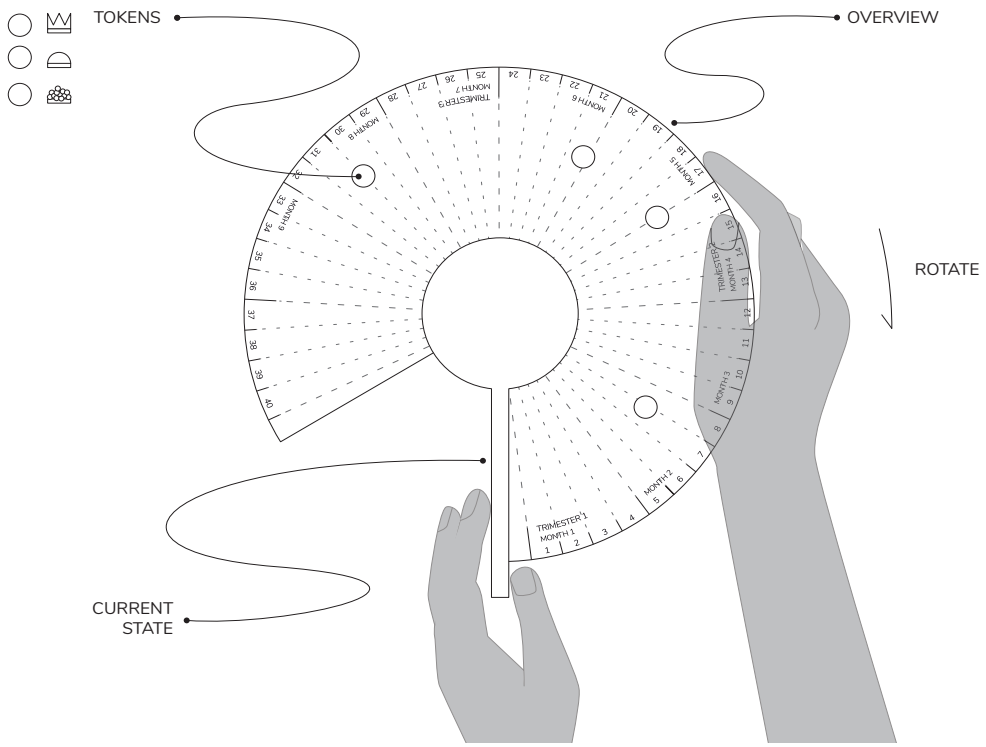

Fig. 10. Overview of design concept.

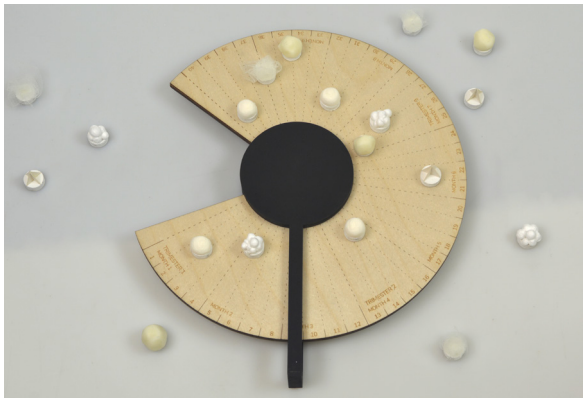

Fig. 11. Plate and tokens.

Fig. 12. Tokens with different tactile qualities.

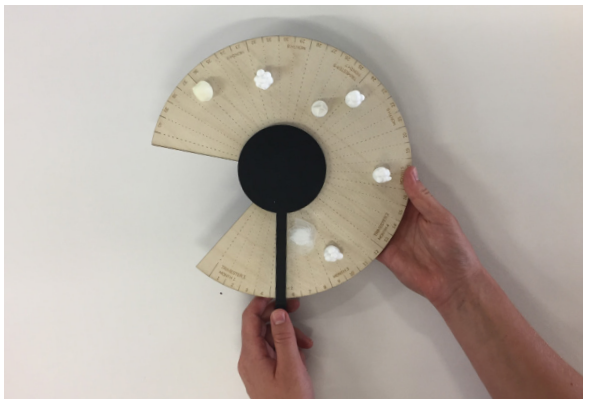

Fig. 13. Plate in use.

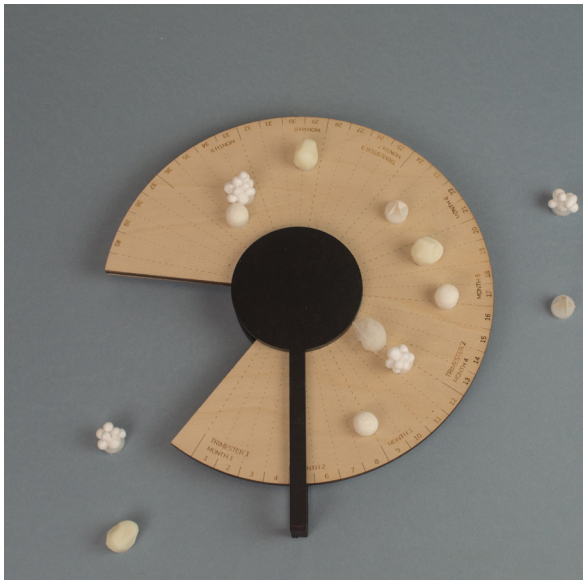

Fig. 14. Tokens on plate.

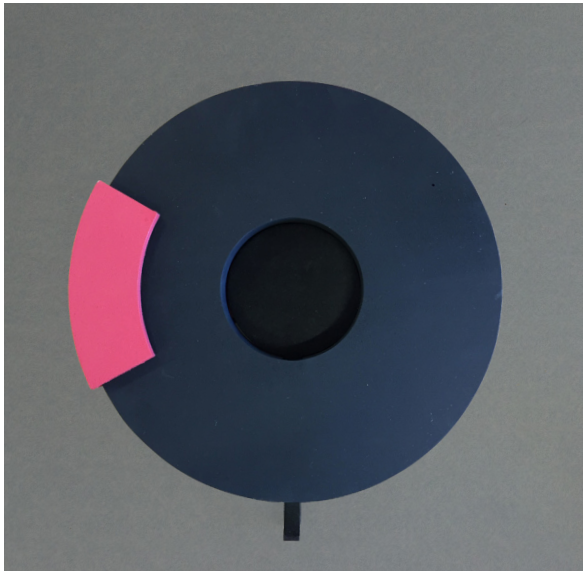

Fig. 15. Plate in closed cover case.

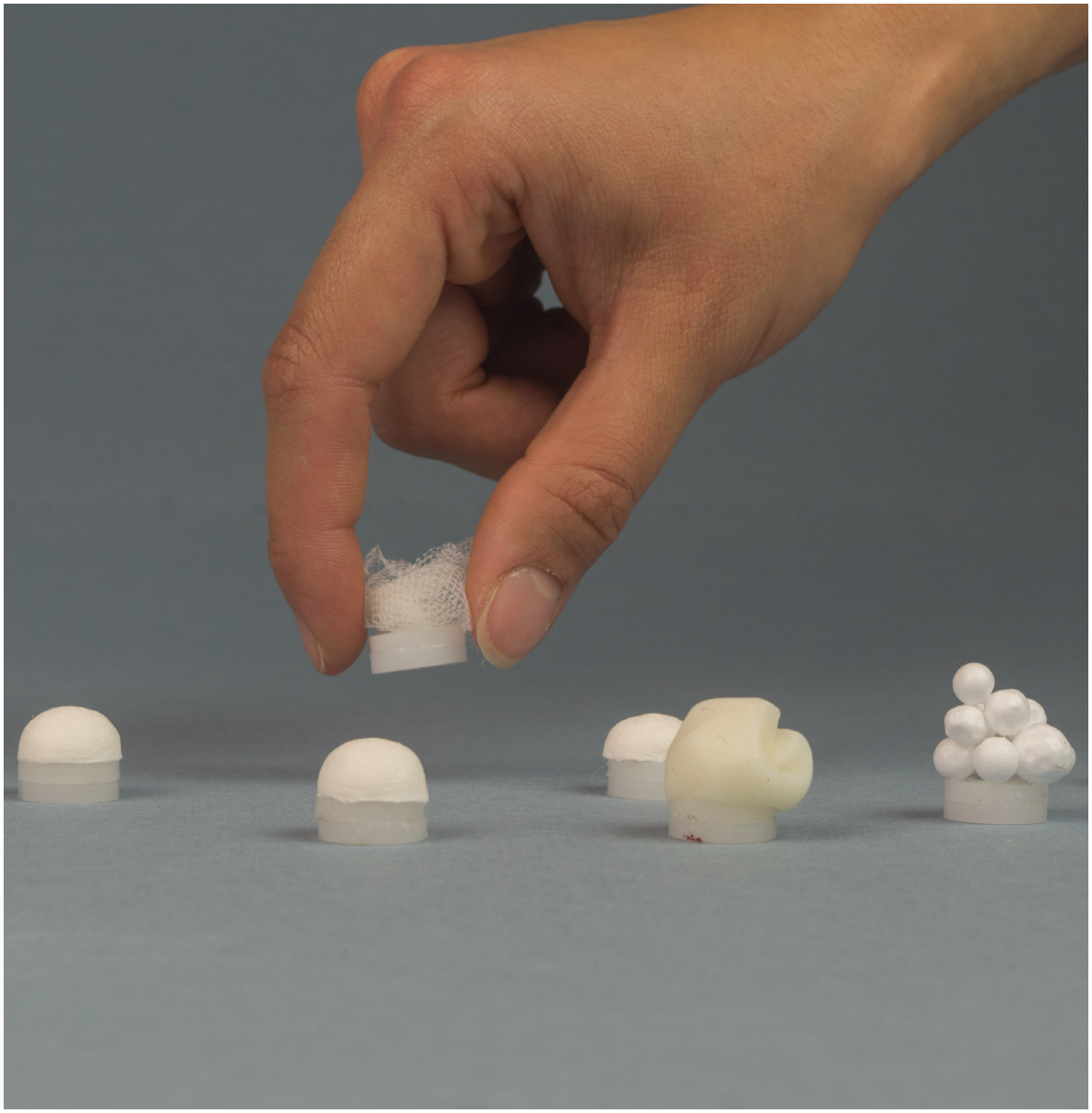

Fig. 16. Detail tokens.

User Evaluation

To evaluated our ideas, we visited the International Health Care system and met with a midwife, who explained how the system in the Netherlands works and what they do in their midwivery practice. After her presentation, we were able to present our designs and get feedback from two women from India, who were planning to start a family here in Eindhoven.

One thing they pointed out was the selection of colours and materials. While one of the women would prefer to have tokens with different colours and a plate material which would contrast more a while wall, the other one preferred the current execution. This discussion showed that is makes sense to consider the possibility for customization. Furthermore, they suggested to indicate in some way which is the next meeting, for example through light indication. Lastly, they appreciated the possibility to place a token to remember a question for example, as they both recalled easily forgetting about such things.

Fig. 17. User evaluation.

Presentation on Demo Day

On Demo Day I presented a physically working prototype. The set up can be seen in fig. 18. We introduced the context of our projects in a joint poster (top), and I elaborated on my design with the poster and artefacts as seen in the picture. The design consisted of a magnetic plate, which could be rotated around a middle axis. The tokens could be placed and moved around on the surface of the plate. The plate could be covered and closed (as can be seen in fig. 15) to show how it could be transported.

The Demo Day was a useful moment to gather feedback and ideas of visitors. The positive reaction of people and interest in the topic was reassuring for my work. Furthermore, the project manager of the program “Living in” of the municipality of Eindhoven expressed his interest in my work and in a possible collaboration. This program aims at integrating internationals in Eindhoven better in the city by improving their living conditions.
Even if a direct collaboration doesn’t result in the near future, it is an interesting possibility of exchanging ideas and standing points.

Fig. 18. Setup at Demo Day.

SEGMENTATION TOOL

REFLECTION

In the initial research it became evident that not all vulnerable women share the same risk, ability to be autonomous, communication efficacy, socio-economic background and lifestyle. In order to develop differentiated support strategies and to help midwives to respond more effectively to vulnerable women with different needs, Nicky and I were tasked to jointly develop a segmentation tool.

Introduction

In our previous research we have learned pregnancy is a highly personal experience (”own reality”) and thus every case it unique. Not only can the experience of the pregnancy itself be very different from woman to woman, physically as well as mentally, but also the cultural background can differ. Each woman brings her own set of beliefs and expectations of the healthcare system into play, which has an essential influence on the interaction with the health care professional. In addition, health care professional can lack the time, due to the limits of a consultation session, or the knowledge, due to possible inexperience with different cultures, to identify and address these factors adequately. These can be reasons for a woman not getting the help and support that she needs. Thus, if midwives had the means to easily identify the specific needs and preferences of expecting mothers, they would possibly be able to identify the level of support needed and provide adequate help. This could lead to a more positive and safer experience for women.

In the current perinatal care system, the link between the primary and secondary care paths is not always optimal yet. Efforts are being made of bringing these two care paths closer together. The concept of a shared care team is for example envisioned, here the different healthcare professionals work together in one team to monitor the expecting mother more seamlessly. However these are not the only professionals that come in contact with (vulnerable) pregnant women, therefore also other professionals such as the social worker and psychologists should be included in these shared care teams.

Identifying which preferences and specific needs an expecting mother has can help all the stakeholders involved in the process. The purpose of this study is therefore to develop a concept research tool that can deliver a potential new approach for insight generation, new insights and learnings for the broader project, as well as a segmentation tool that can later be validated and further refined. That is why it was decided to develop a “segmentation tool”. This should allow midwives, health care representatives and other people who come in contact with expecting mothers, to identify the different risk types of women and how to react to their personal situations. Thus, tailored advice should be provided, depending on the types of challenges which women face and their attitude towards given advice, giving expecting mothers the type and amount of support that they need and are able to act upon it.

It wasn’t the intention to develop a fully finished tool, as the evaluation and verification would have taken too much time and was not doable within the time frame of this project. The content of the segmentation tool is based on previous findings, and the limited field and desk research which was possible within the given time. This work is aimed as serving as a framework for future development directions.

Development

Desk Research Risk x Ability to Act

The starting point of this tool was the finding from our previous research which shows that women show different types of risks (that every pregnancy is “a unique experience”) and that women thus need different types of help. However, which type of advise and how much guidance a woman needs doesn’t only depend on her personal probability of suffering certain risks, but also on her ability to take action against risks or degree of patient adherence (Pedersen et al., 2013). These two factors were supposed to be the axes defining the matrix on which different women segments could be identified. Figure 19 shows schematically how this matrix could be read.

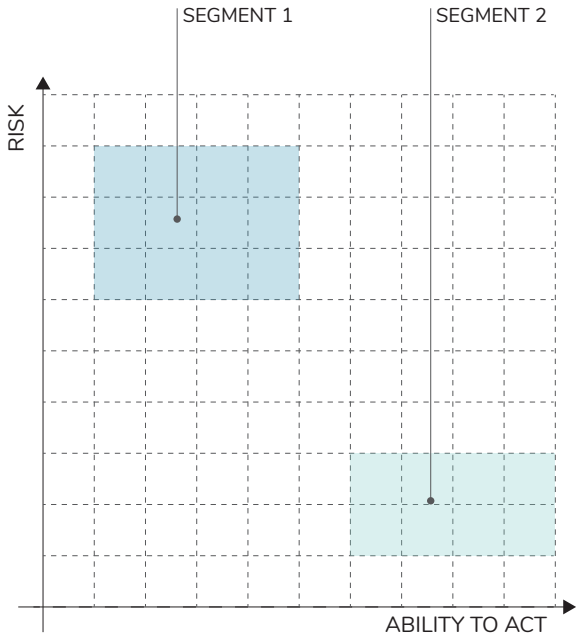

Fig. 19. Mapping of risk and ability to act.

2 axes matrix

In a further development, the Rotterdam Reproductive Risk Reduction risk score card (R4U) (v. Veen et al., 2014) served as a guideline to gather possible risks. The R4U card is a checklist, which is intended to help to identify pregnancies with an increased risk potential by assessing both clinical and non-clinical risks.

The R4U assesses the risks by means of six domains: “psychosocial and economic, communication and ethnicity, pregnancy onset and lifestyle, [...] clinical risk items in the medical [...] and the obstetrical domains” (van Veet et al., 2014). The domains consist of different factors, if one of these factors apply to expecting mother it is graded. All the applying factors are eventually summed up resulting in a total risk score which are eventually summed up resulting in the total risk score. However, we noticed that certain conditions increase the probability for some risks to apply. For example, studies have shown that a low income increases the probability to smoke (Timmermans et al., 2011). This dependency was represented by placing conditions on the x-axis, risks on the y-axis and marking with different colour intensity the presumed high probability of risk prevalence (= ‘fixed dependency’, dark grey), middle high probability (middle grey), and low probably (light grey). Figure 20 shows the general set-up without the specific dependencies. The bottom line indicates the different care paths that could be taken with certain conditions.

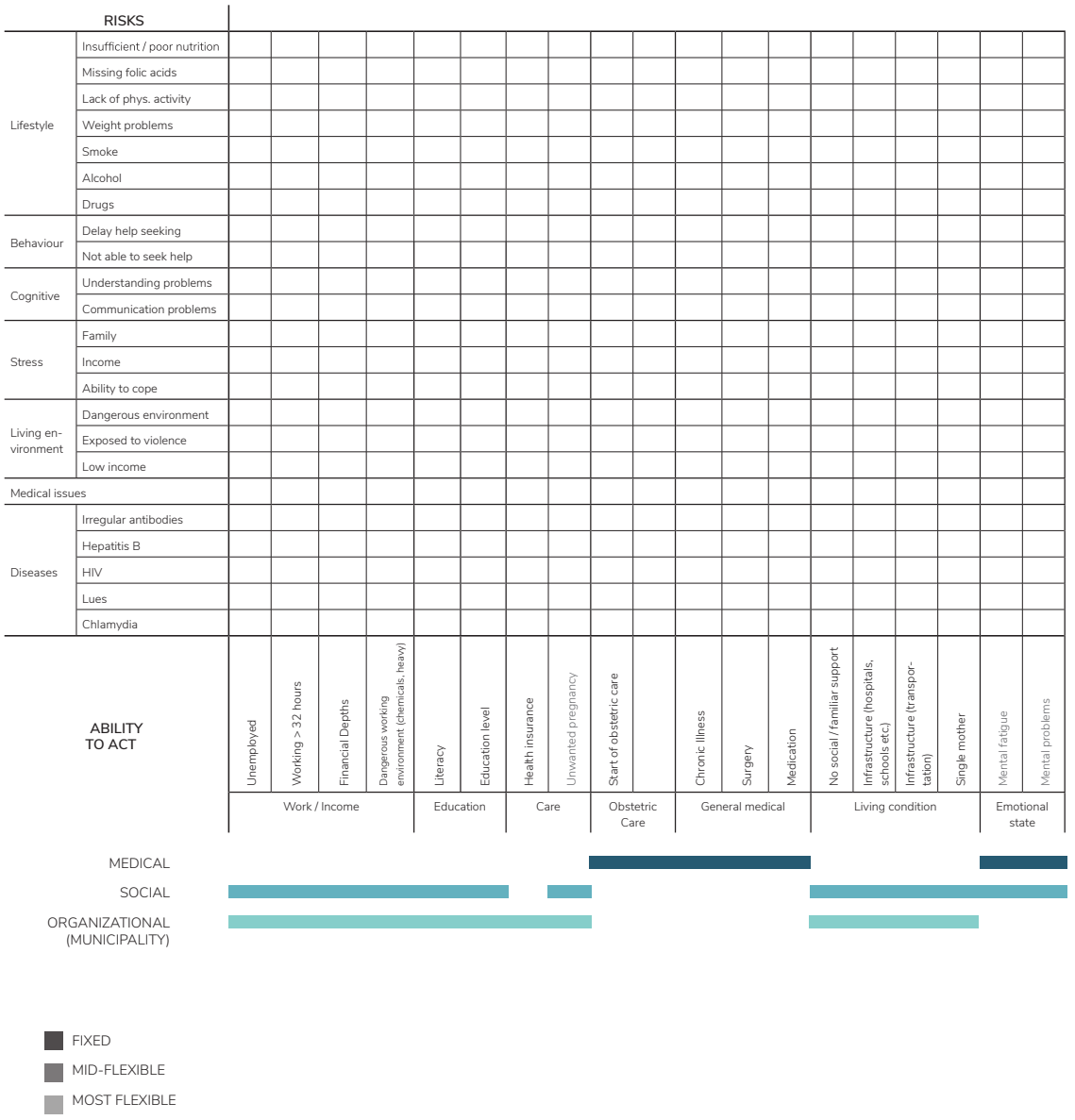

Fig. 20. Overview 2 axes matrix.

4 Layers

In the process of creating the matrix, we noticed that the kind of conditions were actually different, and thus the way in which these could be measured should differ. Some could be evaluated quantitatively, while others were more qualitative (while questions relating income are very factual, the level of social support is subjective). Within the categories of subjective and objective factors, risks could furthermore be divided based on their conditions. Thus, four different categories were created, in which the conditions were organized. Factors influencing the 'general medical' and the 'environmental' conditions could be evaluated in a more quantitative manner (e.g. chronic illness or education level), while the evaluation of 'living condition' and 'emotional' situation was more qualitative (e.g. social support and mental problems). The risk axis (y-axis) remained the same for all of them.

The way in which this was designed was as follows: For each woman, four empty matrix sheets would be placed on top of the reference matrices (see fig. 21). By going through the different conditions (physically, on paper, or digitally, via an app for example), the probable risks could be identified. If a condition was applicable, the same colours as on the reference matrix would be filled in the personal page of the individual woman. When all the four levels were checked, the individual pages could be compared. If a certain risk was marked several times, this could be used as an indicator to monitor it. Thus, a personal probable risk analysis would be created. It should be said that the evaluation of the matrix didn't show all the actual risks, but rather the ones with a high probability of being present.

Next to the structural adjustment, we furthermore extended the R4U risk overview with the findings from our previous research. The R4U checklist for example only takes into consideration the language barrier as a possible risk factor when it comes to migrant women However, we noticed in our previous explorative research that coming from a different country brings much more into play such as an extra layer of stress due to not having any family here (qualitative level 2: emotional) and preferences regarding the birth (risk).

Fig. 21. Overview of the 4 layers matrix of risks.

Tiers

Even though it was stated that the evaluation of the R4U cards in most cases took five minutes (63%, see v. Veen et al., 2014), the apparent complexity and work demanded to evaluate the segmentation tool matrices was a factor which could have a negative influence on their acceptance by midwives and doctors. We explored both the possibilities of different structure alternatives and of separating questions within the pregnancy timeline. The new form resulted from the separation of the questions.

Following the separation of the 4-layers matrix, a new distinction was made based on which factors could be answered before the first midwife meeting by the expecting mothers, which factors should be addressed during the first intake and which should be looked at beyond that. The quantitative factors are able to be answered before, since these are mainly factual. The qualitative layers consists of more complex factors which often cannot be answered so easily but need more context.
In the process of separating the questions it was noticed that there is not only a difference in factual and subjective but that there is also a difference in sensitivity level and thus how easy the questions are to be asked and/or discussed. For example, asking and answering questions about the home environment is easier than discussing someone's mental or cognitive state.

Taking into consideration that the women from the vulnerable women target group might struggle with communication because of their education level, mental state or language barrier and due to the sensitivity of the topics, we believe that these types should be addressed in another way and possibly supported by different tools.

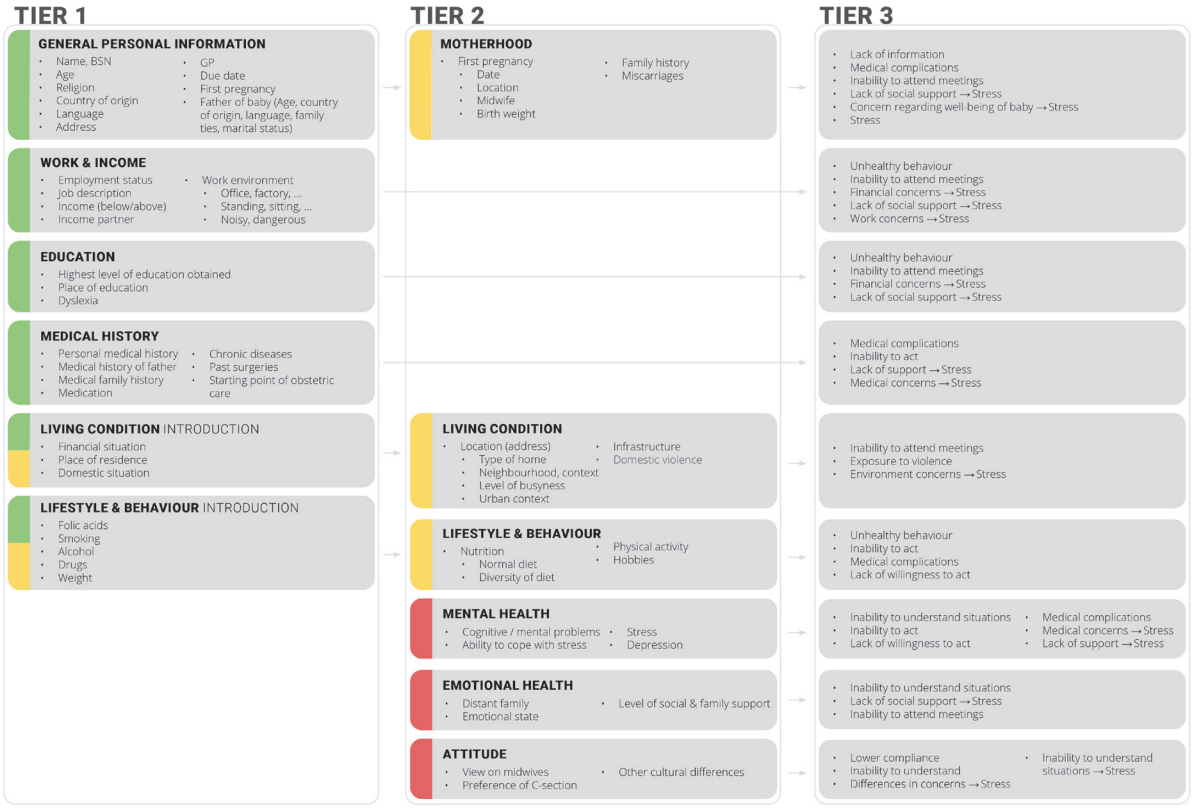

Fig. 22. Division of questions in tiers.

The separation of the three moments on the timeline (before, during and long-term after the first midwife meeting) resulted in a 3-tier-form, which provided a structure for the risk assessment intake. It consists of: Tier 1, the questions that should be asked before the first midwife meeting; Tier 2, the questions that are discussed during the first midwife meeting; and Tier 3, the risk factors that should be monitored throughout the pregnancy by the midwife. The colours indicate the sensitivity rating, green being low, yellow medium and red high.

Toolkit

Due to the different level of sensitivity, we believe that the framework needs to provide different tools to address the topics and uncover the prevalent risks. Tier 1 would be filled in by the expecting mother before the first midwife meeting, either at home or in the waiting room. As the burden should not be high and the sensitivity rating is low, a questionnaire could be sufficient. The questionnaire addresses questions regarding both the expecting mother and father, work & income, education, general medical history and already introduces the medium sensitive topics living conditions and lifestyle. The questions are not complex and offer scales for some topics that might be regarded as intrusive by some cultures (e.g. earnings).

Within Tier 2, there are two levels of sensitivity: medium and high. Both are subjective and can be difficult to get across well. For the medium sensitive questions (motherhood, living condition and lifestyle & behaviour) a simple browse and pick tool was developed as well as a social-circle tool.
The browse and pick tool introduces several topics regarding the women's living environment, infrastructure and lifestyle by a range of pictures. The expecting mother is asked to pick a picture which represents her own situation best. By doing this in the meeting, they can discuss why she picked a specific picture and provide some more context for both sides. The cards do not address all topics as it is likely these are already uncovered in the previous conversation.

As mentioned earlier, it can be difficult to uncover topics with a high sensitivity-rating due communication struggles, and therefore it might need a different kind of means for communication and expressing. Research poses tangible tools could be a way to enable women to express their feelings and thoughts (Smit et al., 2016).

Fig. 23. Segmentation toolkit, view from above.

To provide these kind of tools an elaborate exploration needs to be done, however the time frame was limited thus it was decided to explore some tools from an already existing toolkit which has been explored before and is a result of a bachelor thesis project from Industrial Design.

Tier 3 is an evaluation of the first and second tier. The answers resulting from those two tiers could be directly linked to the possible risks which are mapped in tier 3.

Fig. 24. Segmentation toolkit.

Risk Evaluation and Profile Creation

To be able to segment women into different risk categories and to create a risk profile and eventually provide tailored support, it is not only important to identify the possible risks but also to understand correlation between the different risks.

First we identified the overarching categories,, differentiating medical, social and personal types of risks. Then the risks were organized accordingly, as can be seen in the Risk Wheel. Some risks, such as exposure to violence, can be medically or socially induced, and thus were placed on the crossover, influencing both levels.

The questions from tier 1 and tier 2 can be filled in the according axis and add up to the risk level of that specific category. The sum of the risk values in a certain category (medical, personal or social) determines which care path needs support.

Next to the medical, personal and social risks, the risk wheel can help determine whether the woman is capable to act and/or willing to act. The difference between is important as it defines how to communicate towards the expecting mother as both are influenced by different aspects and therefore require different kinds of support. As for now willingness to act is defined as a combination of medical risks, low compliance, stress and differences & concerns. Ability to act is defined by a combination of medical risks, inability to understand situation, lack of social support and lack of information.

This is our first proposal based on our previous research. For further development and refinement, more extensive and targeted research and validation needs to be performed.

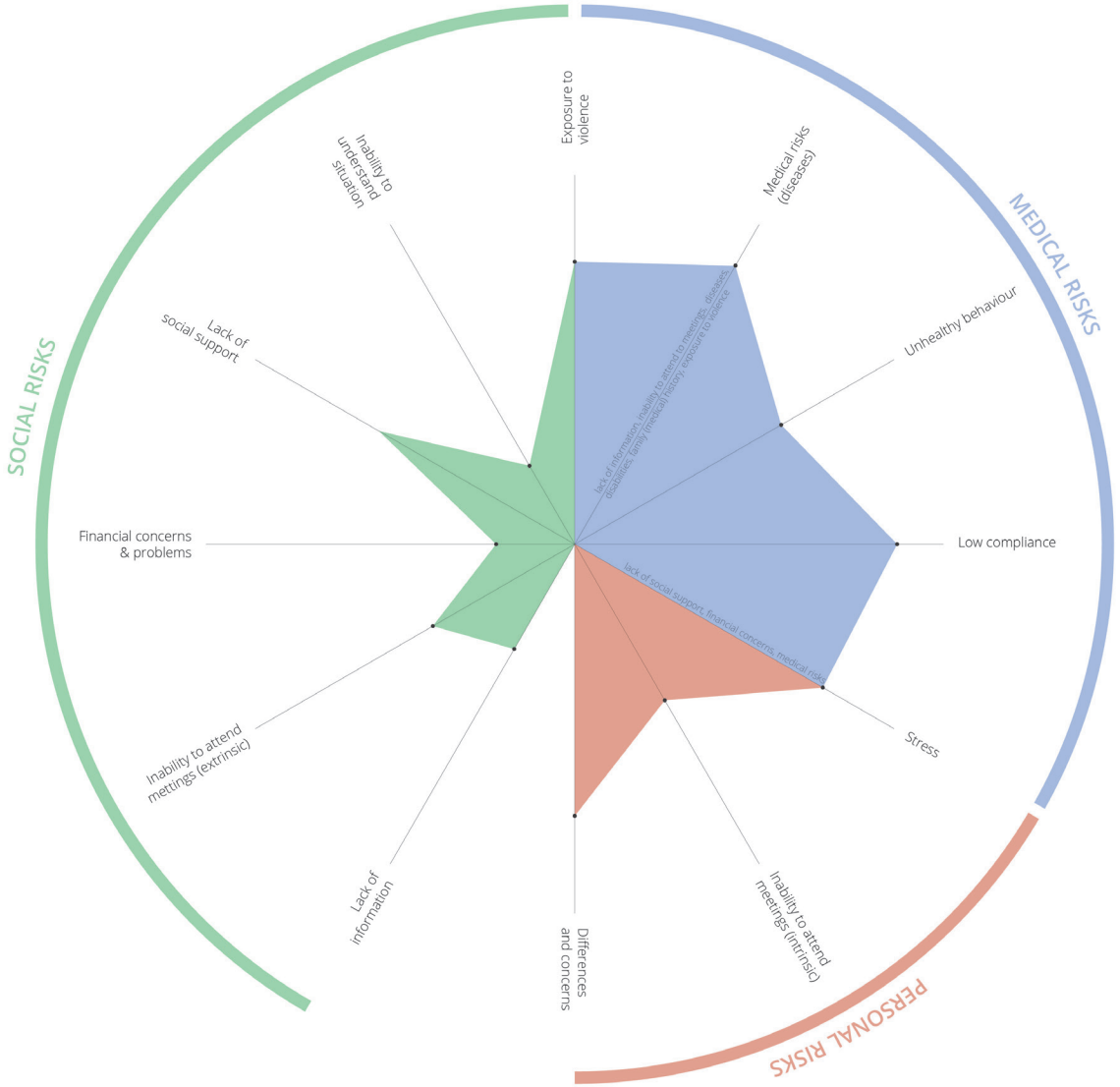

Fig. 25. Risk evaluation and profile creation scheme.

Expert Evaluation

The tool was partly evaluated with three different experts who have experience with the vulnerable target group and/or experience with the perinatal care system from a medical professional point of view. Each of them was interviewed about their experience and were asked to give their opinion on the tool.
The midwife, the social worker from COA (Dutch asylum seekers organisation) and the pregnancy coach with a background in midwifery in the hospital provided many insights which reflect the advice in the next section.

Advice

Framework evaluation

One of the most important questions that needs further research is: When is something actually a concern? When do you categorize something as a risk as some factors might be risky only if other factors also apply? This is something the experts sometimes have difficulties to asses, so more precise guidelines are needed in order to make a proper risk assessment.

Framework in use

We believe the tool can best be used in a shared care team setting as is envisioned for the future of perinatal care. Some aspects can best be evaluated by a perinatal care professional while others could be assessed by psychologists and social workers. Each professional has his/her own expertise area which should be applied to the framework accordingly to achieve the best risk assessment.

When it comes to the interaction with the expecting mother, it is important that the woman feels comfortable and that mutual trust is present. Only then will the woman share personal information, will the medical professional be able to make the right risk assessment and will the woman accept the necessary help. Not only does this mean the environment should feel comfortable, it is important for the medical professional to be aware of any (cultural) differences and what is 'normal' for that specific expecting mother.

One important remark from one of the experts is to pay attention to the way of communication (not act like "you know better or truly understand because you can't. If you do so it will make them less likely to be honest, to share and accept"). The toolkit thus should not only provide a guideline of how to use the tool, but also of how to communicate about it, including the need to explain the reasoning to the expecting mothers.

Future steps

The toolkit offers tools with different levels of expression, for the different tiers. It is however possible that some women feel more comfortable with a certain type of tool. This should be further explored, leading possibly to different types of tools addressing the same topic.

Furthermore, to achieve the best possible implementation, it should be looked at the different topics and which part of the shared care team is the best (in terms of qualification and time) to assess these. We advice to talk to the different members that could be part of the envisioned shared care team in order to understand their perspective better and possibly tailor the tools towards their skills and needs.

We believe that designers could play an important role in this process, as they can use their expertise to gain an understanding of the different stakeholders involved, mediate between them, develop intervention propositions and test these. We believe that this is a dynamic process which needs constant evaluation and revision. We think that the tool we have developed and insights we have won with it can serve as a starting point for future work on this topic.

ITERATION 2

Possible context expansion

As an opportunity to gain a better understanding of the context-specific factors prevalent in this situation and how they can be dealt with, it was discussed to do an additional user test in another setting. The possibility of doing this in Germany was the most probable case, because my existing connections and the fact that I speak German would have simplified the organisation process. The main differences between the German and the Dutch health care systems are that in Germany expecting mothers meet their gynaecologists during their pregnancy, and not a midwife. Furthermore, the number of checks is normally higher than here.
In order to analyse how these differences manifest themselves in real life, and to evaluate the opportunities of such an expansion of project context, I conducted three interviews with migrant women (from Brazil, the US and Japan) in Munich after the first phase of this project. These have shown they were mostly happy and satisfied with their experience in Germany. They all dealt differently with their limited German proficiency (either in English, or in mother tongue, or making use of English and translated German words), but this didn't seem to be a problem in any case. They actually reported similar difficulties to the women in the Netherlands. A missing personal connection and support, like it is usual in other cultures, and a lack of overview of the next steps (regarding the health insurance e.g.) were named as examples.

REFLECTION

Through these interviews, I intended to evaluate the initial idea of a global understanding of local effects, which could support the development of an approach guideline (Gardien et al. 2014) for possible value amplification in different contexts. However, as at this point of the project the focus had shifted, this cultural aspect moved into the background of attention. This doesn't mean that is is not a valuable exploration direction, but rather that it the current project stage demanded for other focus points. That's why, my project focus shifted too, which is described in the subsequent chapter.

Concept refinement directions

Based on the feedback received regarding the first iteration, these topics needed further refinement:

Tokens

As they were until then, the tokens were very open ended and had almost no given meaning. This level of abstraction aimed at promoting the in-situ (possibly joint) sense-making process. However, it was shown that too much room for interpretation might not be the most helpful or effective for the communication between expecting mothers and their midwives. Thus, the adequate degree of openness - closeness should be explored.

Digital system

In this form, the design was purely physical and didn't allow for additional information to be displayed or saved. That is why the combination with a digital system would be a useful development. The degree of information detail should be defined and subsequently an appropriate functioning should be chosen (NFC tags or AR on via phone e.g.). Furthermore, the possibility of sharing information with others, or combining it with another information system was intended to be explored.

Past events

The representation of events and elements that have already passed was an intriguing point and should further be evaluated. This could be done in different ways, e.g. by like leaving the tokens on the plate or letting the tokens leave traces. In the second case, it would also be easy to distinguish which events already happened and which lie still in the future.

Personalization

As already seen, a pregnancy is a very personal and subjective experience. That is why possibilities for personalization (such as the placement of a personal picture in the centre of the plate) could be explored
.

Decisions

After receiving the feedback for the first iteration and evaluating the possibilities of testing the design in Germany as well, the focus of the work shifted towards the segmentation tool. This helped me to sharpen the vision on my project and understanding the target context even better, but at the same time it diminished the amount of time that was left for the development of the communication tool. That is why, I needed to set priorities and focus on some points only.

The process of selecting the focus was challenging, as it had the consequence that other aspects couldn't be pursued to the extent I had intended. Different steps helped me to take decision in the process. In the beginning of the second phase of this project for example, I had the possibility to join a childbirth class, which reassured some elements of my design. During the two hour session, I noticed how important it was for the six attending couples to get an overview of the process and what was going to happen. Furthermore, it became evident it was really helpful for the expecting mothers to receive reassurance about what they had to expect, and the importance of their partners as a part of the process.

When re-evaluating the concept, I identified that the most important aspect was to explore how the tool could support the interaction between expecting mothers and their midwives. Thus, the tokens as the means of expression were the essential part of the idea. In order for them to unfold their full potential as scaffolds, their position towards each other and in the general process showed to be important (Hummels and van Dijk, 2015). That's why I decided to keep the plate as a base for the tokens to be placed on and as an general overview.

To define the most important functions of the design and the thus resulting physical manifestation, I formulated scenarios in order to find out the essential elements needed in different situations (an overview can be found in the appendix II, fig.4). Therefore, I tried to describe as clearly as possible 'who' would want to do 'what' and 'where' this would take place. To reveal the crucial points of interest, I tried to identify how the users could experience the tool, and how this would influence their perception of the world (the 'hermeneutic' relation', as it is called in post-phenomenological theory (Rosenberger and Verbeek, 2015)) and how they would experience the world through the object ('embodied relation', ibid, 2015). Moreover, I looked at the benefits of physical and digital elements in each situation.

The analysis of the scenarios made the following things clear:

Digital System

First of all, in most cases the digital element was rather giving the option for additional feedback than for essential input. That's why, it was devices to focus on the other aspects of the concept and leave the digital system as a recommended extension possibility.

Plate

Secondly, it made clear that the tool as physical object shows a lot of potential in the direct interaction of expecting mother and midwives (see appendix II, fig. 6, scenario 4 and 6 e. g.). For the goal of this study it is thus important that the tool is easy to carry. That's why, the plate was developed further from being round and showing an overview of the complete pregnancy (see iteration 1), to a rectangular shape, which isn't bigger than a landscape DIN A4 and only displayed a section of the process, to ensure that it can be easily transported.

Tokens

The tokens of iteration 1 have shown to be too open, or abstract, to be used in a structured way, at least not in a short amount of time. The goal of this level of abstraction was mainly to give users the freedom to express as much as possible through the tokens. As an alternative, creating a structure with modular elements would make it possible to easier understand tokens which could be combined to build components. That's why, for this iteration the elements were designed in a modular manner. Furthermore, in order for users to have an easier access to them, the tokens should posses certain affordances or, as affordances might not be feasible in this scale and context, signifiers which reference to the meaning of the token (Norman, 2013). Through the creation of the scenarios, some options were identified (like an expandable circular scale as a possibility to display strength of pain, see fig. 26 and 27). To identify which other tokens could be possibly needed, I went through more specific scenarios and explored possibilities for "building" these topics. Additionally, I used the elements defined in the segmentation tool (risks, attitudinal aspects) as guidance. As the overview shows (appendix II, fig. 5), different layers were identified, These differentiated in their level of abstraction but didn't have a clear structure. It became evident that

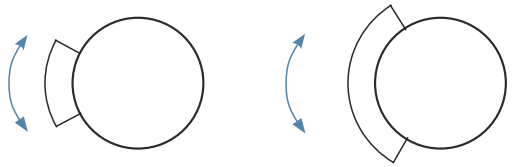

Fig. 26. Token possibility for modifiable indication of strength.

Fig. 27. Exploration of token for indication of strength / size,

Fig. 28. Token explorations.

in addition to signifiers on the tokens themselves, the organization of the elements needed to posses a certain structure, or grammar, to ease the process of understanding and using the tokens. The examples showed that there were some more descriptive elements, while others related either to the place or time, or displayed really specific topics. Based on this insight, the token structure was created (as shown in fig. 29). The first level is for the contextualization of the issue (space, time, topic), the second level offers qualitative elements for further description (for feeling associated or importance e.g.) and the last one offers more explicit elements (which are either open for interpretation, like the texture ones, or display a concrete thing, like fever).

Fig. 29. Overview of tokens.

Paroli - The Final Design

The final design consists of a timeline and two levels of tokens, which can be stacked forming one box (see fig. 31).

The bottom layer can be opened on the side and a paper with a timeline can be placed in. The size of the paper is half on an A4, so that it can easily be print and cut. The scale of the timeline can be chosen according to ones needs, representing for example the time between two meetings with a midwife (in the beginning the intervals in between are bigger, later in the process there are weekly meetings). Under the surface there is a magnetic structure which is divided in 28 sections for some guidance. The magnetic tokens can nevertheless be placed and moved anywhere on the surface.

The two following layers contain the different tokens, organized in the in contextual, qualitative and concrete groups. In between the layers there is a void so that they can be placed on top of each other even when tokens are stacked.

When the different levels are put together, the lit can be placed on top to close the box. The idea is that the expecting mother can have the whole box at home and take only the part needed, so e.g. only the timeline and additional level, to the meeting with the midwife.

It is envisioned, that the tokens would leave traces on the paper, making the past process visible and enabling the users to take the tokens off the plate again. This would allow an easy handling with a limited amount of tokens and at the same time would facilitate to track the frequency of an event (e.g. document how often a certain pain occurs, only adapting the intensity each time). As mentioned earlier, I think that also a digital system to store and exchange information would make sense.

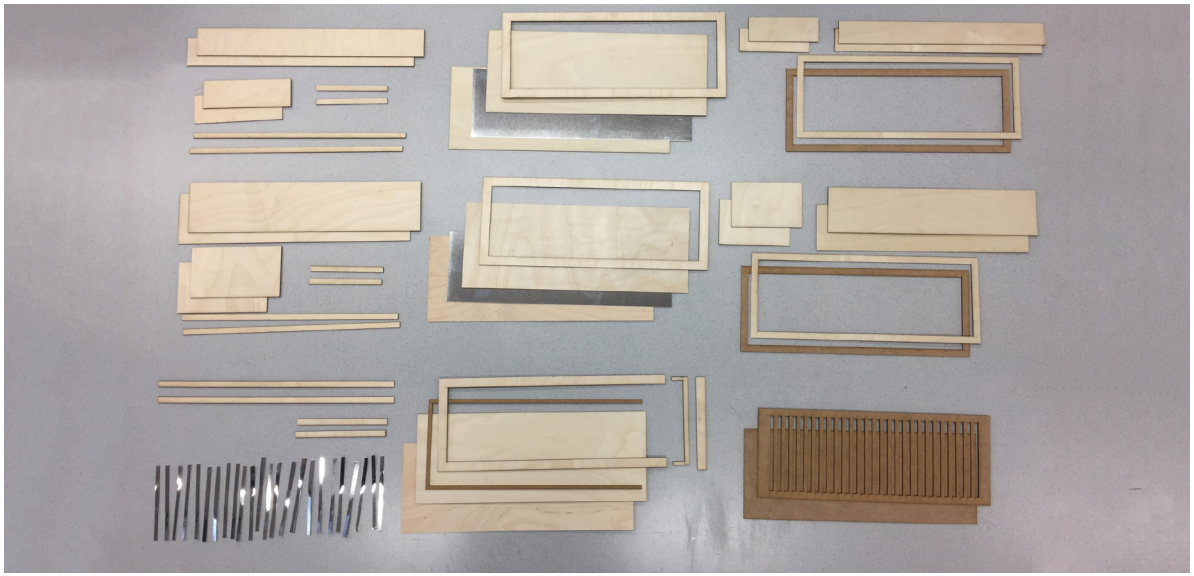

Fig. 30. Prototyping process.

Fig. 31. Paroli box.

Fig. 32. Levels of tool.

Fig. 33. Paroli in use.

Test

As mentioned earlier, the aim of this tool was to evaluate the influence a tangible tool can potentially have on the interaction between expecting mothers and their midwives. Thatfore, ideally the tool would be tested by both women in their meeting. However, due to the very limited time of the midwives, it was no possible for them to take part in the test. That's why, the test was setup for women to use either, if they were pregnant at the moment, by envisioning that they would bring this to their meetings with the midwives, or, if the women had already given birth, envisioning that they could use it to communicate with the health care representatives they were currently involved with (e.g. kraamzorg) or how it could have worked with their midwives.

To facilitate the organization of the user test, Nicky and me worked together in this part. We were able to find 12 women, 6 of which tested Nicky's tool, the other 6 testing my tool. Of this 6, 3 had the time to test it for one week, the other 3 evaluated it in a short-term test, so in an interview of an hour. Of the long-term users, 2 were still pregnant and 1 gave birth to two children here in the Netherlands. Of the 3 short-term users, 1 was pregnant and 2 were already mothers. An overview of the participant can be found in fig. 34.

Of the 18 semi-structured interviews (6 short-term, 6 introductory interviews for long-term, 6 evaluation interviews), 16 were conducted jointly, while I did 1 short term as well as 1 evaluation interview individually. The decision to do the interviews together was based on that, on the one hand, it was helpful to have a second designer present who could pay attention to interesting topics coming up in the interview, and on the other hand all interviews helped us to understand the overall situation better, so hence were very valuable for both of us.

	Testing Period	State	Country of origin
1	Long-term	Expecting mother, 33 weeks	France
2	Long-term	Expecting mother, 36 weeks	Moldova
3	Long-term	Mother, had 2 children here	Syria
4	Short-term	Mother, had 1 child here	India
5	Short-term	Expecting mother, 30 weeks	Korea
6	Short-term	Mother, had 1 child here	Kazakhstan
7	Long-term	Mother, had 1 child here and 1 in home country (before)	UK
8	Long-term	Expecting mother, 6 weeks	US
9	Long-term	Mother, had 2 children here	Romania
10	Short-term	Mother, had 1 child here	France
11	Short-term	Mother, had 1 child here, 1 in another country (before)	Australia
12	Short-term	Mother, had 1 child here	Turkey

Fig. 34. Overview of participants of user test, testing Paroli (upper part) and participant testing Nicky's tool.

As mentioned earlier, the tests differentiated depending on if the women were still pregnant or not. The detailed overview of the protocol can be found in appendix II, fig. 12. In all cases, the interview started with filling in a consent form (appendix II, fig. 7), then general questions regarding the pregnancy experience were asked. During this initial phase, I tried to identify potential problems or cases which I could use for the explanation of the use of the communication tool. After this, I introduced the tool and explained the idea behind it. In case of a short-term test, I let the women experience the tool and, if further support was needed, I recalled a situation from their experience (or similar to that) to help them envisioning the potential use of the tool. In the case of a long-term test, I asked them to imagine using this in the interaction with their midwives (giving

Fig. 35. User test booklet.

again examples if needed). To allow the women to track additional information or ideas while using the tool, I provided a booklet (see fig. 35, complete overview in appendix II, fig. 8-11), which provided space for written notes (a lined page per day), drawings (a blank page per day) and my phone number (to send pictures or questions during the test).

After the use of the tool, the women were asked about how they interacted with the tool and how this changed, or potentially could change, their perception towards some topics. In addition to questions addressing the general possibilities of tangibility in this context (interaction level women <> tool, see fig. 4), questions regarding general interaction (level woman <> midwife), the influence on their perception of own control (woman <> woman) and their perceived safety (woman <> situation) were asked.

Fig. 36. User explaining her set-up.

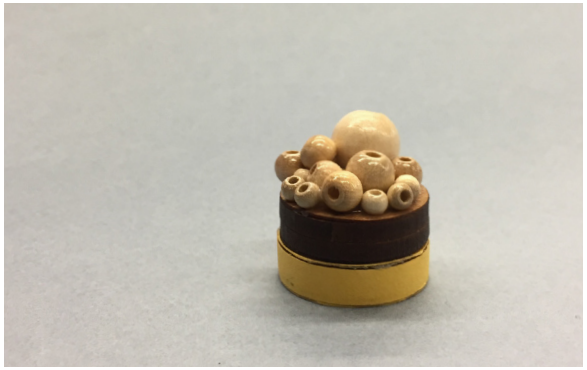

Fig. 37. Token example representing a yoga class.

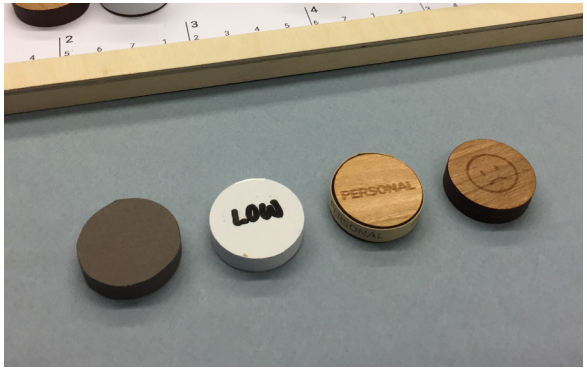

Fig. 38. Example of layers of one token stack.

Fig. 39. Introduction of tool in user's home.

Fig. 40. Token example of one participant.

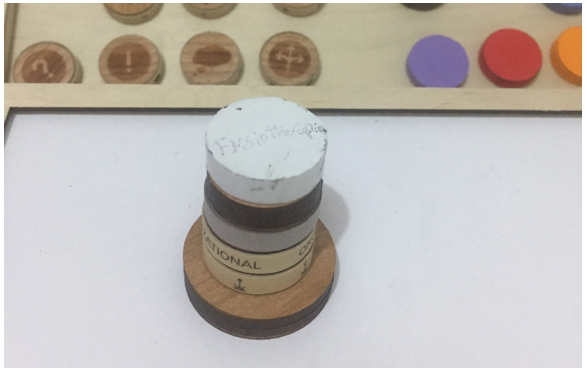

Fig. 41. Token example of one participant.

Fig. 42. Short-term evaluation of tool in user's home.

Fig. 43. User filling in last thoughts regarding tool in booklet.

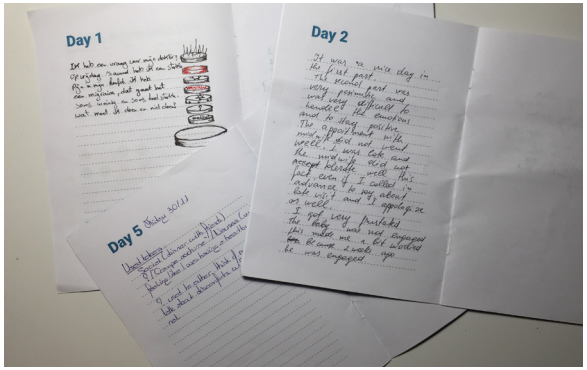

Fig. 44. Booklets of user tests.

EVALUATION

Method

To evaluate the results of the test, the interviews were transcribed. During this process, I made notes and memos to record all the thoughts related to the topic. Subsequently, the interviews were analysed following the method of Grounded theory (Bryman, 2012). I started by going through all interviews using open coding to identify common topics and themes. After that, the interesting quotes were printed and organized in core categories in a round of selective coding (Straus and Corbin, 1990 in Bryman, 2012), trying to identify the relations between the most common topics (as done in 'focused coding' (Charmaz 2006 in Bryman, 2012).

Results

General Context

As expected, these interviews helped to understand the general context better, the most important elements and their connections better. An overview of the context can be seen in fig, 45. This is of course not an absolute overview and by no means exhaustive, but rather an explanatory model which should serve as a support to understand the possible factors and their relations towards each other better.
Interesting to note is that, first of all, women seem generally to be sceptical about the Dutch health care, and more specifically the pregnancy system (participant 6 was sceptical about the "natural and at home" part, participant 4 admitted that it was a bit difficult for her, because, as she said: "we always go to doctors [in her home country], never to midwives"). However, with time they develop a positive attitude towards the system, as they like that a pregnancy is treated as a "normal part of life" (participant 2 and 12), they perceive the process to be "more relaxed" (participant 11) or "healthy" (participant 3) and they eventually trust midwives ("because midwives are experts, while gynaecologists have to deal with many problems of women", participant 11; "I trust midwives, they are medically educated as well", participant 1). This leads to, as participant 4 puts it, that she "can actually see the difference in [...][her] own health, [...][her] own immunology and so on."
They furthermore recognized the transfer of responsibility which is concomitant with this type of system. Participant 2 for example says that as it is about "your own body", this makes "you more responsible for your own health". It was also mentioned, that many things are "your own decision" (participant 12), furthermore that as "they give you a choice [...], you need to be able and confident" (participant 9).
So it was noted that in order to be able to take responsibility, one needs to trust oneself and the own body, because the health care representatives do this as well ("They trust you, they trust your body", participant 12). This has shown to have positive effects, like increasing the perceived own competence ("In this way I've learned that there is a reaction from my body", participant 2), but is not always an easy task ("Sometimes it is difficult to do but you have to trust yourself", participant 12). In some cases, if the women didn't feel confident about being able to make the right decisions, they experienced this situation as problematic ("They were asking me all the time, where I want to deliver [...]. I am still a bit lost...", participant 2).
To support women with this, a good communication with the midwife is thus needed in this case ("I think informing people, or having a good communication is important", participant 2). Possible problems in this context can arise due to language barriers ("I feel like my ideas are not understandable", participant 5) or general difficulties with the medical topics ("Yes, I have problems sometimes explaining myself. But that has more to do with the fact that I have no idea what is going on than the fact that I cannot really put it into words", participant 4).

Values in context

What was particularly interesting was to see how the values identified in the context inquiry of the iteration 1 could be mapped to the context structure described in the previous section.
It became clear that in order to be able to trust themselves, women needed to feel safe. They furthermore needed to feel in control, in order to be able to take responsibility for their situation. That was linked to the need for support (important is "knowing that you're doing the right things, that the way you are feeling is correct", participant 4). Closely related to this is to have a good communication with the midwife, which is highly influenced by the feeling of being heard and respected (when participant 3 for example reported a pain, she was told: "Oh, a fake pain", and participant 2 described her interaction as follows: "So I really, if I have to argue with them, I have to be very tough, to ask for my rights").

These are the levels which the tool aimed at providing support for. The outcomes of the potential of tangibility (woman <> tool), possibilities for the interaction with the midwife (woman <> midwife), her perception of control (woman <> woman) and of safety (woman <> situation) are described in the following sections.

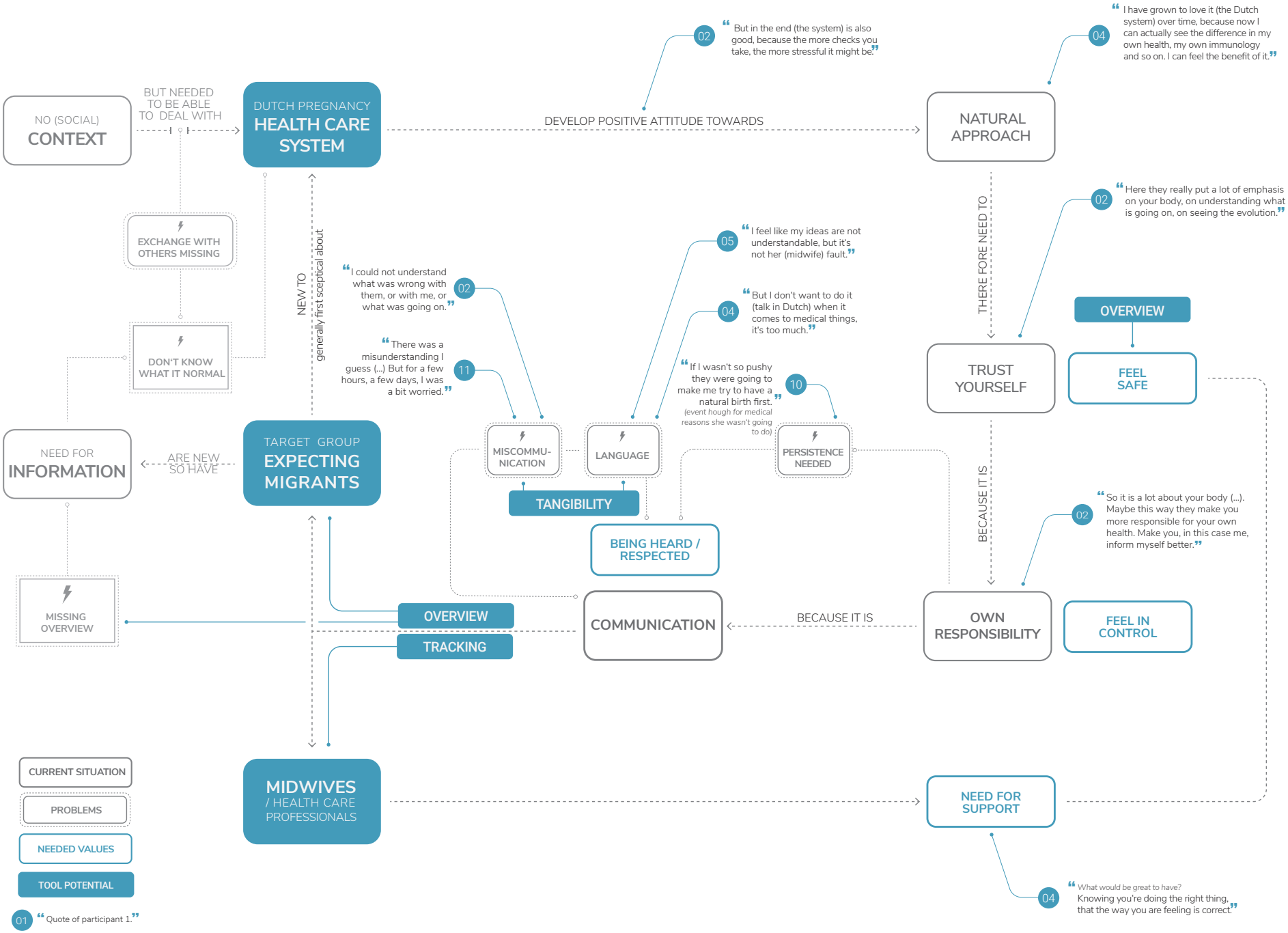

Fig. 45. Overview of project context.

Tangibility (Woman <> Tool)

Regarding tangibility in general, the user test was expected to reveal a general preference for either physical or digital tools. However, it showed that around half of the users preferred the one, and the half the other mode of interaction, not allowing to make any conclusion about general preferences. Amongst the positive aspects mentioned about tangible interaction with the tool, were for example that the interaction was described as 'enjoyable'. Participant 1 for example said: "Then it was quite fun to, first of all, see all the different kind of tokens which were available, yeah because they are of different families and how to set them on the board", participant 1. Most participants made a remark about liking the aesthetic quality of the tool, only participant 2 reported that she would overall prefer to have similar functions in a digital manner. Additionally, it was pointed out that it is good that no prior knowledge or skills are needed to use the tool and it is thus "accessible to everyone" (participant 1), even for users who are not that computer-literate, or have no digital devices. Lastly, it the "game-like" look (participant 1) of the tool was not only aesthetically pleasing, but was also perceived as potentially useful in the interaction with health care representatives as it could help the expecting mother to relax. Participant 6 put it as follows: "Sometimes you need something in your hand to fidget maybe, because sometimes you are nervous and this one [the tool], yeah, you can play with it, and it's maybe a little bit distracting, in a good way".

Interaction (Woman <> Midwife)

For the direct interaction with the midwife, some advantages of the tool were identified. A potential opportunity is that is could help to avoid miscommunication for example. Participant 6 described it this way: "Because for me, it is interesting and I can play with it and so, and to share it without words, and there would be no miscommunication I think in this case." It could furthermore help both sides to understand the situation or the other one better (as participant 1 noted: "I like the use of symbols rather than text [...], it's pretty easy to understand."). This could be beneficial for situations with an unrevealed underlying mismatch in expectations e.g., but also in situations with more salient issues, like language barriers. Participant 6 for example, who didn't speak Dutch nor English very fluently, said that such a tool could help her to communicate with her doctor. For the other levels of interaction (Woman <> Woman and Woman <> Situation), the interview questions didn't directly trigger as valuable answers as expected. This can be due to the short time frame of the test, which makes it more difficult for users to fully immerse in the envisioned experience, and / or due to the higher level of abstraction of these questions. However, I believe that the insights gained about more specific elements of the design (like providing an overview and the possibility of tracking) are aspects which fit in the general context scheme and promote the values I was initially looking for. In fig. 45 it is shown how these elements (called "tool potentials" in the overview) related to the identified challenges ("problems") and values ("needed values").

Overview

One challenge that was identified in the process of the pregnancy was the lack of a complete overview of the situation. This related to the actions needed to be taken ("So what happens? Why do you go to a midwife? When do you go to a hospital? [...] Because you don't know anything at all, so it's nice to have sort of a guide in the beginning", participant 4), the people involved and the time of coming in contact with them ("Who do I contact when? A timeline would be useful [...] What do I need when I see these people? What kind of info and what is the standard procedure", participant 8) and general organizational aspects ("It's a lot of calling", but "who to call when" is unclear, participant 2). The communication tool as an overview could provide this information already in the beginning, not only in the end ("They tell you a lot of stuff pretty late, for example about the birth", which they give in the last weeks, while expecting mothers have been thinking about it all the time, participant 9). The quote of participant 2: "Because I think that this is quite important part for women in a pregnancy, to see evolution, to see what is going on throughout" shows that having an overview, also of past events, is valuable for women in their pregnancy. I believe that this is due to the fact that seeing own process can increase the feeling of control over own situation and thus support the process of taking responsibility.
Lastly, such an overview which can be manipulated from both sides, expecting mother as well as midwife, can also be supportive in the communication between both parties. Being able to add things oneself which are visible to everyone can promote the feeling of being heard and make sure the other side is as informed as desired, thus contributing to the perceived control over the situation ("So before I go to the midwife, it can be something that you can complete, and you send it. And she already sees how was your week, what happened", participant 2).

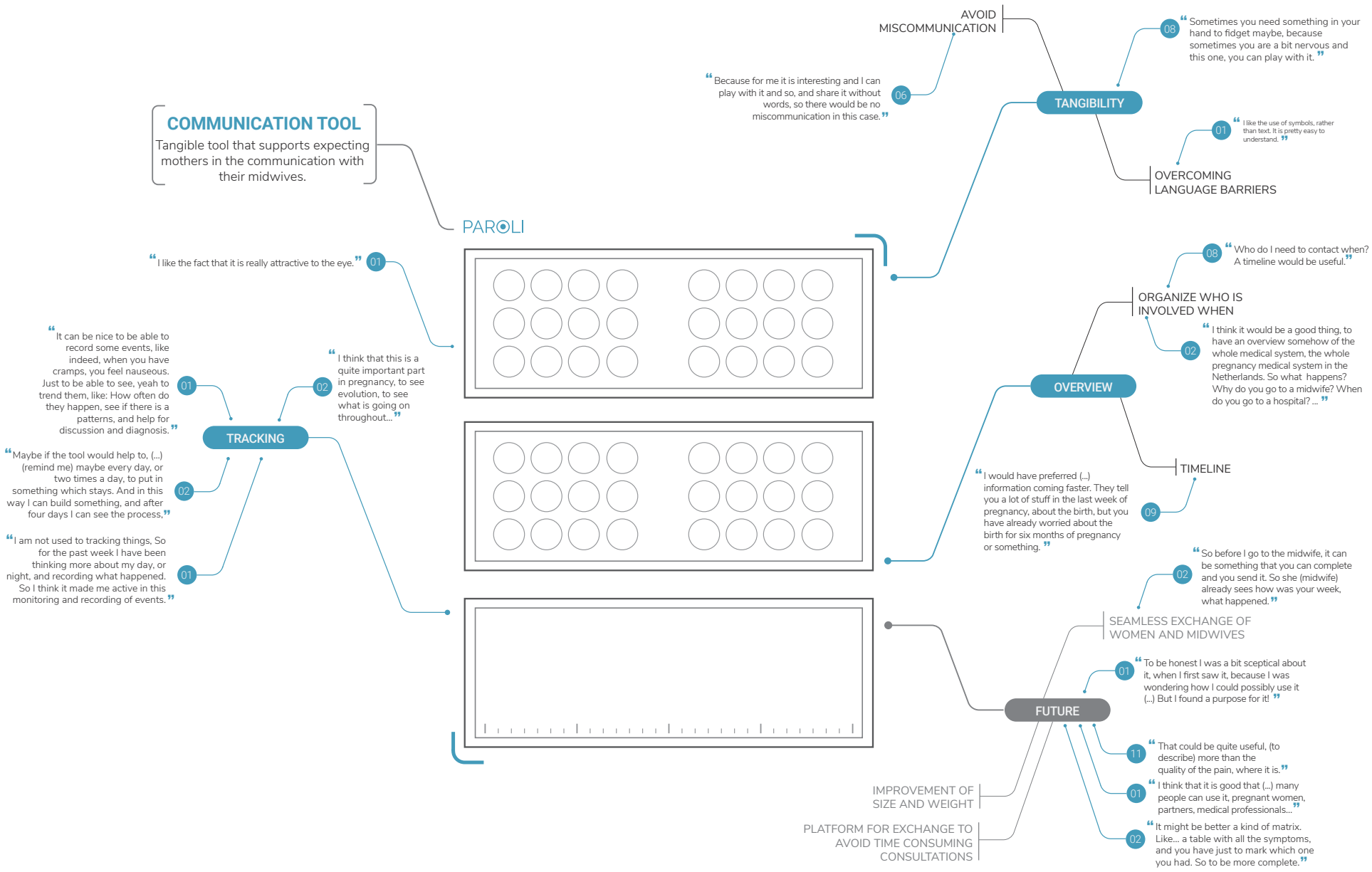

Fig. 46. Overview of insights related to the communication tool.

Tracking

Tracking certain events and issues can be helpful for the health care professional to make a diagnosis about possible causes. Eventhough women recognize this and state that they would start tracking if they had a problem (participant 4), this might be too late already. Through a tool which would demand for, or provide reminders to track certain things, this problem could be (partly) avoided. This way, midwives could not only for example identify hidden issues, but it would also make women document their progress, which is valuable for expecting mothers to see (participant 2). While participant 2 would prefer this to be done digitally, in order to have a detailed overview of all possible symptoms and states, participant 1 enjoyed the tangible interaction and was intrigued by the potential of a three dimensional tool (to display additional information), and participants 8 and 3 said that tracking this in a physical way could help them to communicate better about this topic with a medical professional.
Lastly, participant 1 furthermore responded the following, when asked what she experienced as positive about using the tool: “Certainly the overview, because I am not used to tracking things. So for the past week I have been thinking more about my day, or night, and recorded what happened.” This shows that the interaction with the tool increase her awareness about her own situation. I believe that this can subsequently also increase the ability to make a decision and, as a result, strengthen their sense of safety.

Presentation at Demo Day

During Demo Day, I had the opportunity to present my work to fellow students, experts and other visitors. Already during the preparation of the presentation set-up it the challenge of explaining the project to outsiders in a very limited time became evident.

To show the common project context, the collaboration points and the differences between our project, Nicky and me created a joint presentation stand. Hence, in addition to the information regarding our own projects, we were able to display the global context of both works and their relations towards each other. The segmentation tool, as the result of our direct collaboration, was the connecting element in the middle. This set-up was quite work-intensive in the preparation, but I to my satisfaction I can say that it overall evoked positive resonance and managed to make the project and its complexity clear.

It was an interesting experience to share my results with people who had little prior knowledge about the topic and to hear their questions. The conversations with other designers, students or professionals, allowed me to focus more on the methodology and implications of the results, triggers. Specially reassuring was the reaction of a midwife we hadn’t been in contact with, who was highly interested in the topic and expressed her wish for further collaboration.

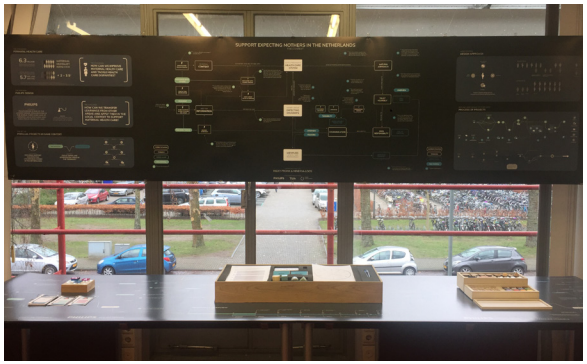

Fig. 47. Demo Day set-up (Nicky on left side, the segmentation tool in the middle and my project on the right.)

Fig. 48. Presentation of prototype at Demo Day, picture taken by Twycer / fotografie voor bedrijven.

Fig. 49. Presenting at Demo Day, picture taken by Twycer / fotografie voor bedrijven.

FUTURE WORK

Tool potential

The test of the tool has shown that there are some practical possibilities of improvement. Some of these didn't necessarily come as a surprise, as the focus of this project lied elsewhere, however I believe that they can be generally useful suggestions for future works. First of all, users noticed that the size and weight of the tool could prevent women from bringing the tool to their meetings. The second iteration was already a development of the first one, in terms of practicality, but there is still room for improvement. Also the limited time available for the meetings between midwives and expecting mothers needs to be taken into consideration.

Secondly, the set of tokens illustrated an overview of possible elements I created based on my research. However, some users expressed their wishes for specific additions (e.g. regarding tracking of a diet). For future work, this should be further explored, in order to provide women the needed elements for supporting them as well as possible (independently of whether these elements are physical, digital, hybrid...).

This leads me to the next point, which is the level of abstraction of the design. It was a recurrent theme in this project, which has brought me to several moments of evaluating the most suitable balance between abstraction and concreteness of the tool elements. While I was initially inclined to providing as much openness as possible, I learned that a too high level of abstraction leads to the concept not being graspable for most users and that the tool rather needed to provide some kind of structure or guidance to unfold its potential. On the other hand, I believe that when designing for these type of complex societal challenges, a certain degree of 'openness' is needed in the concept. The situations one targets in this context are characterized by their dynamic nature, which need to be taken into consideration in the design process. Thus, the challenge for designers I think lies in identifying the right balance for the concreteness of the design, leaving some 'void' for potential situational changes and appropriation by the users.

The way in which I approached this in my project was by exploring the potential of tangible elements in inter-personal interactions. I expected to reach a result which would allow me to make a statement about preferences regarding tangibility depending on elements such as cultural background or educational level e.g. However, this didn't show to be the case, at least in my study. In fact, the physicality of the tool's element have shown to be supportive for specific situations, rather than for specific groups of people. While some elements have been named as being better solved in a digital manner, for example regarding the completeness of the overview or the easier accessibility of information, others were mentioned to be an advantage or potential of tangible elements. In the communication with the midwives, users for example said that the tool could help them to express things which they cannot express verbally, or at least with more difficulty, and that the tool would allow them to share also aspect which are not merely medical, such as their emotional state. They expressed their interest in this possibility, as it is an important circumstance of their pregnancy experience and they could make sure their midwives are informed about it.

While I approached this topic by providing tangible elements and evaluating their potential values, I think for future work it can be interesting to change the perspective, focusing on a certain value and exploring methods to promote this.

Implications for the work of designers

The evaluation of the project context has shown that there is not one isolated problem which needs to be targeted. Rather, the challenge emerges on different levels of this structure. I think that the focus of designers hence might shift from developing solutions, to developing methodologies and tools to identify and test possible solution directions.

In this project, the focus of my work shifted several times along the process. New insights constantly changed the perspective on the topic and the balance between the different partners. As a response to that, my project developed from aiming for a finished product to providing insights through a research tool. I believe that this is a rethinking process which will need to happen on many levels. In my opinion, it can be seen as a condition for the necessary reorientation of the design process and its tools for addressing systemic change. Only in this way can we confront the different levels of interaction (micro, meso and macro) and the existing interdependencies.

The problem of communication which I targeted through my project for example happens on an individual level, but addressing this simultaneously disclosed the problematic dependencies on a systemic level. Thus, in order to tackle such challenges, interventions on the different levels are needed. The difficulty lies in the fact that they cannot be addressed separately from each other, as their multiple and various connections make the different levels influence each other. Issues on a systemic level, such as missing information about the level of patients' responsibility expected in the Dutch health care system, can influence the individual level, on which the interaction between the expecting mother and her midwife takes place.

CONCLUSION

REFLECTION

The most challenging moments for me during this project were the points along the process in which a shift was occurring. I believe that this happened either when the reciprocal influence of the micro, meso and macro level came into play and when a shift in perspective within these levels was necessary. This was challenging for me, as I lacked both own experience in working in this paradigm, as well as exemplary tools or methods to tackle these shifts. As the first projects in this new paradigm are currently ongoing, there is no body of knowledge yet which designers could use as a guidance.

In my case, illustrating the context and mapping the correlations within it has shown to be a helpful tool for me to reflect on it, by identifying and understanding the prevalent relations (see as an example appendix II, fig.22). I believe that it would be very beneficial if the designers working in this paradigm would share their approaches, experiences and evaluations on systemic change, as this could contribute to building up a common pool of experience. This way, a collection of examples could slowly be created, which future designers can learn from and build upon, thus developing the body of knowledge for what designing for systemic change means. I believe that this, in combination with an explanatory model such as the Transformation Practices Framework (appendix II, fig. 21) can together serve as guidance tool for designers aiming for systemic change.

In this report I have described my approach to the societal challenge posed by the perinatal health care disparities in the Netherlands. This project was developed as part of a bigger Philips project line. As a first approach of positioning themselves in the transformation paradigm, Philips decided to leverage their experience from other projects in the local context of Eindhoven. After having validated the challenge of confronting the inequities in perinatal health as a suitable context for this in my research semester, I continued this work in my Final Master Project. Because the tools and methodologies to work in this paradigm have not been developed yet, my project served as an exploration which aimed at supporting Philips to frame their project line. What started with the classic design line in mind, shifted several times in the development process along with new insights that were gained and switches which happened in collaborations. In this report I illustrated my approach to supporting the inter-personal interaction between expecting migrant mothers and their midwives. Eventually, this led to the development of a tool which aimed at providing contextualizing insights of the topic, which can serve a foundation and guidance for future work. The developments that have led to the final design of this concept, Paroli, as well as to the segmentation tool were documented in this report.

The work on this project has shown the different levels of complexity which characterized the challenges in this transformation paradigm. To tackle these, we have to identify what is happening on the different levels, understand the correlations and addressing them accordingly. This represents a complex task, as we don't only need to take into consideration the different layers of problems, but also the fact that these might occur in different places, at different times and in different paces. Additionally, there is a big number of stakeholders involved, which is on the one hand needed to tackle the challenges (Brand and Rocchi, 2011), but on the other hand also adds a level of complexity. In order to achieve systemic change, these stakeholders will need to shift to a first-person perspective. Designers with their experience in empathising with others will play a crucial role in steering this process (Gardien et al., 2014). The tools and methodologies they need for this process have not been developed yet, as the transformation paradigm is still in its initial phase.

I described my explorative approach to a challenge of designing for systemic change and the personal insights I gained, with which I want to contribute to an overarching body of knowledge which can serve as a guidance for fellow designers. This project didn't aim for achieving change on a systemic level, but for showing the opportunities for designing for transformation.

NOTE OF APPRECIATION FROM PHILIPS DESIGN

We would like to thank Minerva and Nicky very much for their contribution to the explorative study on the maternal care challenges in the Dutch healthcare context.
With their study they developed research tools that helped Philips Design to identify valuable insights on the topic of maternal and perinatal care.

Their work demonstrated that a combination of tools, which can lower the barriers of pregnancy health literacy and communication, can increase the level of engagement of vulnerable women in pregnancy journey. This can be very helpful for future solutions that rely on self-reporting and self-monitoring which requires a level of knowledge and engagement.

The insights from Minerva's and Nicky's explorative studies will be leveraged in the joint initiative between TU/e and Philips Design in the next phase of the collaboration.

ACKNOWLEDGEMENTS

I want to thank all the people who have helped me to navigate through this project in this past year. First and foremost, I thank my coach Caroline Hummels for her guidance and support along the process. Further thanks goes to Pierre Lévy, who has also supported me along the way.
The discussions we had served me as inspiration and guidance and often kept me thinking even long time after our actual conversation ended.

I also want to thank Nicky, who has accompanied me throughout this year, always taking her time to listen to my questions and doubts.

Thanks is also due to Chet Bangaru and the d.search team for their prototyping advice and support.

Furthermore, I want to express my gratitude to the team of Philips Design for providing me guidance, feedback and insights into their experience as experts on the field. I want to specially thank Aylin Groenewoud for her help this last semester, as well as Simona Rocchi, Reon Brand, Geert Christiaansen and Patray Lui.

This project would furthermore not have been possible without the help of all the midwives, experts and ladies who shared their insights and thoughts on the topic with me. These conversation have always given me new energy.

I want to express my gratitude to my family and friends, without who I would have never made it this far. My special thanks go to Giulia, Stefano, Ana, Davide, Christian and Alex. Lastly, I want to thank my parents and my sister for their seemingly endless patience, help and support.

PERSONAL REFLECTION

As the final element of my Master studies, this project offered to me the opportunity to apply my learnings of these past semesters.
After having explored the topic of perinatal health care during my research semester, I got the opportunity to dive deeper into the topic in my Final Master project. I was very happy about this possibility, as I had already identified the topicality of the issue and wanted to explore what designers could do to address societal challenges like this one.

Not only the project itself, but also the collaboration with Philips evolved along the process of this year. It went from an inspirational cooperation running in parallel in the beginning to a ever stronger linked and mutually influenced cooperation. Adapting to this changes was sometimes challenging, as I had to, on top of constantly reframing my own focus, also take an external perspective into account for my work. However, eventually this allowed me to learn a lot about the interests of such a big company, about their approaches and how value is developed. Even though at some points in the process I felt like this process could be bringing me further away from my project goals, this was actually the only way in which I was able to understand the perspective and positioning of a stakeholder like Philips in this context and learn from their experiences. Already the diversity within the team supporting us, their different views on certain topics and personal interests gave me an interesting overview. Working in this context was indeed very enriching and I think it would have been beneficial to schedule moments of exchange more regularly already in the initial phase of this project. A close exchange in the initial project positioning phase could have promoted the development of a more coordinated alignment of our projects from the beginning.

What helped me to navigate through this whole process was the collaboration with Nicky. With her as a fellow student working on this project by my side, I had someone to relate to who was going through thee same process and was most of the times experiencing the same difficulties. While sometimes it felt like this made the project reach a dimension which was too big for me to bring further, it was very helpful to have someone to reflect on project together. I think we both benefited from having a second pair of eyes and ears to gather insights, identify issues and develop plans of how to overcome them.

The collaboration with Nicky was specially helpful when it came to the organizational part of this project. The process of establishing contact with all the stakeholders, experts and users and organizing the meetings with them was facilitated by the fact that we could divide tasks and were two people keeping an overview of the situation. This was specially supportive against the background of the time it takes the stakeholders in this context to react, their limited availability and the challenge to arrange moments of exchange with them. Hence, being two people working on the same topic helped to tackle the very practical manifestation of the complexity of this project.

For the more abstract levels of complexity of this project, the exchange with Nicky has helped me, but I needed to figure out how to tackle them in my work on an individual level. Difficult in this context was the same aspect that motivated me to pursuit the project in the first place. The lack of a given procedure structure made it necessary for me to find the a way for this project as I went along with it. The highly qualitative nature of this work furthermore made it difficult to find helping guidelines. Often, mainly in the moments in which the project needed a shift in direction, I struggled to find supporting examples or references which I could base my decisions on. In this moments, I experienced to have an intuitive understanding of the directions that would need to be taken However, in the beginning I was scared to follow this intuition. With time, I noticed that sometimes it was the only possible way to move further. What I think is really important in moments like this is to, first of all, learn to understand the own intuitive thoughts and then to validate them in field. Unlike in projects with a more quantitative nature, where you can test a certain assumption with the help of set guidelines and rules, I believe that sometimes the only way to evaluate the validity of a direction in this type of projects is to test them in context. Important here is to keep in mind that they are assumptions and to be prepared and open to look for another way.

That's why I believe that it is necessary that we, along with the projects for systemic change, also develop the methodologies for this, by describing and sharing our work. I think that thus a framework of how to navigate through the process of designing for transformation can slowly be built up.

As my project was developed within the Research, Design and Development track, I started my work with the classic design approach in mind. The process of this project however, as I described in this report, shifted the result from the expected outcome of a working prototype which I could test in field, to a tool aimed at researching the context and providing an understanding of it.
Initially I planned to improve my math and computing skills within this project by creating the digital platform I envisioned as part of my concept. However, during the process and in exchange with Philips, it became evident that this would not be a valuable contribution for the project. As the project is still in its initial phase, what was needed

at this stage are inisights about the context rather than high fidelity prototypes. That's the reason why, contrary to what I planned in the beginning, I didn't spend a lot of time on developing my technological skills further. Hence, while in this project I focused on my core areas of expertise, I used the opportunity to developed the other skills in my electives. Looking back at where I started 2,5 years ago, I can say that I am very satisfied with my personal development, not least when looking at the outcomes, with one project (volo) being exhibited at the DDW and in a museum exhibition, another one (FRANK) being presented at the TEI 2019 conference in and one being prepared to be sent to the DIS conference.

This project allowed me to apply and develop my skills on the area of creativity and aesthetics through my work, which I tackled with an approach developed from the perspective of the individual users and their bigger societal context.
The strong involvement of users and the focus on their personal values and needs is what guided my work. Through the constant exchange with them, I experienced their appreciation and confirmation of the importance of my work, which always gave me the energy and motivation to continue. Through this encounters I learned a lot, not only for the development of this project, but also for me as a person.

Overall, I can say that I am satisfied with the outcome of the project, even though I have struggled with the fact of developing something that is so different from what we are used to within this faculty, and as designers in general. I think that if I would have approached the project with a different mind-set from the beginning, freeing myself earlier from the idea of what I think is required from me as a student and focusing instead on what I think the situation demands for, it would have made it easier for me to navigate through the process of the project. However, I don't believe that the type of the result would have been a different one, as I think this is what is most valuable for the stage of process we are looking at. Hence, I think that designers should, rather than thinking about how to make their projects fit the expected outcome, explore what is the most appropriate outcome for the different stages of a project.
This can even lead to rethinking if the academic requirements we impose are still fitting the design challenges we are facing and if we need to re-evaluate them to promote a shift towards designing for transformation.

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APPENDIX I

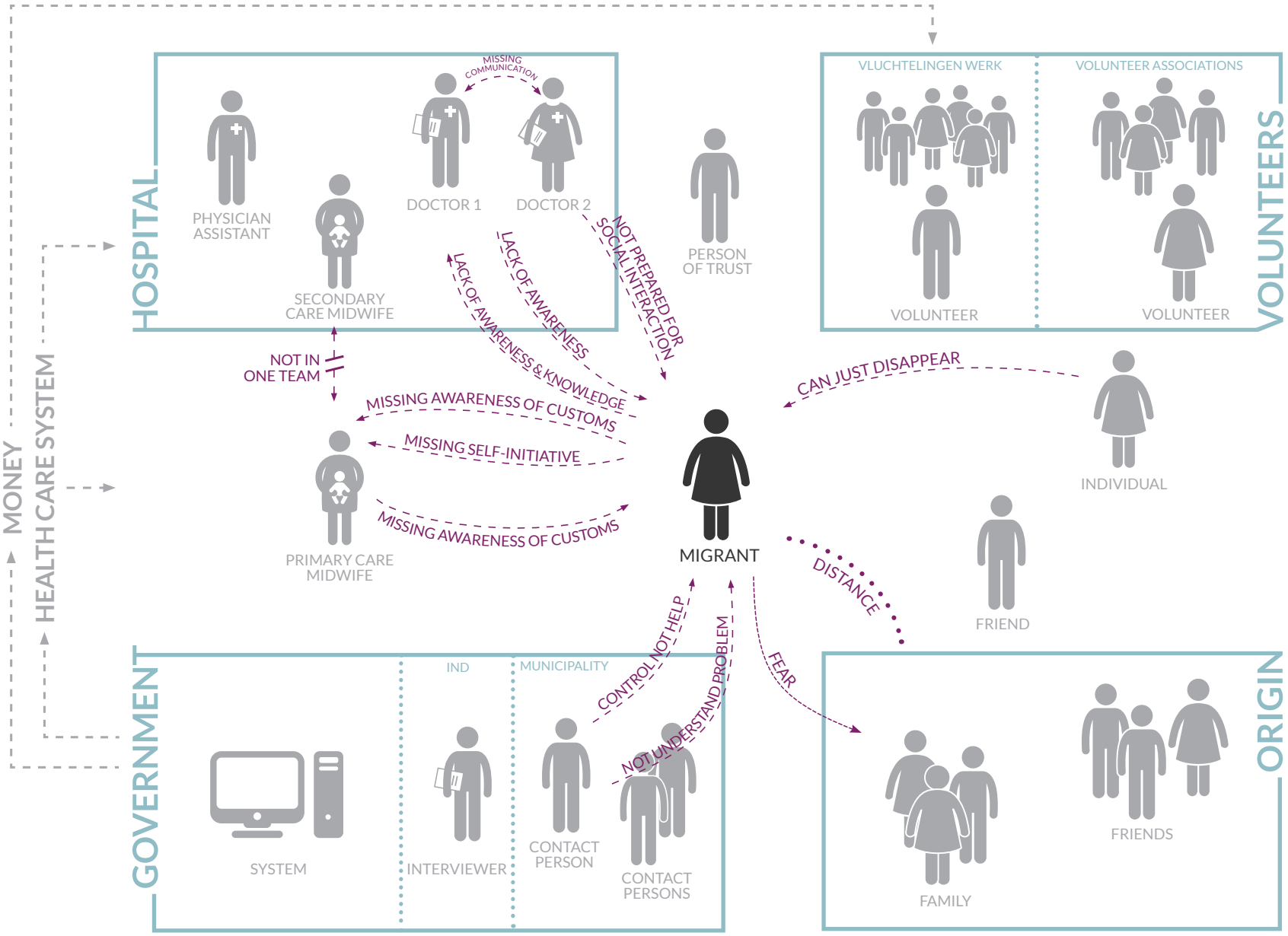


Fig. 1. Illustration of issues of communication and awareness within the stakeholder network around pregnant migrant women in Eindhoven (Loos, 2017).

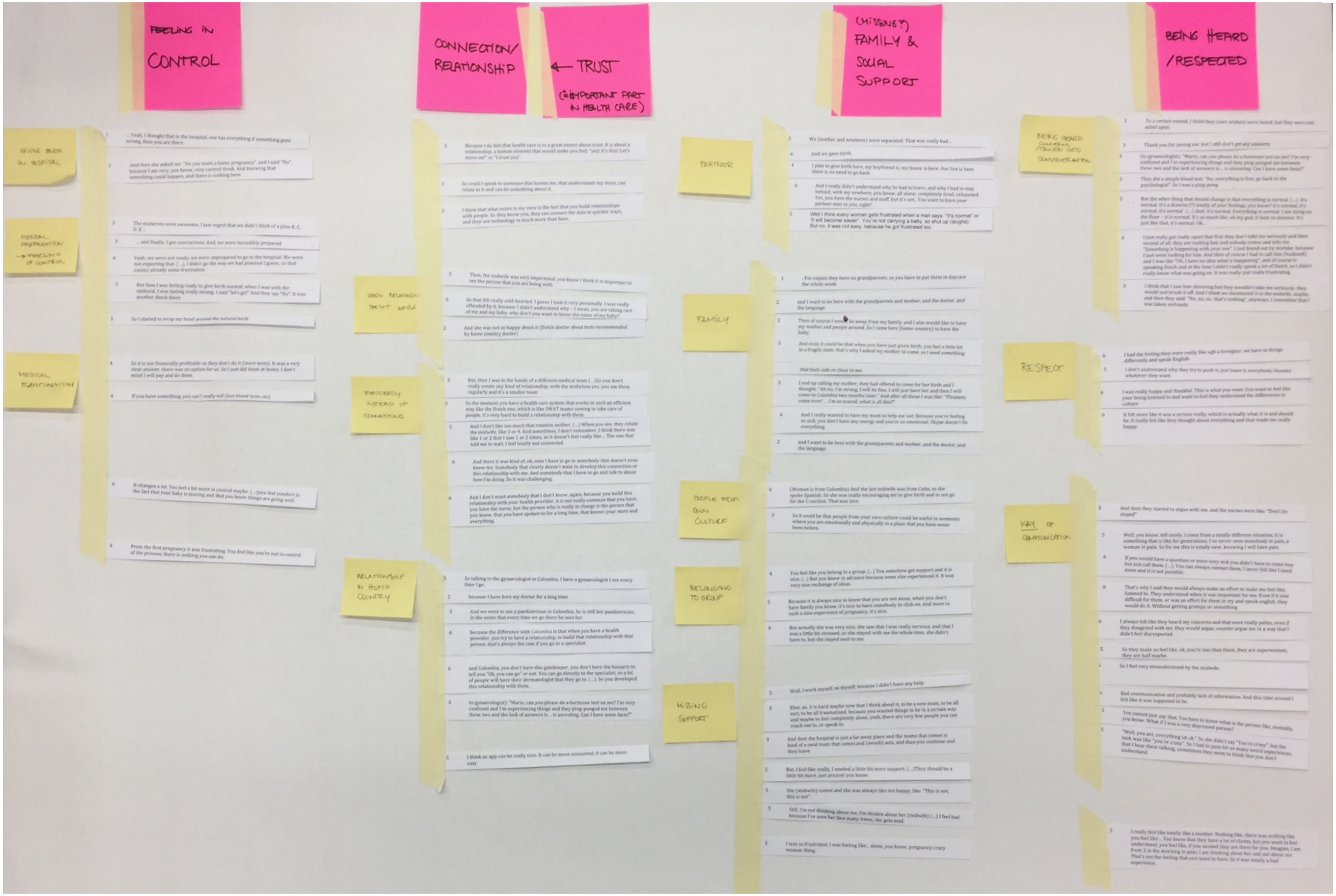


Fig. 2. Insights Overview, Semester1

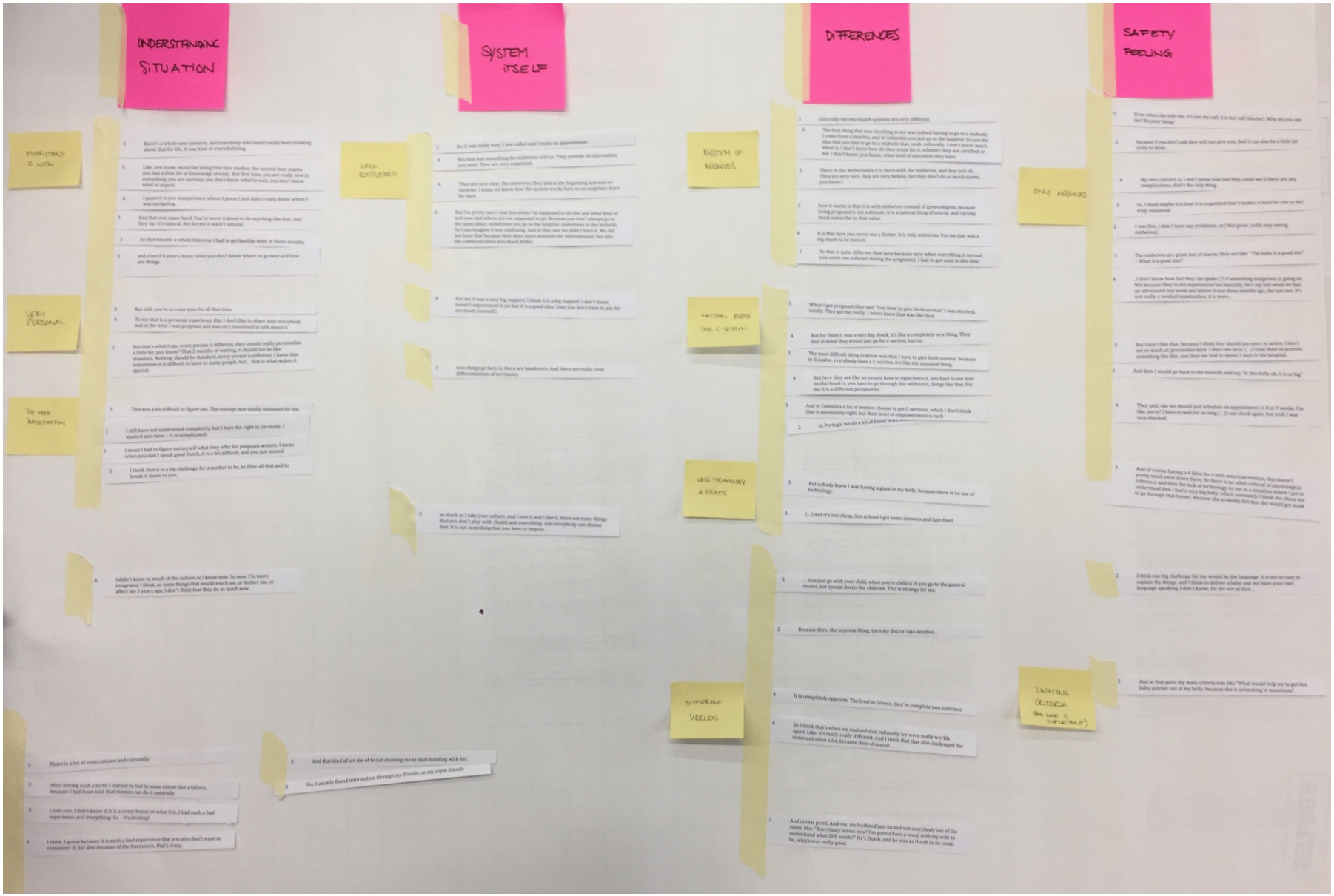


Fig. 3. Insights Overview, Semester1.

APPENDIX II

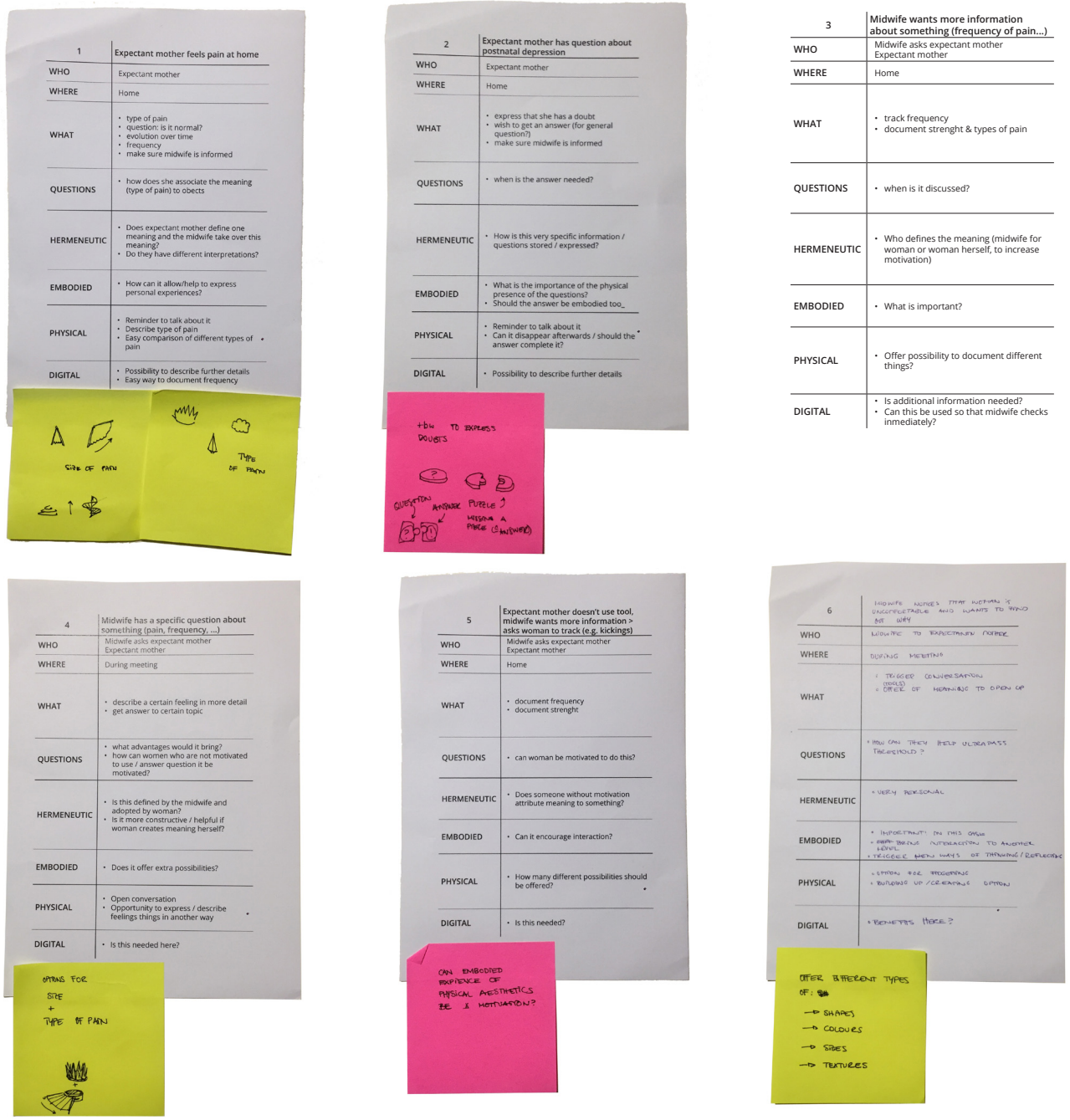


Fig. 4. Overview scenarios.

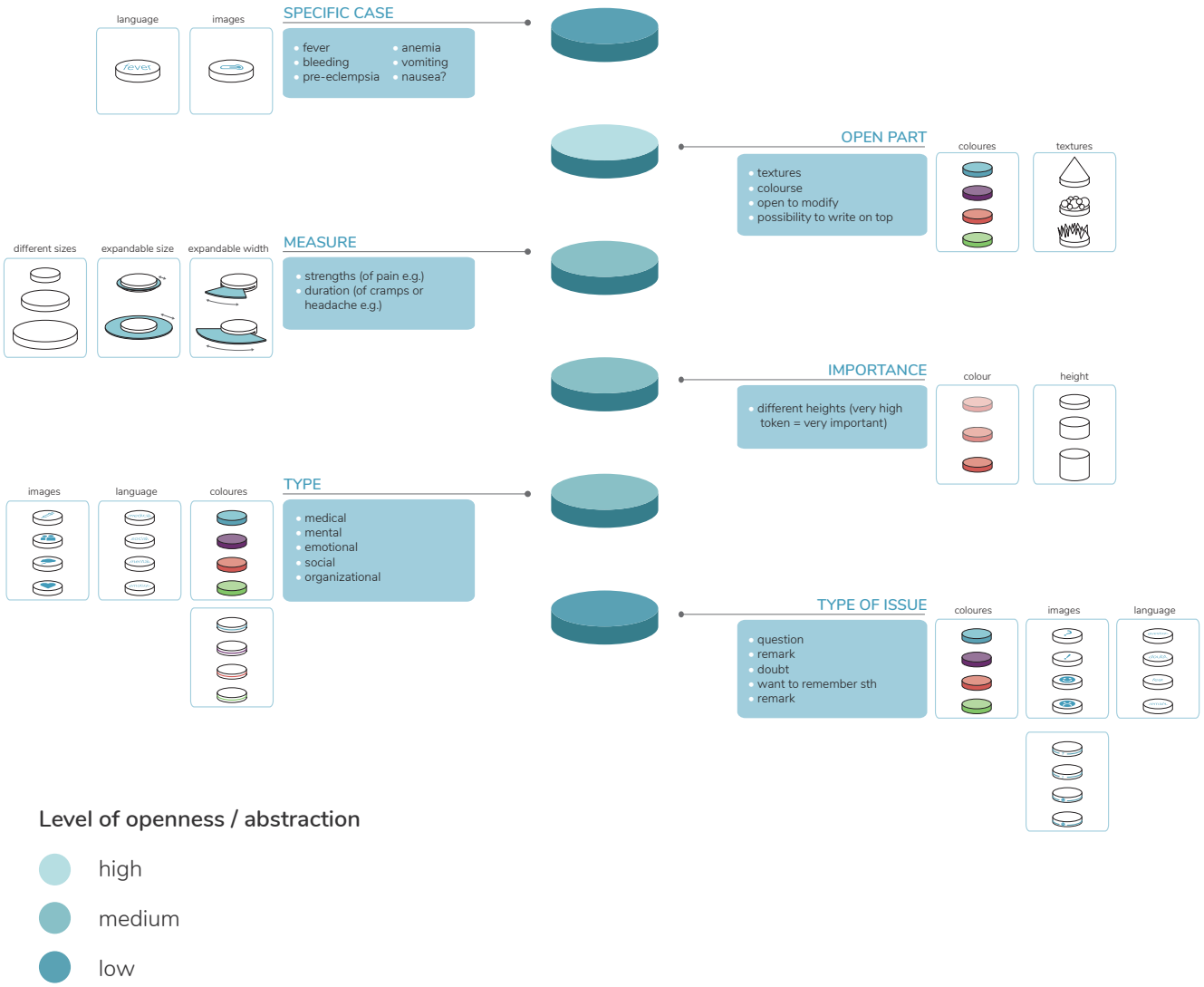
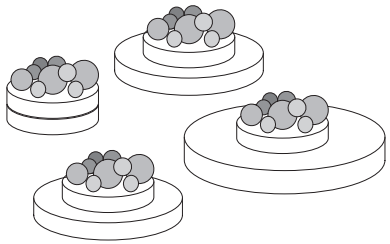
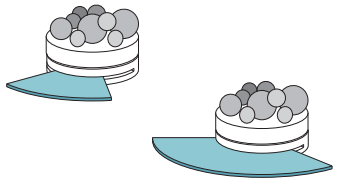


Fig. 5. Token structure overview.

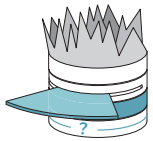
Example of token combination for a question.



Example one for tokens with different levels of importance.



Example two for tokens with different levels of importance.



Exemplary token combination.

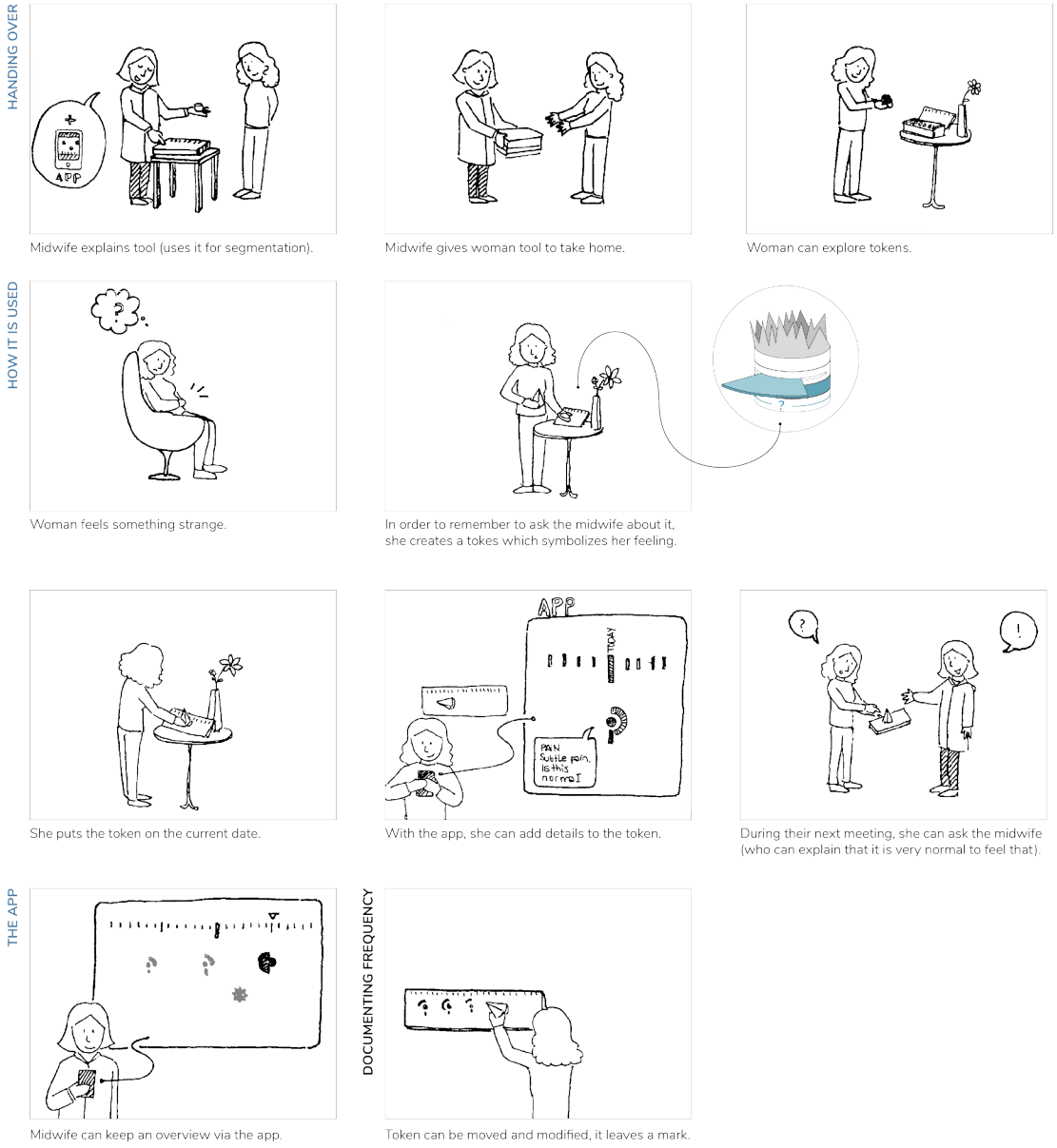


Fig. 6. Explanatory scenario.

CONSENT FORM

Researchers Minerva Loos | m.i.loos@student.tue.nl
Nicky Pronk | n.m.e.pronk@student.tue.nl

Thank you for agreeing to be consultes as a part of the above design project.
This information sheet explains shortly what the study is about.

We are Industrial Design Master students at the University of Technology Eindhoven working on our Final Master Project. The purpose of this research is to explore the challenges and risks, both physically and mentally, that come into play during a high risk pregnancy with regards to vulnerable women in The Netherlands. The research is being conducted together with Philips Design.

We developed some tools that are aimed at supporting (pregnant) women in their process and we would like to learn how you experience them. Nothing you do or think can be wrong and anything you want to share valuable to us.

We will use the outcomes of our studies for research purposes. You can decide how much you want to share below. If you agree to it, the interview will be audio recorded. The interview will be transcribed and analysed by us, Minerva Loos and Nicky Pronk, and the recording as well as the transcription will be kept safe. If you agree to it, a summary of the interview content, or direct quotations from the interview might be used in the final report. This will happen anonymously.

Please state what you agree with by ticking the corresponding box:

I agree with:

- o This interview being audio recorded.
- o Being quoted anonymously.
- o My age being mentioned.
- o Where I come from being mentioned.
- o The state of pregnancy I am in being mentioned.
- o The audio recordings of this interview to be shared with researchers of Philips Design.
- o Pictures / Videos to be taken of this session.

By signing this form I agree that:

- I am voluntarily taking part in this project. I understand that I don't have to take part, and I can stop the interview at any time.
- The transcribed interview or extracts from it may be used as described above.
- I have read the information sheet.
- I don't expect to receive any benefit or payment for my participation.
- I can request a copy of the transcript of my interview and may make edits I feel necessary to ensure the effectiveness of any agreement made about confidentiality.
- I have been able to ask any questions I might have, and I understand that I'm free to contact the researcher with any questions I may have in the future.

_____ _____ _____
Name Date Signature

Fig. 7. User test, consent form.

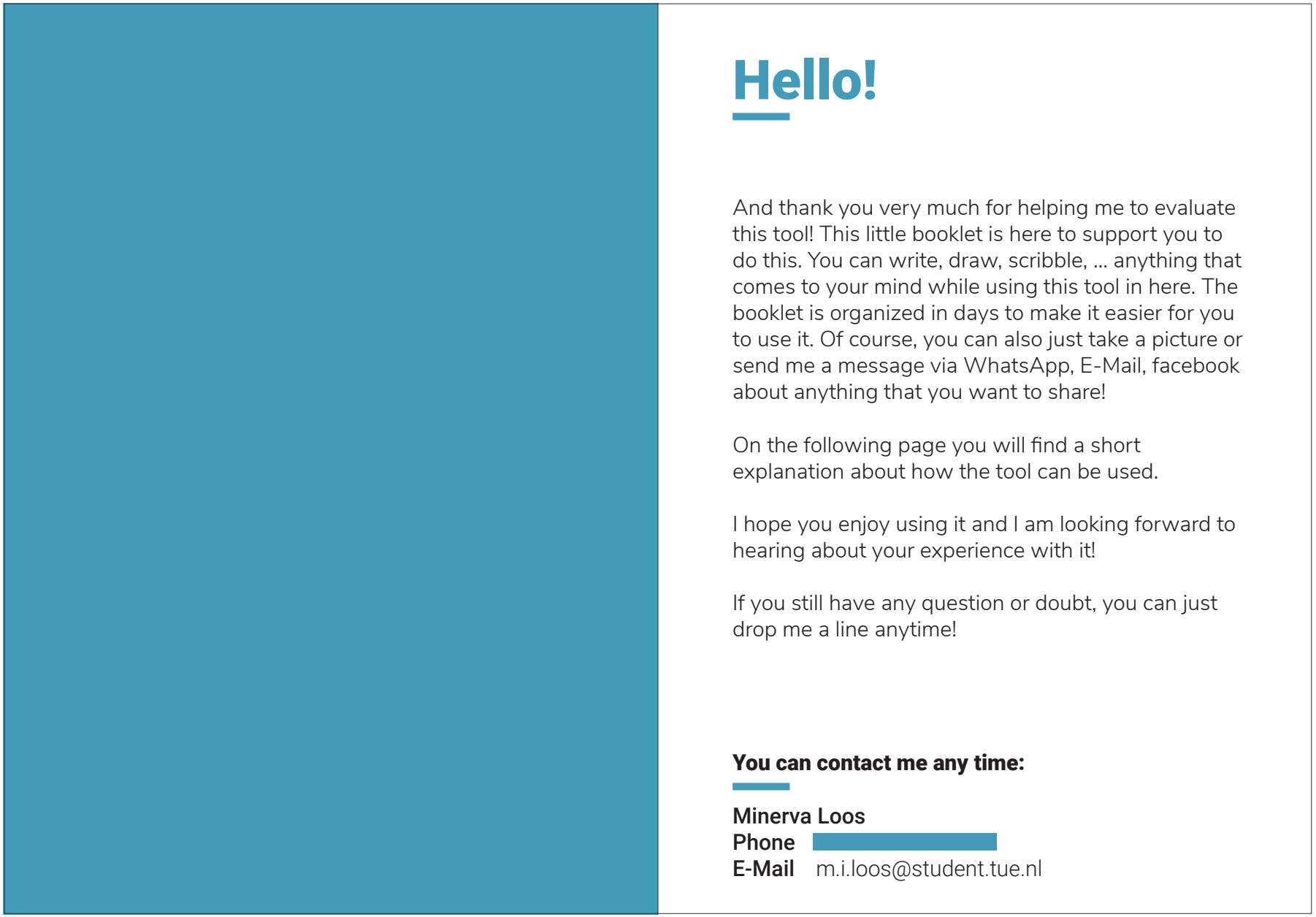
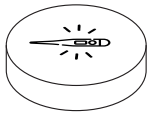


Fig. 8. User test booklet, introduction page.

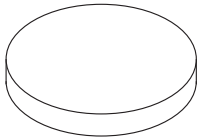
Some more info...

The way you can use these tokens is very easy: You can simply pick the elements that you think represent your thought in the best way, put them on top of each other and place them on the overview board. For example...

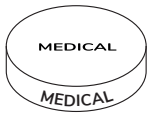
3
... because you are having high temperature sometimes.



2
... and it has been bothering you for a while, so it is quite important for you to talk about it...

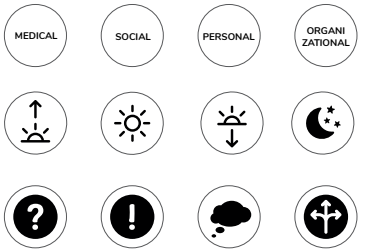


1
If you have a concern, which you would like some medical advise on...



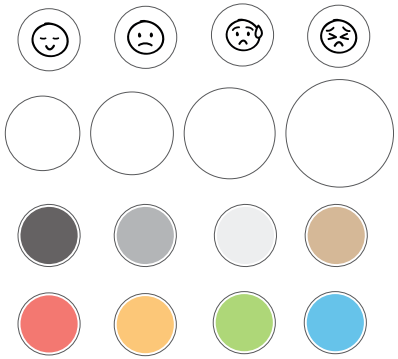
LEVEL **1**

These tokens can help you to describe the type of thought you have, when or where it happens...



LEVEL **2**

With these you can describe how you feel about a certain issue...



LEVEL **3**

These show specific things, like...

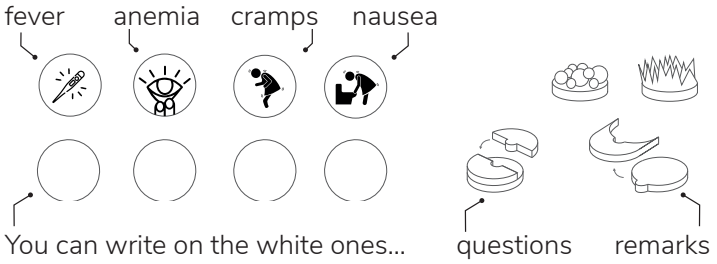


Fig. 9. User test booklet, explanation.

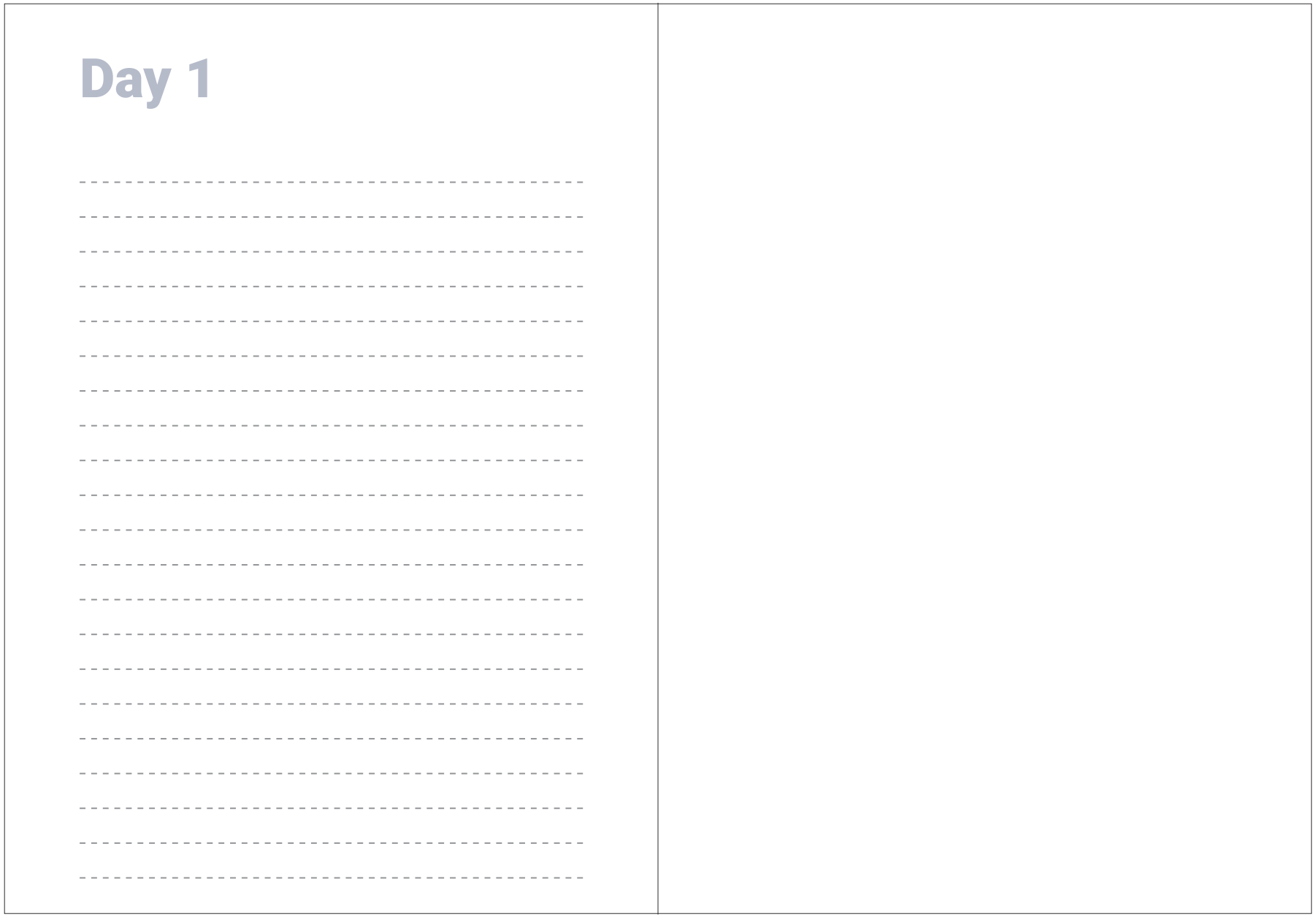


Fig. 10. User test booklet, structure for days with same set-up for following up days.

Other thoughts, ideas, remarks...

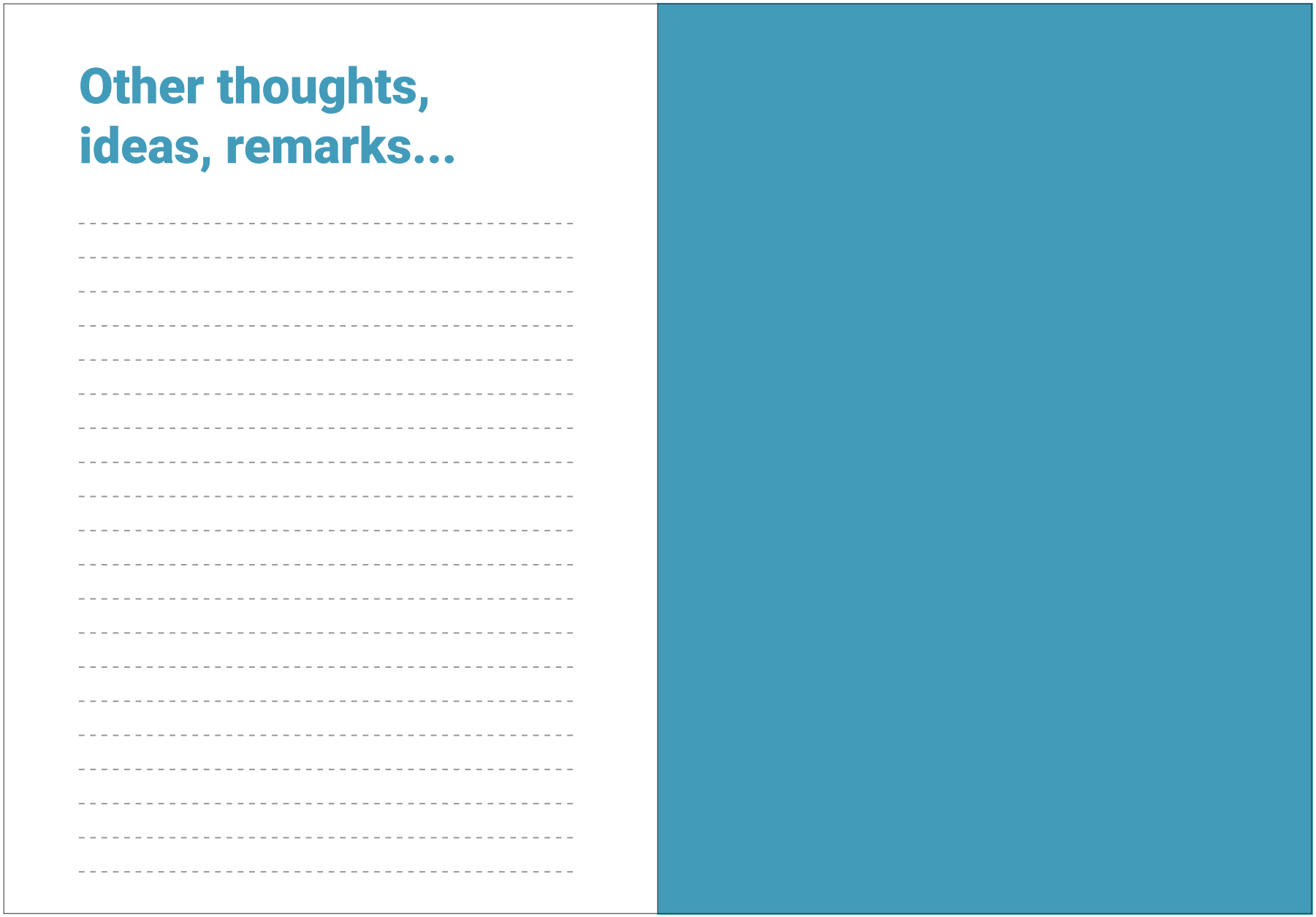


Fig. 11. User test booklet, space for additional remarks.

Situation ‣	short term (pregnant)	short term (not pregnant)	long term (pregnant)	long term (not pregnant)	

Evaluational levels ▾	• describe: perceived situation
	• describe how you feel in this situation
	  • how much influence do you feel you have?
	  • do you feel safe?
	  > me: identify risk
		• describe:
		a) when you were pregnant
		b) situation now in relation to h.c. s. (kraamzorg, ...)
		  • how much influence do you feel you have?
		  • do you feel safe?
		  > me: identify risk
			• describe: perceived situation
			• describe how you feel in this situation
			  • how much influence do you feel you have?
			  • do you feel safe?
			  > me: identify risk
				• describe:
				a) when you were pregnant
				b) situation now in relation to h.c. s. (kraamzorg, ...)
				  • how much influence do you feel you have?
				  • do you feel safe?
				  > me: identify risk
					CURRENT SITUATION

	• Tool:
	a) Imagine talking about this 'risk' / concern with midwife (or explain this to me)
	b) Introduce a random topic (in relation to her, e.g. pain)
	  ‣ How would you do that?
		• Tool:
		a) Imagine having talked about risk with midwife
		b) Imagine talking about this 'risk' / concern with h.c. representative (or explain this to me)
		c) Introduce a random topic (in relation to her, e.g. pain)
		  ‣ How would you do that?
			• Tool:
			a) During this week, use it whenever something comes to your mind (about your pregnancy, your situation, anything that you would like to tell your 1) midwife 2) me
			b) Actually bring it to a meeting
			LOG IT if needed (book, whatsapp, ...)
				• Tool:
				a) During this week, use it whenever something comes to your mind (about your pregnancy, your situation, anything that you would like to tell your 1) hc repr. 2) me
				b) Actually bring it to a meeting
				LOG IT if needed (book, whatsapp, ...)
					INTRODUCTION OF TOOL

					TEST

woman ‹› tool	• Why did you use these? Which ones didn't you use? Why?
	• Do you think there is something essential missing?
	  • a specific topic
	  • a way of communication
	  • a combination possibility
		• Why did you use these? Which ones didn't you use? Why?
		• Do you think there is something essential missing?
		  • a specific topic
		  • a way of communication
		  • a combination possibility
			• Describe what you have built / used it for
			• Why did you use these? Which ones didn't you use? Why?
			• Did you miss anything / do you feel like you couldn't visualize something specific?
			  • a specific topic
			  • a way of communication
			  • a combination possibility
				• Describe what you have built / used it for
				• Why did you use these? Which ones didn't you use? Why?
				• Did you miss anything / do you feel like you couldn't visualize something specific?
				  • a specific topic
				  • a way of communication
				  • a combination possibility
					potential of tangibility

woman ‹› midwife	• Do you think this could help in the interaction with your midwife, if so, how? • If feeling not understood: do you think this could help to make yourself clear? • Do you think this could have changed your relation to / the interaction with the midwife?	• a) Do you think this could have helped / changed something in the interaction with your midwife, if so, how? • b) Do you think this could help in the interaction with your the h.c.s. representative? • If feeling not understood: do you think this could help to make yourself clear? • Do you think this could have changed your relation to / the interaction with the midwife?	• a) Do you think this could help in the interaction with your midwife, if so, how? • b) How did it influence your interaction with midwife? • If feeling not understood: do you think this could help to make yourself clear? • Did it change the way you think about midwife? • Do you think this could change your relation to / the interaction with the midwife?	• a) Do you think this could have helped in the interaction with your midwife, if so, how? • b) 1) How did it influence your interaction with hc representative? • b) 2) How do you think it could influence your interaction with hc representative? • Did it change the way you think about midwife / hc representative? • Do you think this could change your relation to / the interaction with the midwife?	mutual understanding being heard / respected
woman ‹› woman	• Do you think this could change how much influence you feel you have? • Do you feel more in charge in regards to your own situation within the health care system?	• Do you think this could change how much influence you feel you have? • Do you feel more in charge in regards to your own situation within the health care system?	• Did it change how much influence you think you have on your own situation? • Do you feel more in charge in regards to your own situation within the health care system?	• Did it change how much influence you think you have on your own situation? • Do you feel more in charge in regards to your own situation within the health care system?	feeling in control
woman ‹› perception of their situation	• Does it change the way you perceive your situation / do you think it could? • Does it change how safe you feel / Do you think it could? Do you feel your wishes / needs are / would be acted upon?	• Does it change the way you perceive your situation / do you think it could? • Does it change how safe you feel / Do you think it could? Do you feel your wishes / needs are / would be acted upon?	• Did it change how you thought about your situation? • Did it change how safe you feel in your situation? / Do you feel your wishes / needs are acted upon? a) in h.c. system in general b) in relation to the midwife	• Did it change how you thought about your situation? • Did it change how safe you feel in your situation? Do you feel your wishes / needs are acted upon? a) in h.c. system in general b) in relation to the midwife	feeling safe
	• When thinking about our first meeting, did something change for you? • Remarks? • negative aspects? • positive aspects? • potential / improvement suggestions?	• When thinking about our first meeting, did something change for you? • Remarks? • negative aspects? • positive aspects? • potential / improvement suggestions?	• When thinking about our first meeting, did something change for you? • Remarks? • negative aspects? • positive aspects? • potential / improvement suggestions?	• When thinking about our first meeting, did something change for you? • Remarks? • negative aspects? • positive aspects? • potential / improvement suggestions?	

Fig. 12. User test protocol.

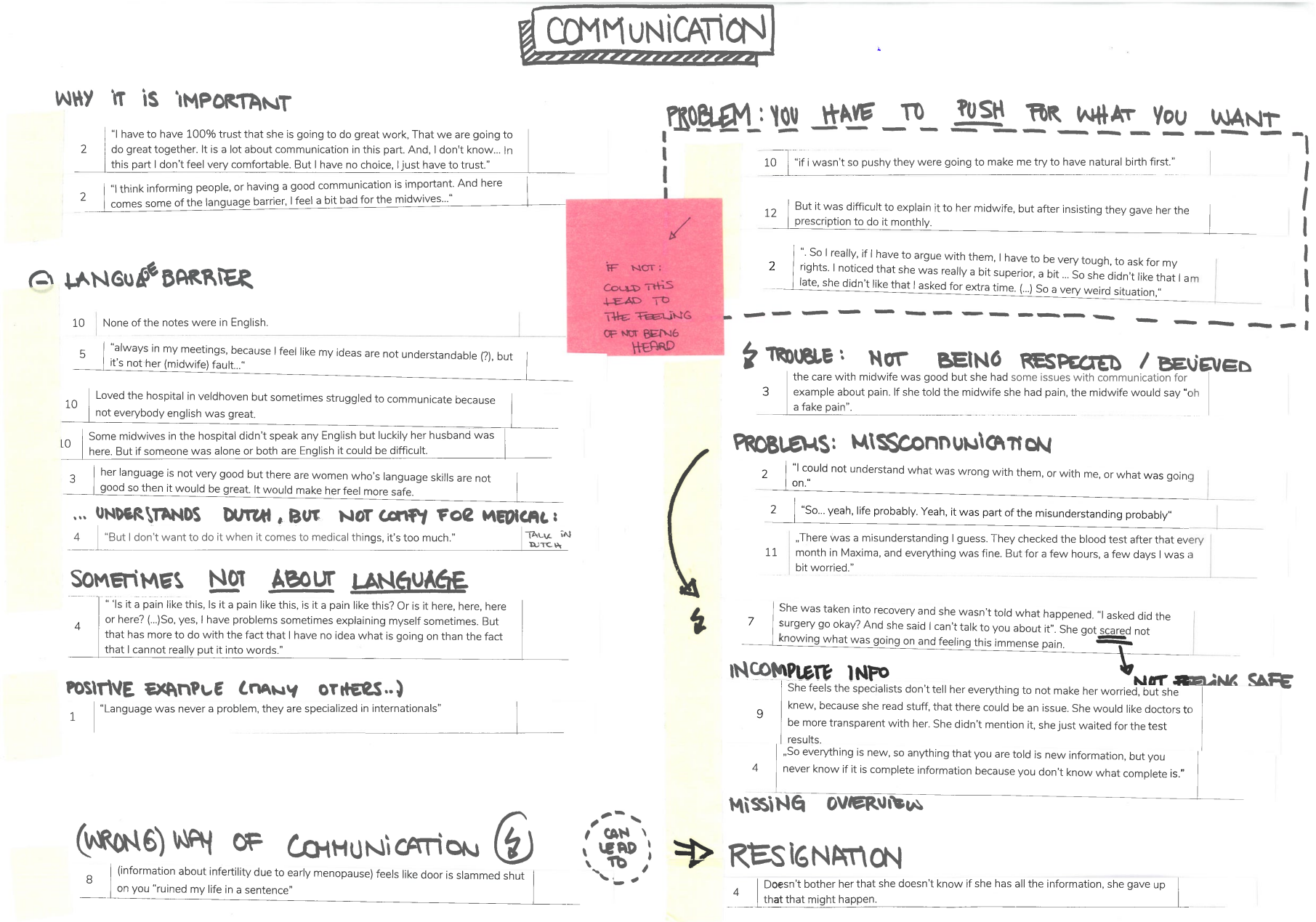


Fig. 13. Interview evaluation overview, topic communication.

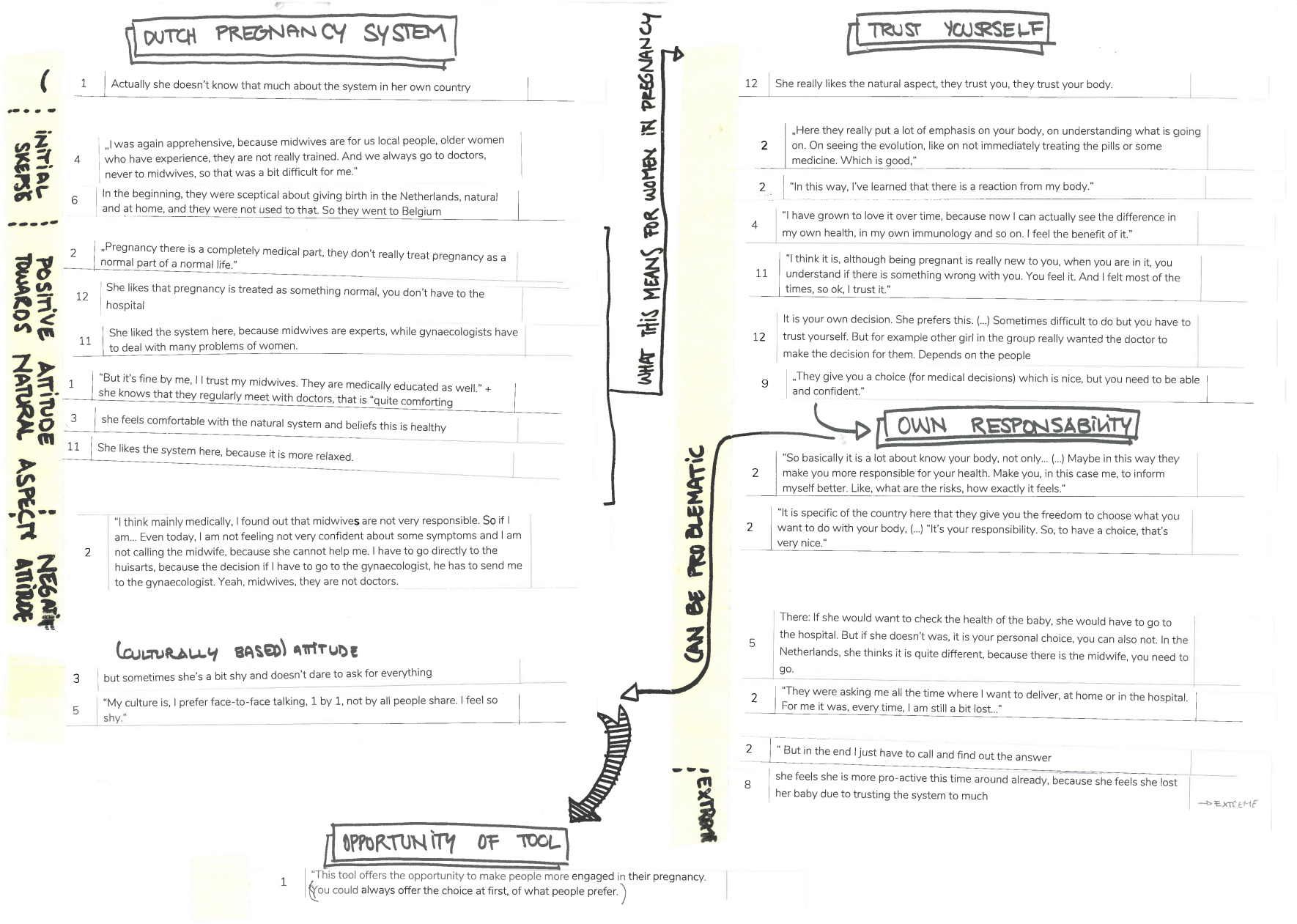


Fig. 14. Interview evaluation overview, topic health care system.

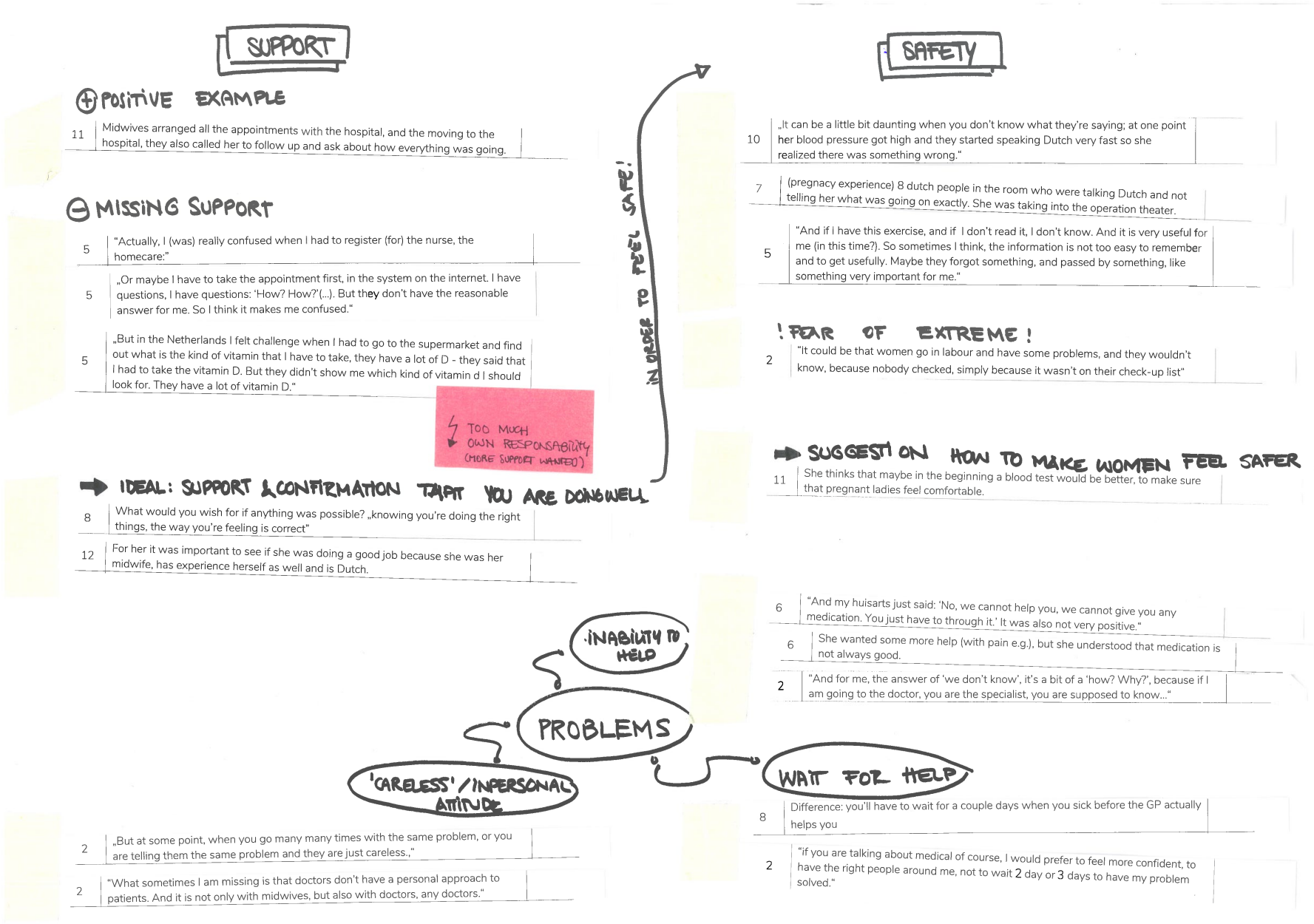


Fig. 15. Interview evaluation overview, topic support and safety.

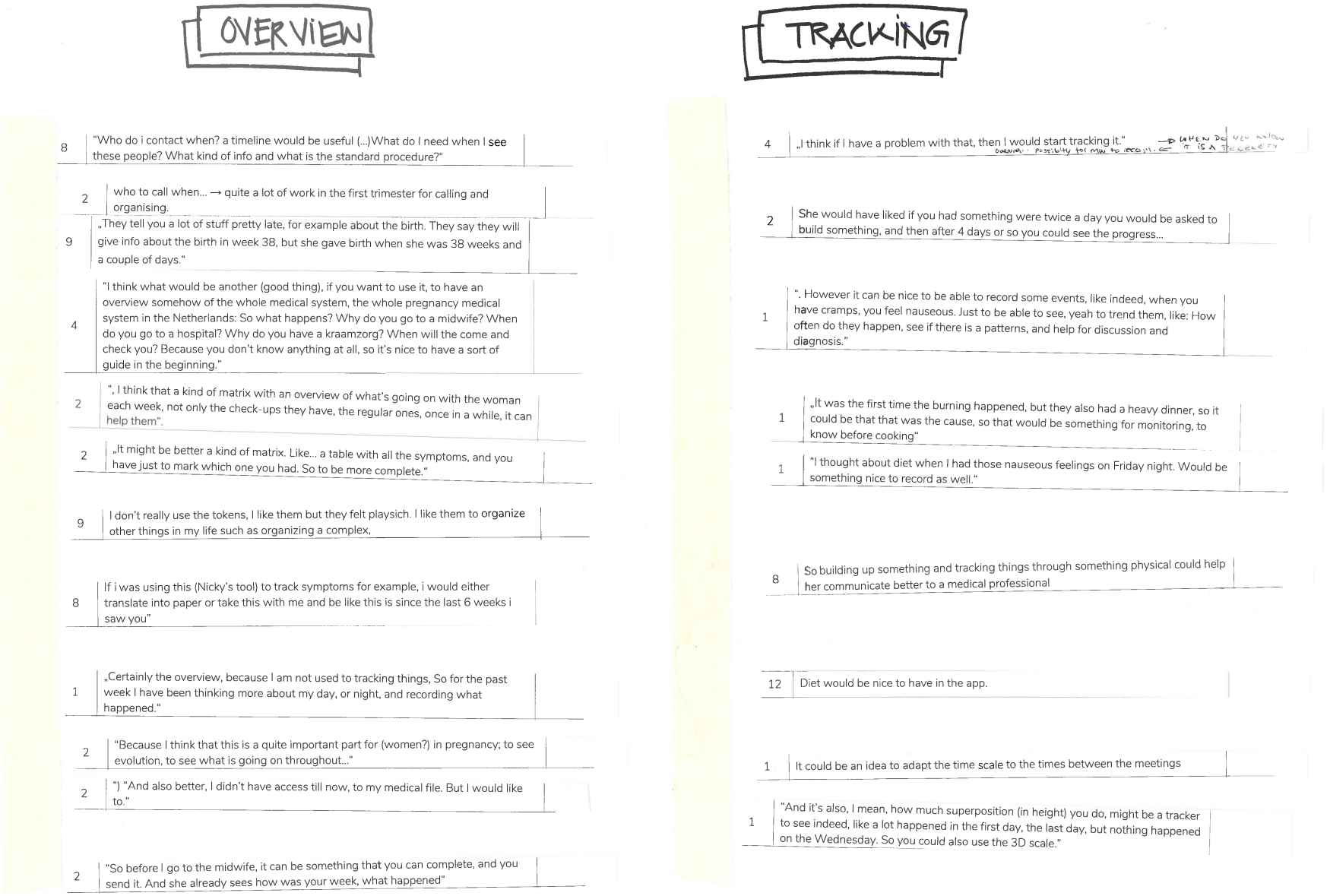


Fig. 16. Interview evaluation overview, topics overview and tracking.

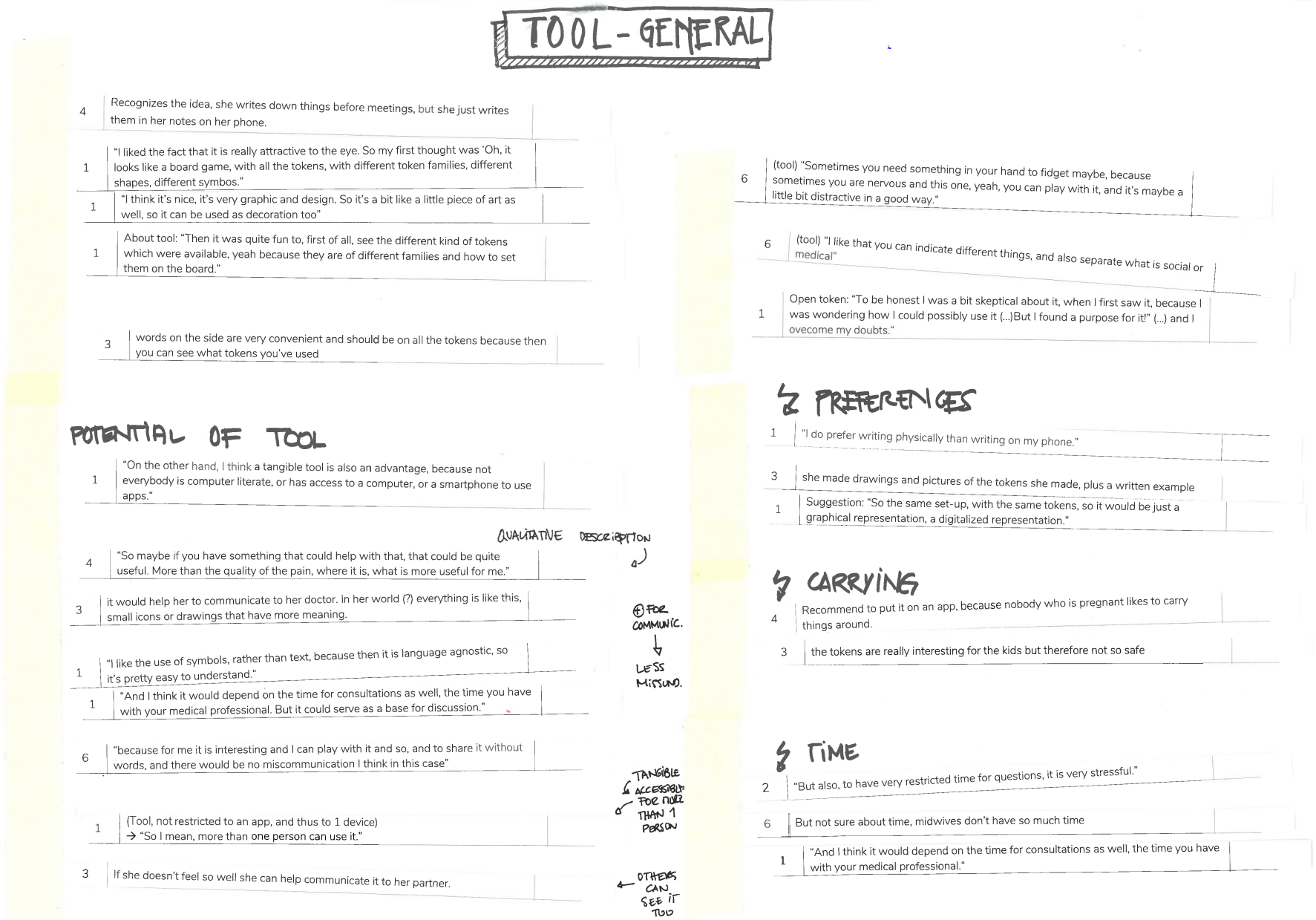


Fig. 17. Interview evaluation overview, topic tool in general.

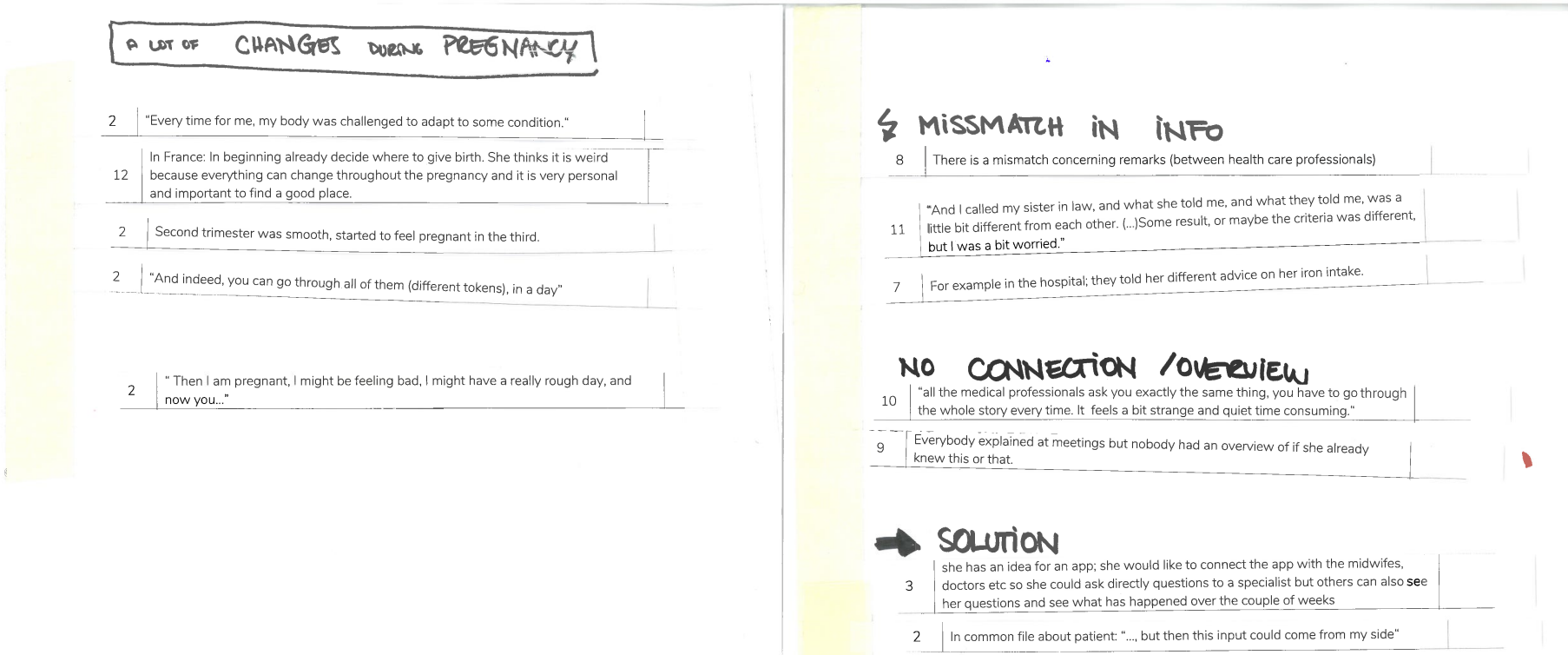


Fig. 18. Interview evaluation overview, additional insights.

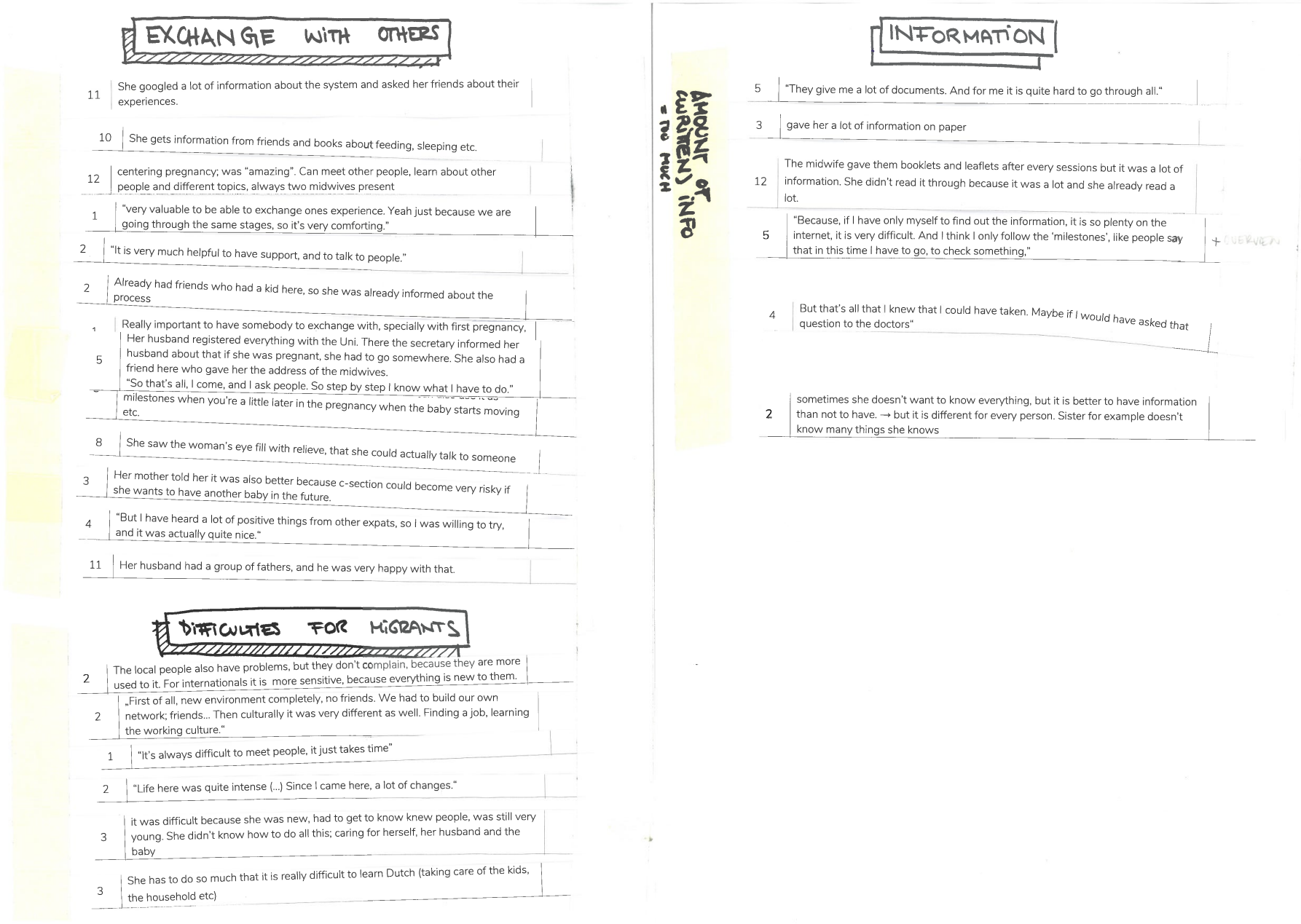


Fig. 19. Interview evaluation overview, topic challenges for migrants.

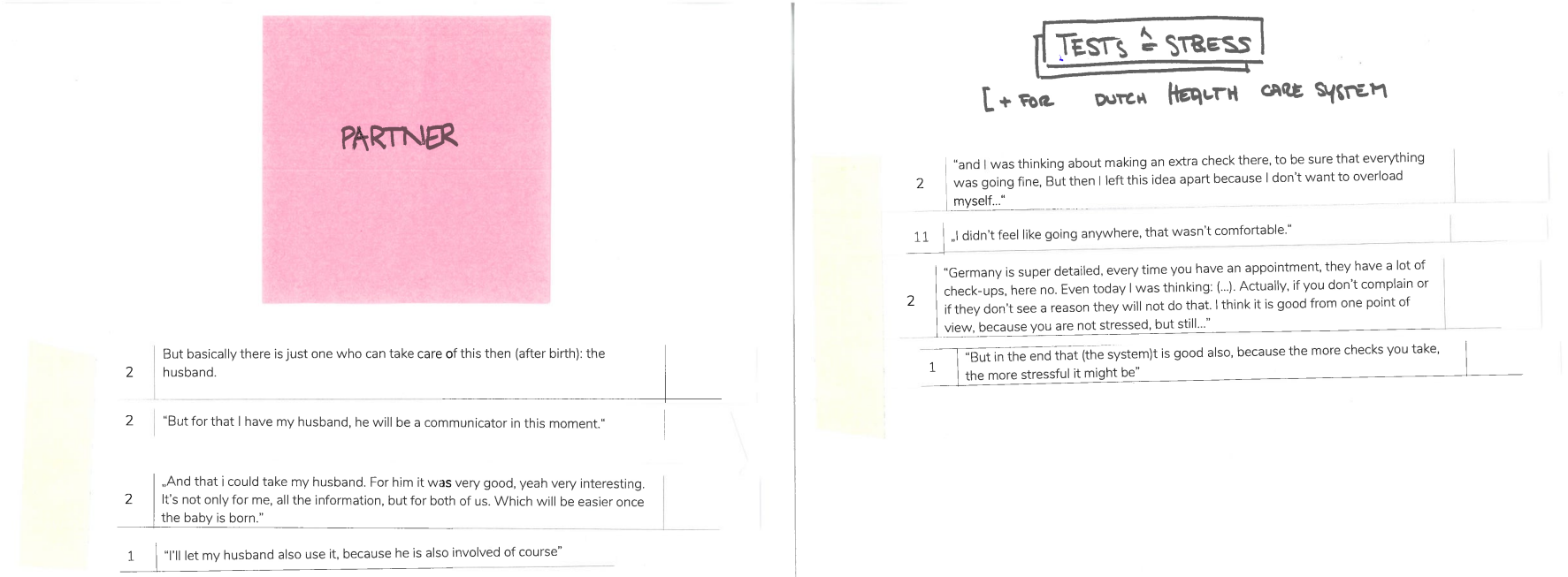


Fig. 20. Interview evaluation overview, topics importance of partner and stress in medical system.

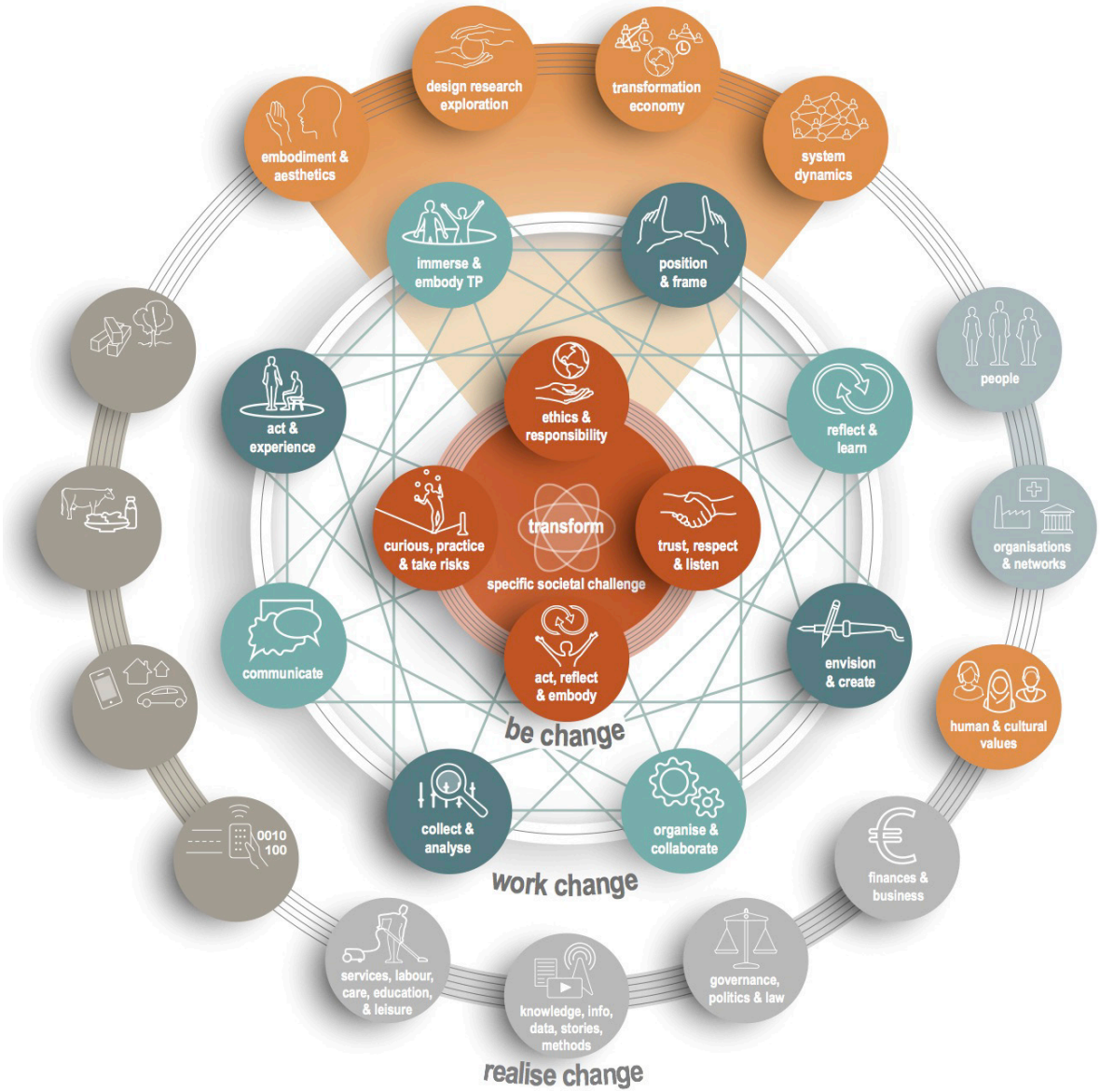


Fig. 21. Transformation Practices Framework (Hummels et al., 2019).

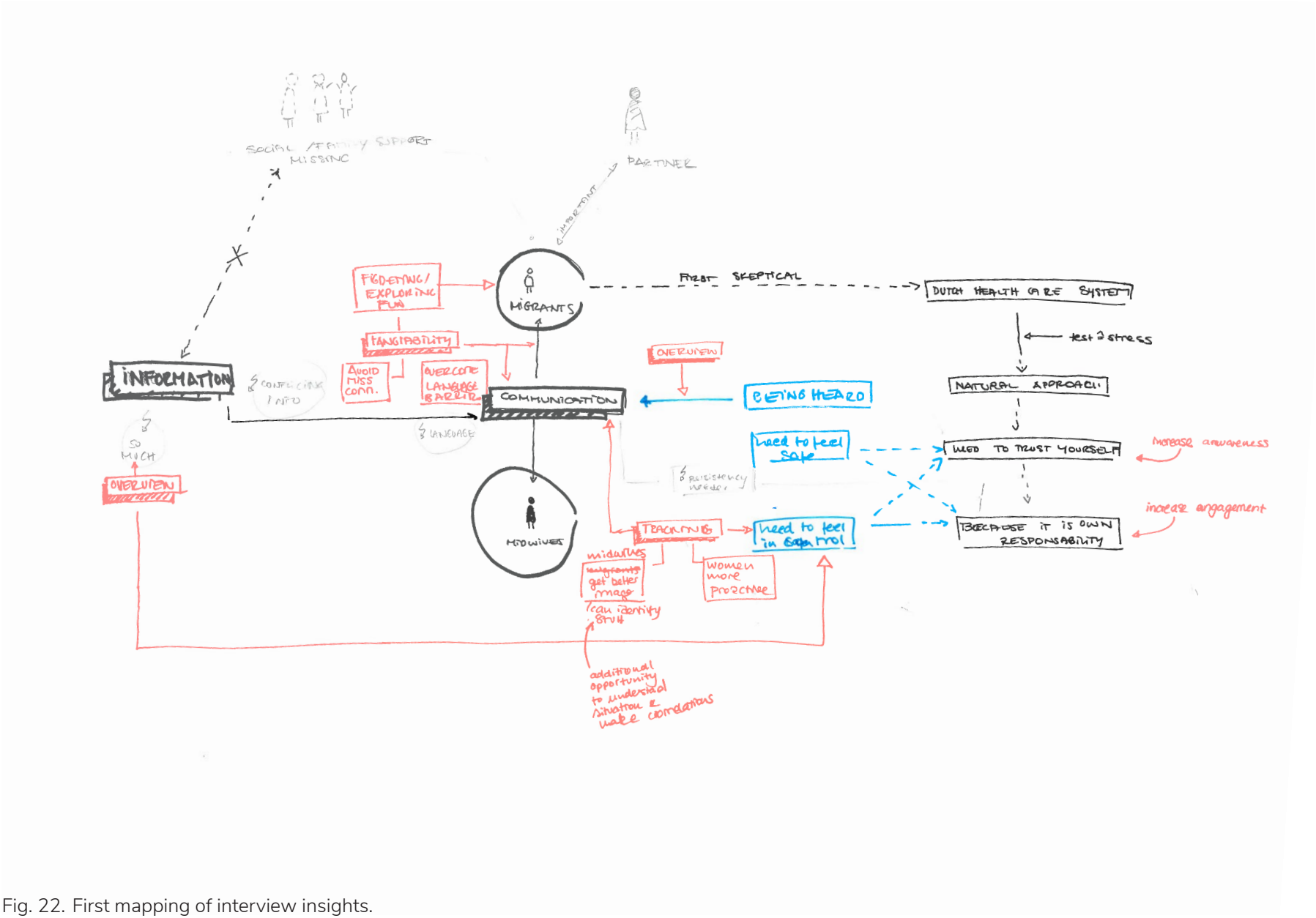


Fig. 22. First mapping of interview insights.