MyShare

Visualising collective stress through a tangible interface in the office environment

A master 1.1 project by
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MyShare

Abstract

The most prominent occupational disease for office workers is stress, which can over time lead to mental and physical health problems such as burnouts. These consequences of chronic stress are preventable if its formation is recognized early on, but the office environment and culture do not currently facilitate this enough.

This design project, in collaboration with a Dutch occupational health organization, aims to provide insight in stress in a concrete, low-threshold, and playful manner. By measuring and displaying the collective stress of the workspace anonymously and in real-time with MyShare, we aim to encourage awareness, reflection, and discussion of stress amongst colleagues. User evaluation also highlights the value of MyShare as a feedback tool for supervisors, and the opportunity to facilitate solutions more prominently through the design. This is a first step to encourage preventative actions by individual users, as well as medical professionals or supervisors.

Further appendices,
scan QR code

Introduction

Stress is the number one occupational disease for the office environment. It is responsible for 36% of the work-related absenteeism, and costs employers 1.8 billion Euros on a yearly basis (Hooftman et. al., 2014). Stress is defined as “an unpleasant state of emotional arousal” (Nair, 2013). This paper considers that emotional arousal can be either positively or negatively experienced by an individual, but only the negative is defined as stress. Although stress is a normal experience, longer periods of negative arousal, chronic stress, can have severe consequences such as burnouts. Over one million people in the Netherlands risk a burnout or other psychological condition every year because of occupational stress, while another million employees already suffer from signs of burnout (Hooftman et. al., 2014). This can create severe consequences for not only the employee’s own health and overall quality of work, but also their colleagues’.

Despite its serious consequences, it is almost considered taboo to discuss the topic of stress and related problems in the workplace (Bharadwaj, Pai, & Suziedelyte, 2017). One can feel expected to perform at a too high level while hiding the consequences of such demands, or even consider it a normal part of the job to suffer (mental) health issues. However, despite this secrecy, those who suffer burnouts are often less able to recognize the warning signs in hindsight than their colleagues are (Ericson-Lidman & Strandberg, 2007). It could be valuable to use their observations as a means to prevent these issues, but the social obstacle to discuss stress honestly often prevents this.

A popular approach to reducing stress is individualistic intervention in the form of personal therapy or tools such as self-help books and mobile apps. These encompass both preventative insights and recovery from harm, and can be used to gain insights in one’s behaviour over a longer period of time through diary studies or short surveys. Another approach is to measure stress levels through lowered heart rate variability (HRV), a physical indication of stress, with smart sensors, although this lacks any subjective information about positive or negative experiences.

However, according to Houtman’s model of causes and consequences of work-related stress (Houtman, 2007), the risk factors of work-related stress are largely dependent on external factors that an individual has limited to no control over, such as aspects of their job organization and the mood of colleagues. This highlights the value of investigating the collective stress in the workplace, further discussed in the next chapter.

In Europe, interventions specifically meant for the office environment take the shape of voluntary group workshops addressing stress management, or counseling for individuals who suffer from extreme stress-related problems (Cooper & Kompier, 1999). These interventions are used as a countermeasure for present stress in the office, but can therefore only offer limited insight in the patterns leading to serious long-term harm before it occurs. Regular evaluations for individuals not currently experiencing stress seem to be missing in this landscape, although there is much to gain when a company can prevent the consequences of chronic stress.

In this project we aim to prevent burnouts and chronic stress in the office environment by providing insight in these issues. Insight in emerging problems through analysis of continuous personal data is the first step to their prevention, and can therefore contribute to a more sustainable working environment. This is done in collaboration with a Dutch occupational health service, which currently sees occupational stress as one of their biggest challenges (personal correspondence, Gijs Wobben, September 5, 2018).

The following design opportunity emerges:
In the office environment there is need for a method that provides insight in the early signs of chronic stress and burnout for employees, as well as a communication to their higher-ups who can make changes to the work environment. Examining the collective stress experienced in the workplace over time can provide a lot of this insight. This method should avoid any negative social or professional consequences for individuals involved from either mental health stigma or medically-based discrimination. Furthermore, it should combine long-term insights from preventative individualistic methodologies with constructive feedback from colleagues.

Related Works

In order to get a better understanding of the experienced collective stress in the office environment and how the collective stress can be examined, the topic should be further elaborated on. For this, multiple previous designs and their related theories are reviewed.

Collective Stress

Corporate culture is affected by the collective behaviour of employees, this behaviour is instrumental in the achievements of a company (Mathur et al., 2015). Stress in an organization can be approached as collective stress. Like Xue et al. describe; 'Collective stress, as a certain type of stress, represents the stressful feelings of members in a particular organization'. Often, due to practical constraints, social issues are addressed instead of collective stress (Xue et al., 2017).

People nearby such as co-workers are crucial for helping with the recognition of early signals of a burnout. In this way, awareness is raised and taking action to prevent bad consequences becomes more likely. Signalizing these symptoms might be challenging since co-workers might interpret these signs as traits that add up to an idealized image (Ericson-Lidman & Strandberg, 2007), yet it is important to consider co-worker support since it has been linked to a decrease emotional exhaustion (Peterson et al., 2008).

Awareness

Both an interest in the behaviour and an effort of the user is required for self-reflection. (Thieme,2012). For job related stress, peer-support groups working with problem-based approaches may help to lighten burnout and stress (Peterson et al., 2008). A better understanding of the emotional and cognitive states of other people may be gained by obtaining insight into the invisible states (Liu et al., 2017). Study points out that a sense of control and the possibility to act upon this might be stimulated by showing biometric data (Xue et al., 2017). Stress reduction may be a consequence of revealed physiological states (Liu et al. 2017).

Stress Measurement

Among others, heart rate variability and galvanic skin response can serve as a means for designing stress interventions. A visualisation of this input data may raise awareness and therefore might support the coping with stress. However, scaling these data measurements to a collective situation results in high costs (Xue et al. 2017). Xue et al. therefore propose scales and questionnaires as an opportunity, but also note that this might lead to a limited amount of design possibilities. Nonetheless, a quantified collective approach may lead to effective insights (Mathur et al., 2015).

Gallacher et al. researched the user experience when filling in a questionnaire. They focused on gathering input via a tangible interaction. It is described a physical tangible interface can draw attention to a display. It is suggested that real-time data visualisation might enable reflection and conversation in future designs in which the data visualisations are familiar to the user (Gallacher, et al., 2015a).

Visualisation & Playfulness

According to Xue et al., visual representations might help the coping with stress and thus may help to improve the performance of employees. Clockviz, one of their design examples, focuses on raising awareness through a visualisation of collective stress by making use of biosignals. The study proposes a social interaction platform for employees where they can report their stress levels and can help their co-workers. It is suggested to design a public visualisation with the intention to bring people together (Xue et al., 2017).

Another research (Marthur et al. 2015) focused on visualizing the mood in the office environment by the use of a color lamp. Anonymity, transparency, and inclusion are proposed as factors to consider to increase employees' trust. As is described by Mathur et al., 'the participatory nature of our system interested users the most – it gave them an opportunity of self-expression, and at times led them to reflect on their own mood and activity'. The study shows playful interaction can encourage employee participation with a technological system in the office. It is suggested new kinds of displays visualising quantified data and empathic interactions in the office should be explored further.

Panorama is an example of a design that is meant to raise social awareness in a office environment. A display was designed that gave insight into the social environment of the office environment by giving an artistic representation of the input of employees. Explicit information was gathered through electronically submitted personal data. The design research lead to the insight that a higher level of direct interaction with the system was desired. The designers also proposed a more playful interaction (Vyas, 2007). Another study by Vyas (2008) explores employees' everyday experiences with cultural probes in their office environments. The study resulted in the notion that self-reflection and casual encounters were social interactions that encourage playfulness in the office environment. It suggests technologies using non-instrumental aspects in a playful manner can be successful in office environments.

A more collective approach on a collecting data via a technical tangible interface is Mood Squeezer. This is a set of colored balls that allows employees to reflect on their mood. Mood Squeezer did have a positive impact on conversation and reflection, without being disruptive or causing social embarrassment. Discussions between employees were encouraged by the system. It is suggested playful interactions may lead to a positive atmosphere (Gallacher, et al., 2015a).

Employees prefer to compare themselves and their co-workers (Marthur et al. 2015). Besides, showing physiological data playfully encourages their engagement (Liu et al., 2017). If unpleasant data is presented playfully, users may be more encouraged to change their behavior (Thieme, 2012).

User & Context

The occupational health organisation we are collaborating with is 'Human Total Care' (hereafter HTC). HTC is the largest occupational health service provider in the Netherlands. HTC's objective is to help employers as well as employees to draw up and implement working conditions and absenteeism policy. The statutory health and safety obligations require specific expertise that the employer usually does not have. A health and safety service therefore advises and takes over tasks from the employer in the areas of working conditions, absenteeism guidance, reintegration support and risk inventory and evaluation of all this. HTC works together with 65.000 employers and 1,5 million employees in all sorts of industries. One of HTC's products is the My-care platform which is currently in development. (Ren et al., 2018)

My-care

My-care is a personal health platform for employees. This platform gives employees access to health support throughout their entire working life. This health support consists of occupational health professionals, preventive medical examinations and e-learning programs related to health and vitality and sustainable employability. My-care is personal rather than bound to an organisation. In case of changing jobs, the health information will still be accessible in the same way it was before.

My-care currently collects personal data from both medical examinations and surveys about several topics such as physical health and stress. This information is retrieved approxi mately once every one or two years. Preventive medical research on this information leads to data that gives employees insight in the state of their current health and possible health risks. Based on this data, e-learning courses are offered to match their current health status, with the aim of prevention and improved personal health. (Ren et al., 2018)

Opportunities

As the data is only gathered once every one or two years, the preventive strength of the current My-care platform is questionable. Especially for the purpose of preventing chronic stress, we believe it is of great significance to intervene before problems occur. If stress-level data could be measured on a more regular basis, My-care can more reliably help employers and company doctors in preventing chronic stress.

We believe it is interesting to combine two different kind of data: the objective and subjective stress-level data. Currently the HRV is often measured in order to detect stress. Though, objective data such as the HRV, lacks personal perception. We have experienced common vocabulary differentiates "positive" and "negative" stress, rather than defining stress as inherently unpleasant. When combining these two types of data, company doctors can have more accurate insights on employees' mental well-being.

Our contribution to My-care is to design a technology-assisted playful service system that can be embedded into the My-care platform, for the purpose of promoting behavioural change towards healthier lifestyles among office workers. We would like emphasize the analysis and visualization of subjective stress by means of measuring different levels of emotional arousal and levels of (un)pleasantness.

When designing a technology-assisted service system that can be embedded into the my-care platform for driving the behavioural change towards healthier lifestyles among office workers, multiple artefacts and stakeholders have to be taken into consideration.

Stakeholders: the office workers, the employers and the company doctors employed by HTC.
Artifacts: the My-care platform and our design.
Their relations are visualized in fig.1.

As mentioned earlier, there is a focus on gathering and visualising of subjective stress levels for office workers. For now, objective stress measurement by means of body sensors will not be taken into account.

Office workers

Office workers are considered to be the target users. However, this encompasses a broad range of people. Office jobs can vary a lot in routine, tasks and working environments. Therefore it is narrowed down to one particular group of office workers: employees of companies that put emphasis on the trend 'het nieuwe werken' (The New Way of Working).

The New Way of Working is a vision on the renewal of the physical workplace, the organizational structure and culture, the management style and mentality of both employer and employee. For many young and future employees this emerging trend of flexible working conditions and modernization that a lot of organisations embrace feels natural. ("9 experts en trendwatchers over de werkplek over 9 jaar", 2017).

We believe that this trend will progress on a large scale. The increased flexibility of this environment is also an opportunity for more playful interactions than in the traditional office. We therefore believe it is relevant for Human Total Care to put emphasis on this category of offices. For this reason, we have started a collaboration with 'Woonkwartier', which strongly identifies itself with this way of working.

Woonkwartier

Woonkwartier is a medium-sized housing corporation in the Netherlands and has approximately 100 employees. Their office space consists of three floors containing flex working places, meeting rooms, a canteen, and other workspaces with screens, chairs, benches and tables. In order to define corporate culture and to give an impression of internal social norms and interactions, both the observable artefacts and the espoused values have been researched.

We have perceived Woonkwartier as a very warm, open, and caring company. There is a lot of interaction among employees, which is also stimulated by the offices' interior design. They work with flex office spaces and the meeting rooms vary from closed rooms with large tables to open spaces with comfortable chairs and couches . The employees dress casually and also undertake informal activities with their colleagues outside of work.

"At what time are we going to play squash tonight?" *– one colleague to another*

Fig. 1 : context map of stakeholders & artifacts

The CEO of Woonkwartier is very involved with his people and walks around all day in order to check in on his employees. He puts emphasis on celebrating everyone's birthdays, Christmas, Sinterklaas, and he organises a drink every now and then.

Woonkwartier's people-focused approach also becomes apparent in how they work with their customers. They consider themselves socially concerned and they would describe themselves as practical, personal and pro-active.

The user journey in fig. 2 gives an overview of an average day of an employee at Woonkwartier.

"Hey guys, make sure you get some cake before everything is gone" *- one colleague warning the others*

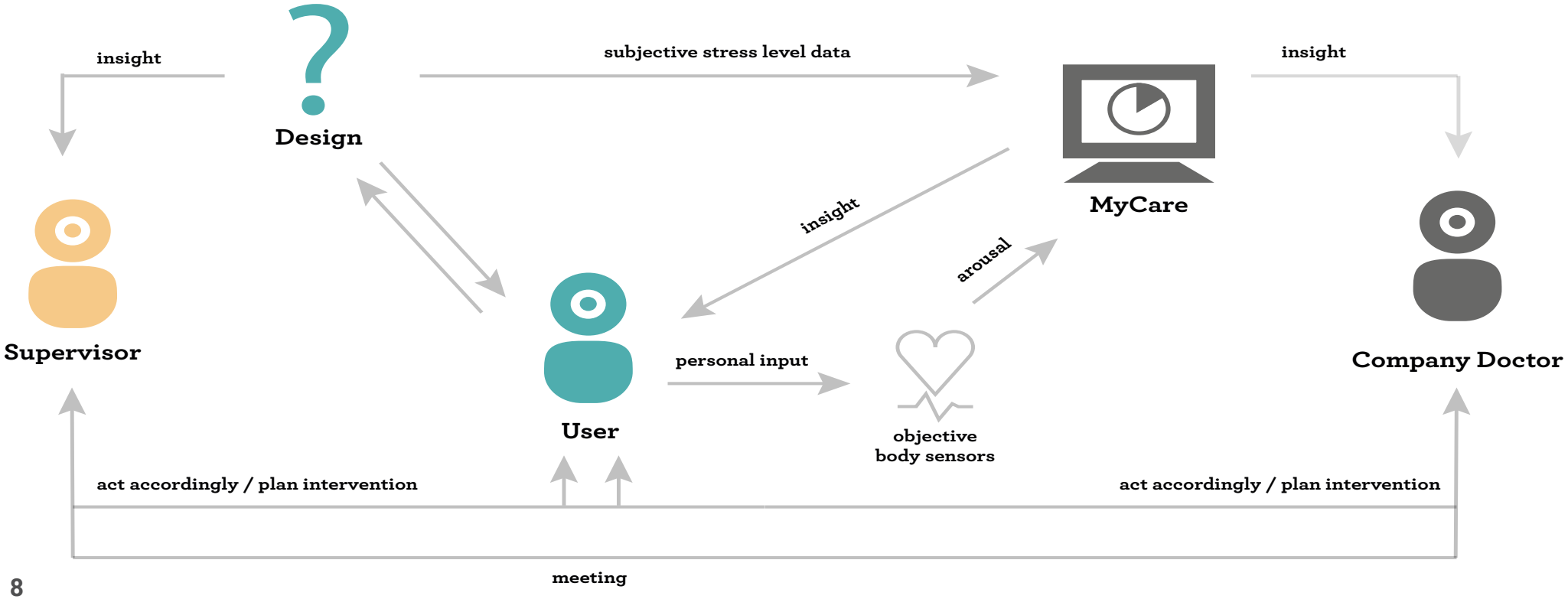
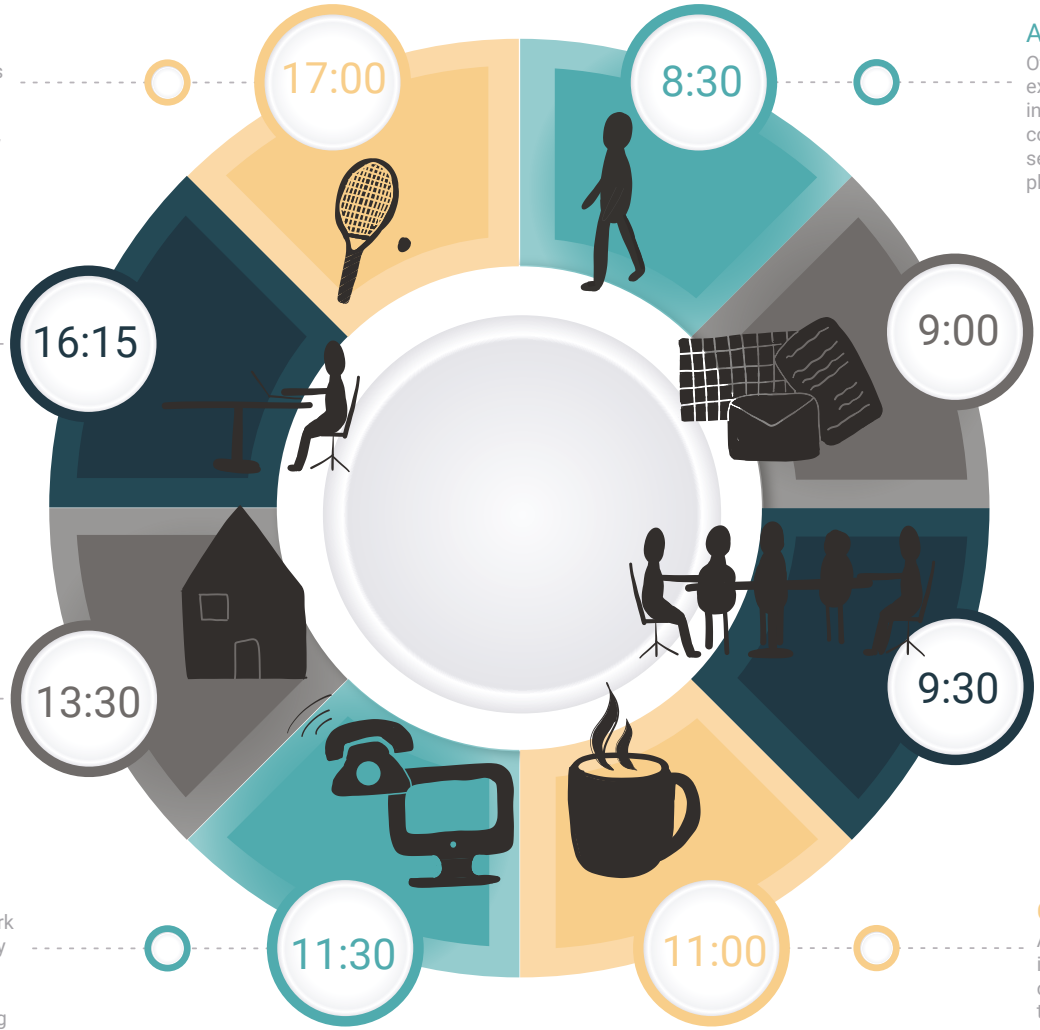


Fig. 2 : user journey: overview of a day at Woonkwartier



Arriving at Work
Otto arrives at Woonkwartier at exactly 8:30. He likes to start early in the morning so he can have a coffee break during the day. He settles at one of the flex working places that Woonkwartier offers.

Mail, Agenda and Meeting
The first thing Otto does in the morning is checking his agenda for that day and checking his e-mails. Every monday morning, there's a meeting for the whole department. Otto likes to take his time in order to prepare well for this meeting.

Department Meeting
Every monday the department has a meeting with all employees. During the meeting, everyone gives an update on their projects and the supervisor gauges how everyone is doing.

Coffee Break
As the meetings can be quite intense, Otto always plans a coffeebreak afterwards. He takes time to catch up with his colleagues and walks around to strech his legs.

Day Duties
After a break Otto is ready to work on his daily duties. His tasks vary from making phone calls to making presentations and preparing home visits and writing reports.

Home Visit
As Woonkwartier is a housing corporation, Otto weekly visits clients at location.

Back at the Office
After the home visits, Otto updates the administration and writes reports on his home visits.

Leaving Work
After a busy Monday, Otto wraps up and is ready to go home. He leaves with some of his closest colleagues and he agrees to play squash with one of them in the evening.

Process

The design landscape is quite intricate with multiple stakeholders, many different theories on behavior change and many opportunities. How to approach such complexity best? The Reflective Transformative Design Process (Hummels & Frens, 2009; Tomico et al. 2009) and the Transformative practices framework (Hummels et al. 2018, hereafter TP framework) argue in favour of a flexible iterative process in which the concept is reflected upon through many tests in context. The frameworks are a combination of steps from design, research, collaborative an developmental elements. The TP framework builds on this by navigating ambiguity from multiple perspectives to make actual change happen. They define three levels (see appendix C) on which designers and stakeholders make change: “be change” (1st person perspective, having an attitude towards changing), “do change” (the activities that can be carried out to make change happen) and “realize change” (elements and parties that need to be integrated in the final change). This project covered the initial phase for further development, therefore the process mostly remained in “be change” and “do change” levels.

This process (fig. 3) takes a lot of inspiration from the aforementioned frameworks. The project’s duration was sixteen weeks, divided over three main phases and two bridges between them (see s for more in-depth explanations). The three phases are similar to Tomico’s three phases: Exploration, Ideation and Confrontation. Though with a bit more changing between the perspectives. The first phase of five weeks, called Exploring the Collective, focused mostly on framing and expanding the design landscape. Then one week was used to substantiate a need for more careful considerations about privacy in data-driven designs. The second phase of three weeks, called Connecting in Context, aimed to combine all the loose data from the first phase into a more coherent story and concept. This was followed by another sidestep, verifying and testing our concept map in the context. The final phase of six weeks, called Making It Tangible, focused on realizing our prototype and validating it with the stakeholders.

Retroactively, some elements from the TP framework were associated with the different phases, once done halfway and once in the end, to give a better understanding on the core of the phases and activities for the team and stakeholders. All phases clearly showed steps for Positioning & Framing, Reflect & Learn and communication, as we constantly had to update our vision and story regularly and keep all stakeholders and coaches informed. Collect & Analyse through Design Research Explorations are also often returning as every has multiple tests with users and stakeholders in context. One big difference is that at the start values like System Dynamics and Ethics & Responsibility are more important, while later this moves to more concrete values like Embodiment & Aesthetics and Envision & Create. By shifting between perspectives and testing often, the process aims to make sense of a lot of ambiguity and create a concept that fits the context.

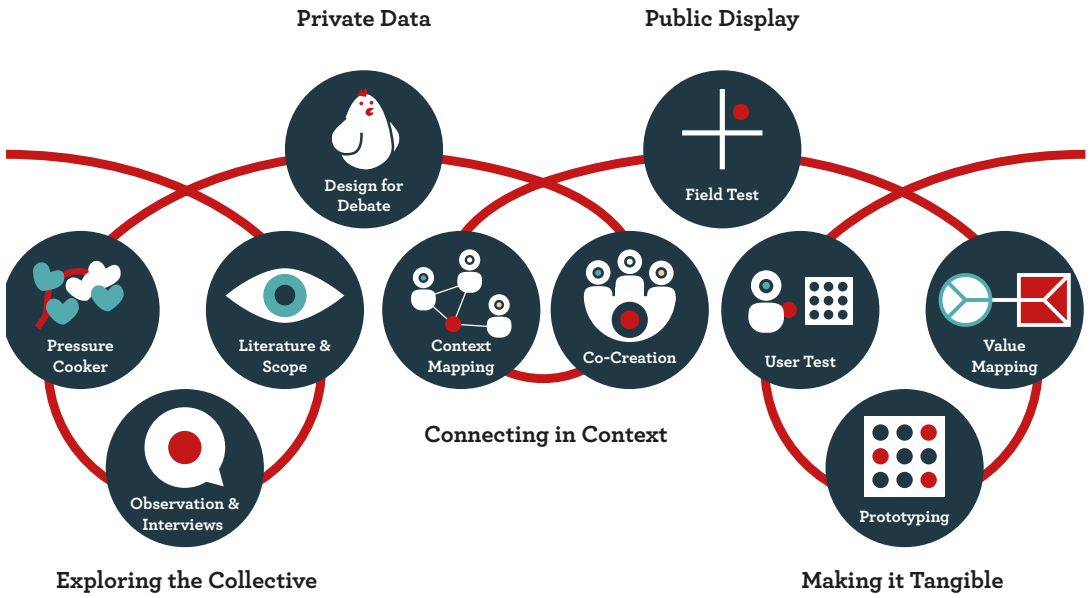


Fig. 3: our three main phases in the design process

Iterations

Phase 1 : Exploring the Collective

Goal: *define scope and explore the design landscape. Create some thought-provoking concepts for feedback.*

Methods & Theories: *pressure cooker, literature review, user interviews, context observation, market analysis, brainstorming, storyboarding.*

Outcomes & Insights: *long-term stress is a big problem for employees, employers, and occupational health organizations. Most current solutions focus on personal stress or put responsibility on a single actor, despite the importance of social factors in stress. Three concepts were brought up to enable discussion and participation. However, the storywas in need of more coherence and could be specified more.*

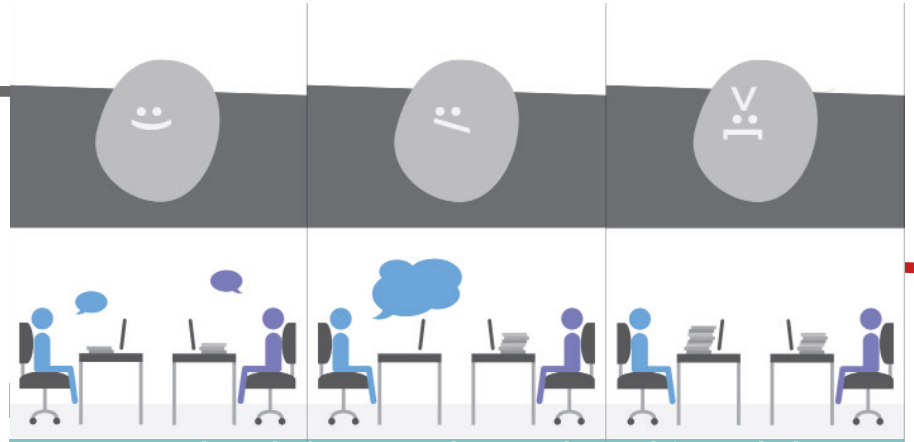


Fig. 5 : a storyboard of a potato showing the work/stress balance

A market analysis (appendix F) found most data-driven designs to reduce stressful behavior focused on the individual, while most larger scale interventions did not make use of any data. Trends were found that showed a need for more privacy, better integration and more fun in. All insights were used in a brain storm session. Three concepts were chosen and worked out in storyboards: a heart tree where colleagues leave compliments, a potato showing the stress and workload balance, and a chicken displaying stress levels and giving intervention ideas. Our squad suggested to do more research on social support and persuasive design, and to consider gathering personal data to support the link with MyCare. We felt that we received a lot of controversial and contradicting feedback about the project's direction from different stakeholders and coaches, and set up a plan for better relations. One of the controversial topics was data privacy, therefore one week was planned to explore this topic for our client.

The project started with a briefing from the client followed by a Pressure Cooker. The client technology-driven vision for decreasing absenteeism and our vision on relieving health stigmas resulted in a focus on stress reduction for nurses an cooks. Through a literature study it was found that occupational stress was a big issue and that social and behavioral interventions might be good solutions (see page 5 & 6.). However, the largest segment of HTC's customers are officers workers. Therefore, our focus shifted to this target group to suit the client's interest.

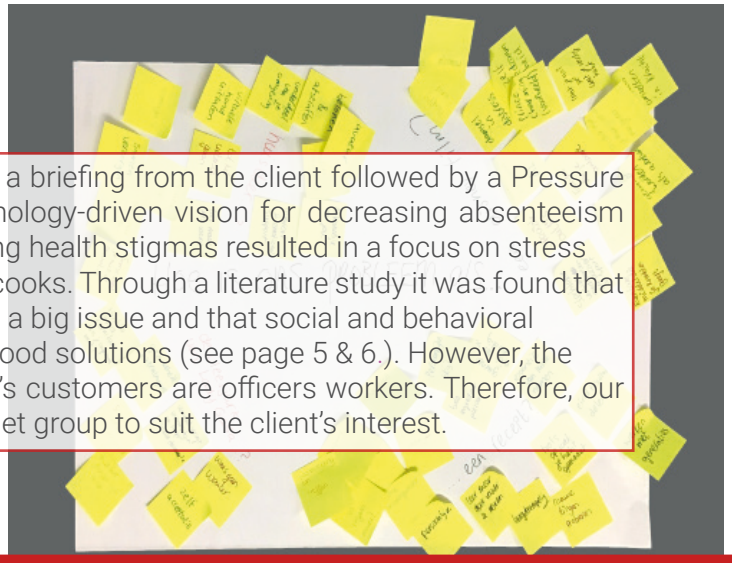


Fig. 4 : a brutethink exercise from the pressure cooker

Two quick studies were carried out to gain a better understanding of our target group (see appendix D & appendix E). Employees at the High Tech Campus were interviewedabout their percetion of stress in themselves and heir colleagues and how they dealt with it. They easily recognized signs of stress in their colleagues, but had difficulty pinpointing specific signs. For solutions they often looked at their supervisors or company-wide programs rather than their close colleagues. We saw an opportunity for enabling colleagues to help each other. The second study's goal was to observe the office workers of Human Total Care in their daily routine and find opportunities to measure stress. The results gave us a better insight in the working environment. We saw the opportunity to use the coffee break, as it was social and relaxing in nature.

Bridge 1: Private Data

Goal: *convince the client of a more conscientious handling of data in future concepts.*

Methods & Theories: *expert meetings, design for debate, wire framing, quick and dirty usertesting.*

Outcomes & Insights: *through a structured argument with evidence from societal developments, expert opinions and usertest data, the client was convinced to go in a direction that respect the user's data and privacy.*

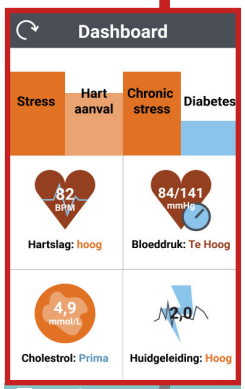


Fig. 6 : a screen shows extreme stress data

Fig. 7 : a screen shows advice out of context

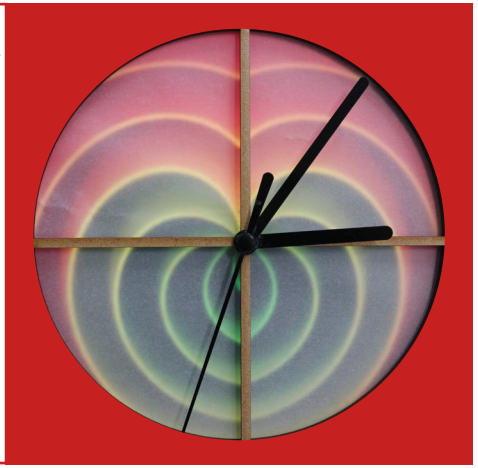
We wanted to go in a more user-centered direction and felt like the client wanted to go more into a data-driven direction. Users should be able to trust the system with their personal details and choose who to share it with. Together with a master student focusing on privacy in design, a plan was set up to show the client that we take their perspective seriously but convince them of our own direction's merit. The argumentation consisted of information from lawmakers and societal trends, combined with the results from a short Design for Debate study. A mock-up app was created, exaggerating how confronting numbers and figures about stress could be. The app was tested with random pedestrians in the city center (see appendix G). They stated the data said little without comparison and they would never wish to share this information with their boss. With our argumentation, supported with such quotes and trends the client was convinced. The group vision changed to using both subjective data and objective data to give completer picture of the work ambiance and stress.

Phase 2 : Exploring the Collective

Goal: *construct a more coherent story of our context, concept and vision and create a prototype of a product that would fit well in the story.*

Methods & Theories: *context mapping, envisioning, co-creation, rapid prototyping.*

Outcomes & Insights: *the concept needs to be a bridge between insight and action, clearly communicating data for a better understanding and triggering intervention. A clock interface could fit here as a public display of the collective stress level, though it might be too passive and is not concrete and personal enough yet.*



Another point of feedback that needed improvement was the coherence in storytelling. Each group member noted down their personal vision and how this could be implemented. Before the midterm we came together to put the current vision on paper, first in words and then in visuals. This gave a clearer overview of how the concept was situated within the story. Two simple prototypes were made with lasercut wood, semi-transparent paper and an tablet showing calm movies. The prototype and visuals were shown to the squad again. The vision came over well, but people could not relate to it, since the employees and stakeholders were barely specified (which was later improved upon in fig. 1, p8). It was also questioned whether creating awareness was enough of a trigger to change. Would employees even look at such a display when they were stressed? The group chose to focus more on triggering the input and visualizing and set out to make the story more personal and contextual.

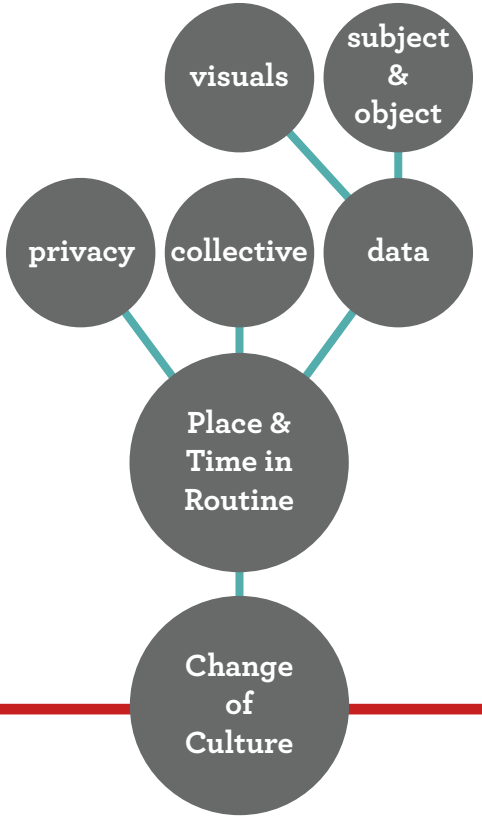


Fig. 8 : a hierarchy of our values

Bridge 2: Public Display

Goal: *1. understand the effect of either private or public input of subjective stress data on the perception of stress. 2. understand how visualisation of trends or instances during the day affects office workers perceived collective/individual stress in the workplace. 3. understand what triggers office workers to self-report subjective emotional data. 4. Get a better feel of this specific workplace, it's people and routines.*

Methods & Theories: *Observation, interviewing, paper mock-ups, thematic analysis, user journeys.*

Outcomes & Insights: *a public display has to be combined with a private input tool. The display should show changes over time in an intuitive way. The system needs to give strong physical triggers for giving input.*

Fig. 11 : a userjourney based on the test

For goal 3 & 4 all interviews and observations were transcribed and clustered using thematic analysis. Some interesting topics were discovered like Reflection on Visualization and Playful Social Interactions. Based on these, user journeys were created to see what triggered or withheld people from self-reporting (see appendix I & appendix J).

The first test focused on goal 1 (appendix I). In group A people reported their stress levels on personal papers and insert them in a box. In group B people put a sticker on a large sheet that was visible for all. In both areas we removed the input every hour to analyze. Observations were made and questions were asked about their experiences. The results showed a clear preference for personal input as people felt more comfortable and felt that the outcomes were more reliable.

Fig . 10 : pictures and quotes from the four test cases

In test 2 goal 2 was researched (appendix J). Both groups gave input via a box, which was emptied every half hour. In group A, a visualization was made with all the points of the previous half hour. In group B, a visualization of the whole day was made, where older points were colored darker. People liked seeing the trends in output. However, a meaningful visual required many entries, showing a need for a strong trigger.

Next a co-creation session was held with experts from diverse areas within HTC and a PhD student focusing her research on presenting physiological data about collective stress (see appendix H). The session mainly focused on what they saw as problems, opportunities and values and less on the actual concepts themselves. Important insights were that stress is not always negative or resulting from more work. Ease of use, being social and understanding were also important values.

Fig. 9 : during the co-creation experts rated their concepts on a value rubric they created

Phase 3: Making it Tangible

Goal: *finalize the concept and create a working prototype. Bring the prototype back into context in a field test and interviews with stakeholders. Communicate the project to interested parties.*

Methods & Theories: *brainstorming, shitty prototyping, rapid prototyping (e.g. laser cutting, electronics and Arduino code), probe study, observation, interviewing, value mapping.*

Outcomes & Insights: *a tangible interface with playful balls and a local visualization was brought up to trigger easy input and combine it with meaningful output. Through the user test some small changes were made for better usability. Through conversations with stakeholders future steps for implementation and intervention were generated.*

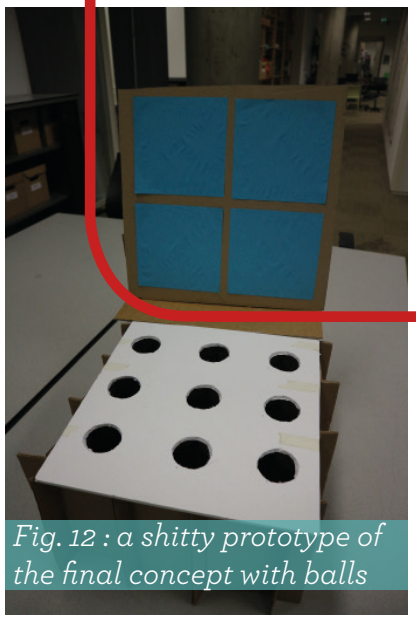


Fig. 12 : a shitty prototype of the final concept with balls

An important missing element in our concept was triggering people to report. From the previous test it was clear that Woonkwartier was quite flexible, social and playful, which could be leveraged in a tangible prototype. Through the final brainstorm with sketches the idea of using a ball was born. When it would fall out of the prototype, employees could not let it roll away and after inserting they could give it to another.

Sensors were chosen that interfered little with the playfulness. It was decided to put the input side vertical, to free space and have a clearer mapping. Each grid point the data visualization was represented as a star with the brightness of the amount of people that inserted there and a flow of the trend through the day. However, it needed to be simplified as the prototype only allowed for a simple grid of Leds to lower costs. Then all individual elements were put back together and the prototype was built and the effects were tested (see pages 15-19). This was presented at the Demoday. Visitors appreciated how we handled the complex topic and made it tangible. The visualization could have been clearer and there was still a need for action based on the insights Myshare generated.

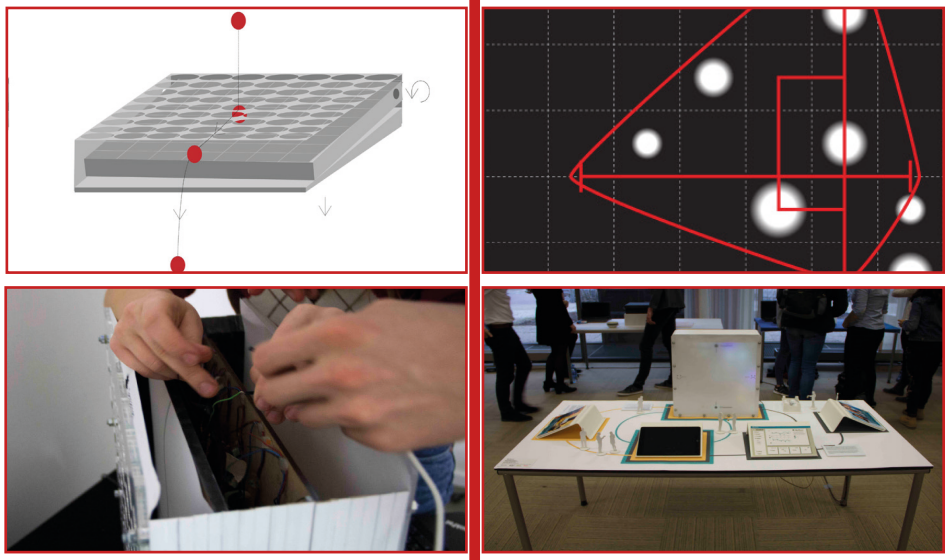


Fig. 14 : clockwise : early frame drawings, early visuals, electronics, demoday

The substantiation for individual elements were divided and worked out further. The playful nature and grid validation were done through literature examples (see pages 15-19).Furthermore, the context maps were updated with the current prototype and a value flow was created to show how each stakeholder benefit.

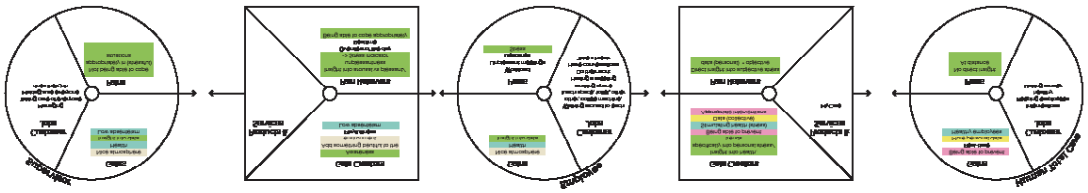


Fig. 13 : a value map with the employee, supervisor and HTC (see appendix L)

Concept Description

Experience & Function

MyShare is a playful intervention that creates awareness of stress in the office environment by low-threshold anonymous self-reports during the workday. By using MyShare, employees become more aware of their personal stress level, as well as the collective stress levels in their office environment. This awareness makes it easier to recognize unhealthy levels of stress as well as repeated stressful experiences over a longer period of time, and can be the first step needed to prevent chronic stress and issues such as burnout through early intervention.

To measure a user's mood, MyShare displays an axis that represents level of emotional arousal against level of (un)pleasantness. Measurements of an employee's experienced stress are taken on the backside by inserting a ball into a grid on this axis. The ball can then either be passed on to a colleague or put down.

The collective stress level of the users is visualized on the front through a display of LEDs, and updates continuously during the day. New measurements are bright white lights on the coordinate grid, while older measurements turn dimmer and more orange until they go out. In this way, the visual changes over time to fit the current emotional state of the department, and gives an indication of the changes during the day.

Technical Details

The device consists of 3 parts: the display, the housing for electronics, and the space for inserting balls.

The display consists of a grid of 7 by 7 pixel LEDs that represent the coordinates of the axis behind a semi-transparent sheet of plexiglass to create a diffusion effect for the lights.

The balls are inserted in-between a similar sheet with a grid of 7 by 7 holes cut out, with an empty space to let them fall and roll out of the prototype. To determine the position of a ball, a row of distance sensors are placed right above each vertical row of the grid. When a ball is inserted, one of the sensors will measure a distance closer than the bottom of the device. This will then be translated to the corresponding coordinate to display on the LED grid as a new entry. Further measurements are discarded until the device no longer registers the ball. (appendix M)

Background & Decisions

Because of the value that awareness has for solving stress (Liu et. al., 2017), we decided to focus more on this aspect rather than create an active intervention method or suggestions to improve one's stress level.

From our earlier phases, we have determined a low-threshold and anonymous method was needed for gathering data. In our user tests, public visualization of the data encouraged people to discuss it and interact with the prototype, confirming the suggestions of Gallacher, et al. (2015a) about real-time visualization.

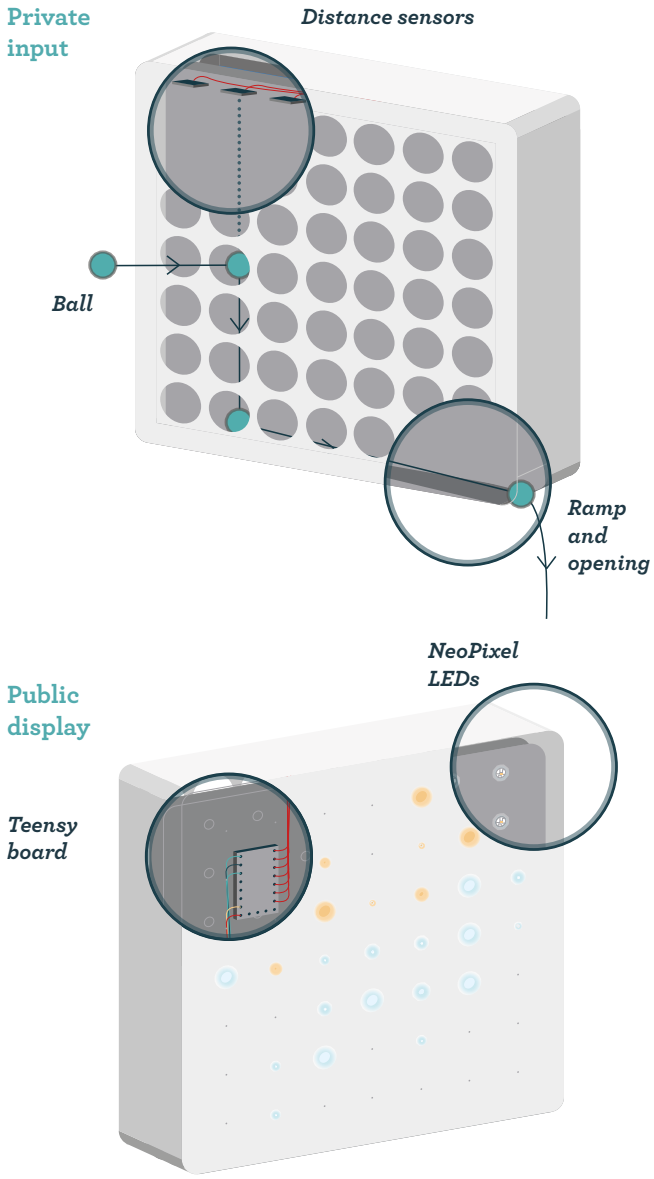


Fig. 15 : schematic overview of prototype

If the visualization can be used as an environmental trigger to interact with MyShare, it should be possible to submit data nearby it to lower the interaction threshold. This inspired our design decision to integrate the data gathering and visualization in such a manner that input is privately given on the back side while easy to connect to the visualization on the front. Furthermore, a ball was used to attract attention to the device and lower the threshold for user participation by tangible playful interaction (Gallacher, et al., 2015a).

The tangible nature of other playful devices discussed in our Related Works, such as Clockviz, (Xue et al., 2017) and Panorama (Vyas, 2007), further supports our decision to create a physical output. The value of a tangible prototype was also partially a consequence of our research on private data (see: Bridge 1). People were uncomfortable with personal health data becoming available to their boss, and digital input from their computer or smart device could raise unwarranted suspicion about personal data being tracked by outside parties, which is an increasingly common concern (personal correspondence, Daphne Muller, 4 October 2018).

Because stress is “an unpleasant state of emotional arousal” (Nair, 2013), we decided to measure in what degree both the unpleasant state and emotional arousal were experienced to determine the presence or absence of stress.

Scales are often used to describe mood in research. Notable examples are Unpleasantness to Pleasantness and Wakefulness to Drowsiness (Cox & Mackay, 1985), Pleasure to Displeasure and Arousal (Morris, 1985), and Arousal and Valence (Bradley & Lang). Bradley and Lang’s scales are broadly applicable to many different situations and users, and therefore used as the basis for our design. For usability and clarity purposes we have made the design choice to combine these loose scales into an axis, which we tested in an earlier for its suitability. The seven-point scale is used to ensure sufficient variance and reliability in our measurements (Cummis & Gullone 2000).

Initially a more artistic visualization on a digital screen was considered in phase three, but due to practical limitations we decided to directly translate the seven-point scale input to a LED grid. The limited time and funds available to build and test the prototype limited our freedom to experiment with the design of our visual, but gave us the opportunity to gather very specific feedback about inhowfar users understood abstract visualizations.

Study aim

As MyShare is designed for a particular target group in a particular context, it is of significance to gain insights on whether MyShare fits within this context. Therefore a two day field study was set up to test MyShare’s feasibility and motivational aspects. During this test MyShare was used as a technological probe to acquire data and insights on the usability, user experience, long term interest in the system, and most effective motivational aspects. This test serves as a means for orientation for a long-term study.

The study was conducted to answer the following research questions:

Does the social trigger mode of MyShare stimulate interaction between colleagues?

Is MyShare feasible to use in the office environment?

Setup

This pilot test took place at Woonkwartier, a housing corporation in Zevenbergen. Woonkwartier’s head office consists of three floors with several working spaces. We focussed on the right space on the second floor, from now on referred to as space B (appendix K.2). It was decided to test in that particular office space because of its location, accessibility and favorable observation spot.

MyShare was placed on a table in space B near the entrance, many people passed by this area. The visualisation side of MyShare faced

Field Study

the passersby, while the input side was more concealed. The balls and an instruction note were placed on the same table (appendix K2 & fig.16). These were intended to invite office workers to interact with MyShare according to the social trigger mode, which means that the balls could be passed on to colleagues in order to motivate the next person. The study was conducted over two days between 9am and 3pm.

Participants

The participants were recruited at the start with only a general indication about the goal of the study. After introducing the study to employees of office space B, volunteers were asked individually for their consent, by means of a consent form (appendix K.1). They were also given the opportunity to withdraw at any point. In total 28 employees participated in the field study (gender distribution: 12 males and 16 females, age distribution: between 20 and 60).

Procedure

During the interaction with MyShare, one researcher sitting at spot X2 (appendix K.2) passively observed the participants in a non-obtrusive way and took notes. These observations focussed on how the participants interacted with Myshare. In particular the use of language, behavioural cycles, and whether they interacted with MyShare intended manner. Do they place the ball in the holes? Do they take the ball and pass it on? Do they look at the visualisation? The observer also noted down where the balls were thrown in and would update the led grid every half hour.

Fig. 16 : context map of stakeholders & artifacts

At the end of the study, individual semi-structured in-depth interviews (approx. 15 min) were conducted and recorded with 9 participants. These interviews consisted of open questions regarding usability, routine, user experience, and privacy related to My-care (appendix K.3).

Data Analysis

The notes from the observations were used to create a user journey. The recordings from the in-depth interviews were transcribed. These quotes and observations (appendix K.3) were clustered along with the observation notes through an open thematic analysis.

Findings

The participants were given the task to pass on the ball by the instructions. This task was intended to make users motivate their colleagues to join. Because the office space has a lively atmosphere and many employees regularly move around, we believed this task would not be obtrusive. During the observations it became immediately clear that the level of intrinsic motivation was quite high. Many participants walked by and inserted the ball. Surprisingly, the ball had not been passed on once throughout the whole test. Participants were either motivated themselves or were motivated by their colleagues by means of comments and conversation.

"has anyone inserted a ball in the upper left corner?" "no" "Well it's about time don't you think" "I agree haha" *– a conversation that took place between two colleagues while sitting in front of each other at their desks*

"have you already shared how you feel today?" *– a conversation between colleagues who had a work related discussion at one of their desks*

When addressing the participants' motivation during the semi-structured interviews, it became clear that it was based on convenience. Some participants treated interactions with MyShare as a short break in between tasks. However, most participants used MyShare whenever they were close by and had already interrupted their work, which we also observed during the test. Often when employees went to places such as the coffee machine, the toilet, the canteen or to other departments, they would insert a ball. This was only possible because we placed MyShare next to the door, where a lot of

employees pass by naturally.

"I used MyShare when I went to the toilet or would grab a coffee, we don't have set breaks so whenever I was heading somewhere, I would quickly stop by" – *P2*

The interviewees have indicated the importance that MyShare fits in their routine. When motivating employees to insert a ball, we believe the most appropriate location to place MyShare is near an entrance or exit. However, because employees only quickly stop by, they do not have a lot of attention for the visualisation. Some participants also suggested placing it next to the coffee machine.

When discussing in which way MyShare could be best implemented in the routine of employees at Woonkwartier, participants proposed the weekly department meetings as an interesting opportunity. This meeting can either be used to discuss the output of MyShare, or can be used as a moment to gather everyone's input.

"I think MyShare can be used when we are having department meetings. It can help to give an impression on how everyone is feeling so everyone can take this into account and we can discuss it." – *P8*

MyShare seemed to encourage discussions on how everyone was feeling. However, they would also like to see something happen with the data or they expect someone to stand up and to act on it, preferably someone from management.

The aforementioned department meetings would be an interesting opportunity to discuss the output of MyShare.

"I think an overview is good for the supervisors. We have a weekly update, so that would be a good moment to use this as input. 'Guys, we have been in the red for some time, what can we do about it?'" – *P7*

"I think it is up to the employer to do something with it." – *P4*

Concerning the feasibility of MyShare, we mainly focussed on the usability and the user experience. While observing and conducting the interviews, a few cases quickly became apparent. Using the ball and using MyShare in general is considered simple in a positive way. Participants also described MyShare as 'playful', 'funny' and 'something that sparks up one's curiosity'.

The visualisation had some flaws that will further be elaborate on.

• The colors of the light were considered as misleading. The lights lighted up in shades of red. However, the red color was interpreted as 'negative'.

"It's not going well because the lights are red" – *quote retrieved while observing*

"Red. That's not good" - *quote retrieved while observing*

• MyShare was built to have the axis on the input side look the same as the output side. This means that the interface had not been mirrored but vertically rotated 180 degrees. Participants found this confusing: they would insert a ball in the top left corner, and expect a LED to light up in the top directly on the other side (so, top right).

• In order to guarantee employees' privacy, we intended to build in a delay in the visualisation. The output would not immediately become visible after inserting a ball, but would be manually updated every half hour. Although we informed all participants about this, they would stand in front of MyShare while waiting for something to happen. Some people believed that their input was not processed and inserted another ball.

"My experience was actually not good, no. I just inserted how I felt on that moment and nothing happened." – *P9*

"I did it twice to see what would h appened, but it wasn't clear." – *P7*

"The LEDs were unclear" – *P2*

Design Implicaions

We made the following adaptations to the design based on our findings. The delay after submission was shortened, and an extra LED was added at the input side to confirm that input is recognised. Furthermore, the visualization side of MyShare was mirrored to make it more intuitively understandable. The colors of the lights have also been changed from red to orange for the same reason.

Discussion

Whether these changes increase the usability and user experience has to be tested in a next test. We do believe that it would be interesting to re-test MyShare with a focus on the feasibility again, as well as putting more emphasis on how could MyShare fit within their routine. During the semi-structured interview, a question concerning a possible link with their data and MyCare has been asked. However, we noticed that people were not sufficiently informed about My-care's functionality and purpose at the time of the test, therefore we could not consider their answers a reliable indication for a real-life scenario. Therefore we think it would be interesting for a next test, to create an experience in which employees can experience the possible the link between MyShare and My-care and then further discuss their thoughts on that. Also, the long-term interest in MyShare is crucial to test for which a longer study has to be conducted.

In our literature study, we have found that colleagues are crucial for helping with the recognition of early signals of a burnout. (Ericson-Lidman & Strandberg, 2007). We have recognized this during the pilot test as well. Participants indicated that they are not aware of their personal stress levels but that they do think about their colleagues. When discussing the necessity of MyShare at Woonkwartier, all participants stated that such a tool is not suitable for Woonkwartier, but would definitely be more suitable for other companies that do deal with stress problems. We believe this might be based on the same principle that is discussed in Ericons' study. We have no insights in whether Woonkwartier really doesn't deal with these kind of problems so we cannot draw clear conclusions from this. However, because of this, it would be interesting to research whether MyShare will be perceived in a similar way at other companies.

Fig. 18: MyShare could be implemented during meetings (appendix K.4)

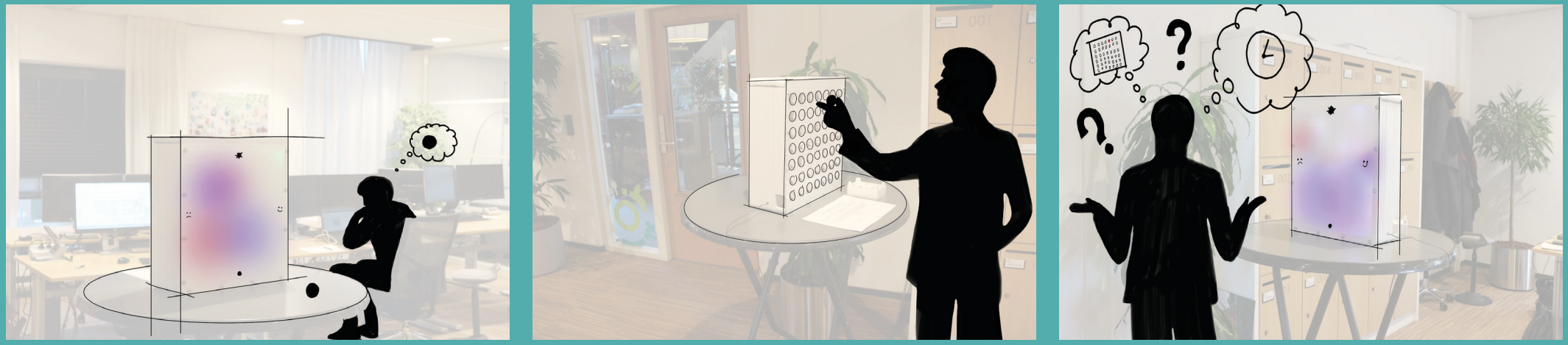


Fig. 17: Scenario 1: scene1 intrensic motivation, scene 2 employees understand what to do, scene3 visualisation is not clear (appendix K.4)

Back to Context

The pilot test gave a good understanding of how MyShare was perceived by the target users. Because MyShare is a system that involves multiple stakeholders, it is important to revise the context in which MyShare should be implemented.

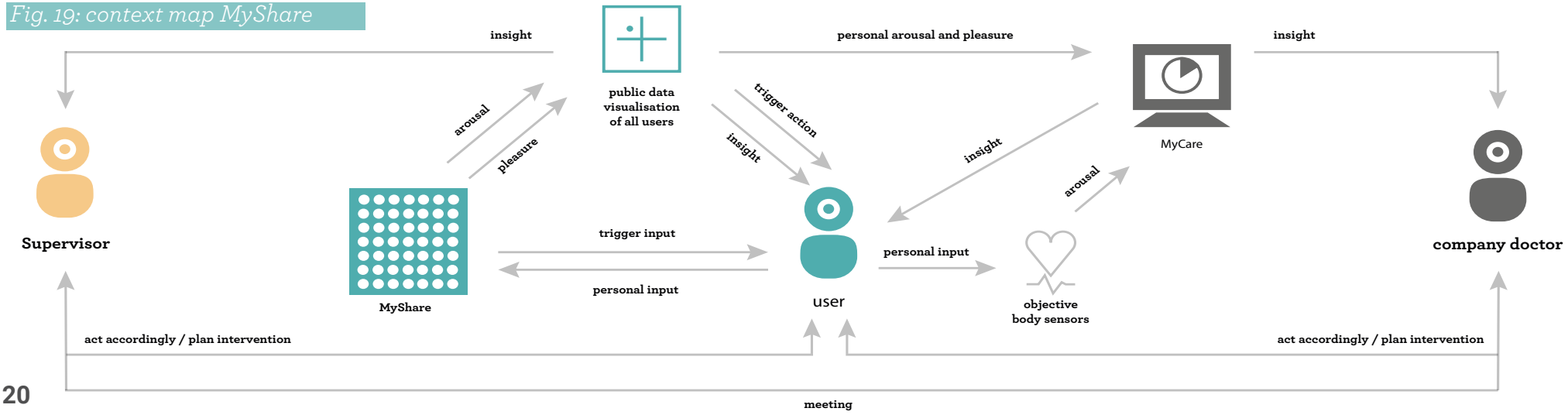
Although the user takes center stage in the context map of MyShare, multiple stakeholders play a crucial role in the concept. As shown in the context map (fig. 19) the company doctor and the supervisor not only deliver valuable input in the system, but also gain beneficial insights and opportunities.

To clarify how MyShare would fit in the future office environments, we review how MyShare would fit the new way of working. Of course it is not possible to predict the future, but by looking at trends a picture is drawn. Robin Goemans is the Managing Director of Ahrend which is the leading international project designer specializing in delivering contemporary and highly sustainable office lifestyles to business end-users around the world. During an interview on his vision of the workplace of the future, he stated that there will be an increase of working with smart devices and that technology will be integrated more and more within the office routine ("9 experts en trendwatchers over de werkplek over 9 jaar", 2017). Ricoh is a consultancy agency in the area of software and hardware to companies all over the world. Their vision on the workplace of the future consists of interactive objects and applications everywhere that are constantly connected, growing need to always have access to information("De toekomst van werk - Ricoh", 2016). So both Ahrend and Ricoh, would likely value the interactivity and smart technology of MyShare. Furthermore, TrendOne, a company specialized in trend forecasting, describes 'the Connected World' as a global trend. This trend entails interconnection is essential in daily life in which the internet plays the main role ("Mega-Trend: Connected World", 2018).

Furthermore TrendOne describes the importance of data is growing ("Mega-Trend: Data Era", 2018) and health is more being related to health innovative products instead of hospitals ("Mega-Trend: Healthstyle", 2018). Related macrotrends, trends that affect users on a shorter timespan, describe users are seeing the human body as under construction ("Macro-Trend: Human Enhancement", 2019) and that people are under pressure to work the hardest they can to perform high ("Macro-Trend: Performance Culture", 2019). Since MyShare is a tool connecting multiple stakeholders using data, improving the health of its users, MyShare is a tool that fits this described future image well.

In the value proposition canvas (appendix L) the pains and gains of the different parties are described. For the user, the employee, both pains and wishes are addressed. The employee is linked to MyShare and to My-care. We found that the employee might be coping with bad

Fig. 19: context map MyShare



consequences caused by chronic stress. Besides, the employee benefits in being healthy, having a nice atmosphere and having insight into personal data. As described before, MyShare stimulates discussion and raises awareness over stress levels. Next, My-care offers the employee insight into a trend and comparison of stress levels by showing the employee's indicated stress levels and the collective indicated stress levels over time. Therefore we might say the system helps the employee in maintaining healthy and working in an open atmosphere.

Since the employer may have no direct insight into My-care, the supervisor is only linked to MyShare. Healthy employees and low absenteeism are important for the supervisor. However, it might be difficult for the employer to get insight into the mental state of the employees. MyShare might help the employer maintain the mental health of employees and therefore lowers absenteeism. Also, myShare gives insight into the stress levels of the employees as such, the supervisor might be able to identify issues relating to stress and therefore being able to cope appropriately.

On the other hand, the occupational health organization Human Total Care is directly linked to My-care. Chronic stress is one of the biggest challenges for HTC. Therefore they are interested in motivating employees to deal better with occupational stress. he company doctors that they employ only have insight into the stress levels of employees one or every two years.

Having real-time information on employees' stress levels would make them much more competent to act accordingly. HTC already has effective interventions that encounter stress problems, but they will likely be more effective when acted out sooner.

In short, the main goal of MyShare is helping employees to cope better with their stress levels. In this way, the chances on negative consequences of chronic stress are lowered. In the concept, the ball can be personalized by for instance scanning the ball with a personal token. The data can be presented in My-care as a comparison to the collective. Not only the employee is related to the occupational health organization, also the supervisor is. The company doctor and the supervisor can discuss the data of MyShare once in a certain period of time. In this way, relevant measures can be undertaken. As derived from the test results, the supervisor can discuss the data with employees for instance during a weekly meeting to encourage engagement with the system. The morning department meeting as described in the user journey (see fig. 2, p9) earlier on, might be a well suited moment for this.

The current prototype does well at creating awareness among coworkers. Users started discussing the prototype and stress both during interacting with MyShare and in breaks. However, the test results showed the link to actual interventions was still vague. Some paths were defined for finding opportunities, like the company doctor analyzing the data and using the data in weekly work updates. People noted that the system should take a more active role in this. Perhaps MyShare could suggest certain activities at the gathering tool or it could suggest specific workshops in the platform. During another design research , these options should be evaluated.

MyShare is a new concept that benefits multiple stakeholders, which is probably scalable. In the pilot test, MyShare was tested at a housing corporation. It might however be suitable for multiple large enterprises. MyShare can be sold to the customer as additional tool to the My-care package (appendix N). It is a one-time purchase for the company, but the maintenance of the tool and the extra data in MyCare will lead to recurring revenues. When HTC stays owner of the software of MyShare, updating the software will lead to recurring revenues.

MyShare is an extra tool that keeps customers engaged with MyCare (fig. 20). The concept of MyShare is scalable in such that it can first be purchased for multiple departments, however in time, multiple MyShare tools can be bought to introduce the concept to more employees. The concept results in real-time data on subjective stress levels of employees, both collective and individual. This may lead to faster and better intervention decisions. If MyShare indeed encourages discussion and raises awareness on stress levels, this may lead to better coping with stress and therefore might lower absenteeism.

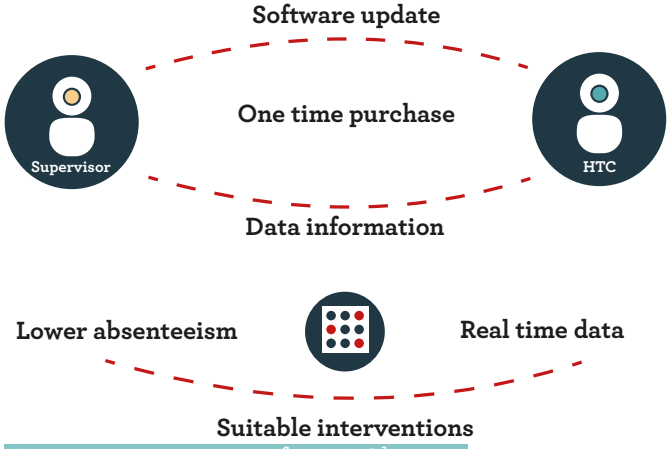


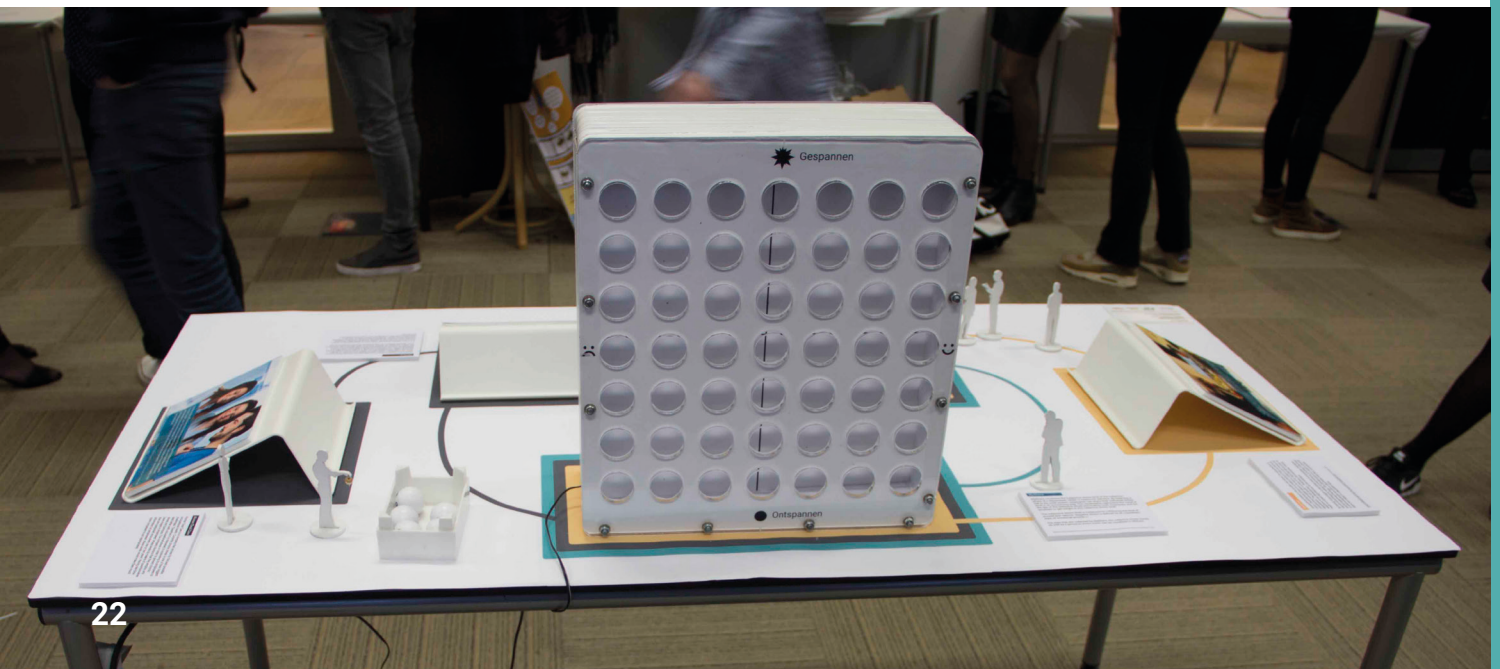
Fig. 20: money transfer MyShare

Process Evaluation

The prototype was shown with a description of its context during the Demo day. In general the concept was positively received. However, some critical thoughts have been made. As MyShare is a product that should encourage positive mental states, it was questioned whether a more positive interpretation of stress should have been taken throughout the process. Should MyShare be promoted more as a tool that helps to keep your emotions positive instead of a tool that helps you stay away from the negative? This is an important remark that should be further elaborated on in future design research

Throughout the process we have been in close contact with our stakeholders. In the beginning we have struggled with meeting requirements from the client and the squad. This was mainly caused by miscommunication. After the midterm we have adapted our way of working and applied stakeholder management techniques in order to make well thought through decisions on what is important to work on and what is important to communicate to whom.

An example of something that found important in the beginning, but lost focus afterwards, is the topic privacy. This is something that we find very important. Though, due to the sensitive data that is dealt with when people's health is at stake, it was unrealistic to include this topic into our field studies. We did not have access to data that is needed in order to test certain elements of our context and therefore we have made the decision to take a step back on that.



Conclusion

Because of the hazardous consequences of stress in the office environment (Hooftman et. al, 2014), it is very important design solutions to this problem are explored. In this project we aimed to prevent the negative consequences caused by chronic stress from happening by providing insight into these issues. After examining the possibilities of playfully visualising collective stress, MyShare was developed. MyShare gives insight into the collective stress levels in the office environment in a playful way and as was found, likely encourages employees to reflect on their stress levels and to discuss them.

MyShare offers
employees a low threshold manner to discuss and to indicate their stress levels. This discussion will be the first step in conquering long term negative stress and gives the supervisor and occupational health organization an accurate real-time starting point to find applicable interventions for stress. Further research should explore what long-term effects MyShare has on the stress levels of office workers in large enterprises. However, MyShare already gives a good indication that such a system in place will help employees to battle negative stress.

Future Steps

Visualization

Both during the user test and during the demoday, people had trouble understanding the data visualization on the Led grid. Seeing where most balls were thrown in was easy, but seeing how old data points were was much harder. Even with limited understanding it triggered discussion, though a more meaningful visual would give more depth to them and might be a leeway to actual intervention. Some visiting experts (mostly researchers with a background in data visualization) suggested adding parameters to the visual, like animation and shapes. The current prototype does not allow for these, because the LEDs are too few to get details in.

Another would have to be done to add this to the prototype. Easiest would be to add a screen to cover the visualization side. Next to having a higher resolution for shapes it could also show animations over time. The current mapping was inspired Van Gogh's starry night, this could be elaborated upon in the 'tails' of the stars representing the trends over time.
Animation could also be used for this. An artwork might be more pleasant to look at and could be easier and faster to interpret (Cawthon & Moere, 2007).

Intervention

The current prototype does quite well at creating awareness among coworkers. Users started discussing the prototype and stress both during interacting with MyShare and in breaks. However, the link to actual interventions was still vague. Some paths were defined for finding opportunities, like the company doctor analyzing the data and using the data in weekly work updates. People noted that the system should take a more active role in this. Maybe it could suggest certain activities at the gathering tool or it could suggest specific workshops in the platform. Another design research would have to be done to make these systems and test the effects.

In B.J. Fogg's behavioral model (2009), he defines three main elements for changing behavior: Motivation, Ability and Trigger. The interaction was kept easy and fun, which possibly increased the motivation during our user test. The ball, and specifically the passing it along were designed specifically to trigger people. The thing that missed most was the ability to do something. Another would have to be done, looking together with health-care professionals and stakeholders to what kind of information systems and exercise systems could be coupled to the system. The employees routine and interaction with supervisors, the company doctor and MyShare/ My-care should be central to find the best fit.

Intervention

If playful behavioral intervention should work over longer timespans, they have to negate novelty effects (Cugelman, 2013). Two days is not nearly enough to see this effect. In order to give HTC insight in the impact of the concept a long-term study would have to be carried out. In all our studies we saw that our physical presence was a big trigger. Therefore the long-term study should be a field-study with minor involvement of the researchers.

One method for this could be the Experiential Design Landscape (Peeters et al. 2013). This method uses data-gathering probes in context over longer timespan, in order to act on changes in behavior while they are happening without interfering with the interaction. MyShare lends itself nicely, as it already gathers and stores some data about the work ambiance. Ideally one would build up gradually, first a base-line, than only MyShare and then adding interventions on top of that. The improvement on visualization and intervention do not have to be fine-tuned yet as they can be iteratively improved upon through the EDL. The effects can immediately be seen and increased for maximum impact for HTC. The longer the test runs the better, but in one month the effects of the current system can be verified.

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Appendix I: Test 1 Woonkwartier
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Appendix K: Field study Woonkwartier
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Appendix L: Value propositions

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- M.3: Arduino code

Appendix N: My-care visual

Appendix A: Bibliography

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My contribution to this project therefore mainly consisted of conducting market, user, context and stakeholder research both in the field and in literature in a substantiated way. Beside this, I have been able to convert the research done into meaningful analyses, documentation and visualisations. Another major contribution I delivered was setting up a three-day field study. Due to the malfunctional prototype, this study unfortunately couldn't go through as planned. I have adapted to the situation and worked on the setup of a pilot field study instead.

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This is a design project for the master Industrial Design in collaboration with the University of Technology Eindhoven, Studio Silver, Human Total Care and Woonkwartier.

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STUDIO SILVER

Human Total Care

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Appendix C – Transformative Practises

Design research and innovation framework for Transformative Practices

In order to address societal challenges and be able, for example, to bridge social divides, make communities safe and sustainable, and ensure healthy and fulfilling lives, we see the need for new paradigms, i.e. new shared beliefs, values, models and exemplars to guide a community of practitioners and theorists (Kuhn, 1970), that support building sustainable futures. Over the last 40-50 years, one can detect several types of societies and underlying paradigms in the Western world, of which e.g. the circular economy (Pearce and Turner, 1989), the transformation society and economy (Pine and Gilmore, 1998; Brand and Rocchi, 2011) and the purpose economy (Hurst, 2017) are a response to our societal challenges.

In this chapter, we introduce the concept of transformative practices, i.e. shared relative steady ways of living and working with others (Wittgenstein, 1993), including specific configurations of actions, norms and knowledge (Freeman et al., 2011) and related tools and environments, focused at addressing our societal challenges, by transforming (elevating) our personal and social ethics and related behaviour through designing new ways of interaction with each other and the world. Through design research and innovation within these practices, we work together towards social-culturally, environmentally and economically sustainable communities.

In order to design transformative practices, we developed a framework to support teams in this process. This framework is called: DRIving (Design Research and InnoVation) framework for Transformative Practices (in short: TP framework). It aims at helping multi-stakeholder teams to research, design and innovate transformative practices to tackle societal challenges, which are inherently wicked and systemic. TP operates within the paradigm of the transformation economy, where societal challenges are addressed locally, though taking into account their systemic complexity, through multi-stakeholder collaborations (Rocchi et al., 2018).

In this chapter, the TP framework will be explained at three levels. 1) a zoomed out version focusing at change; 2) a more detailed version, that shows the main components necessary to support this change, and 3) a very detailed version, that helps on a practical level to design for transformative practices.

First level: Change

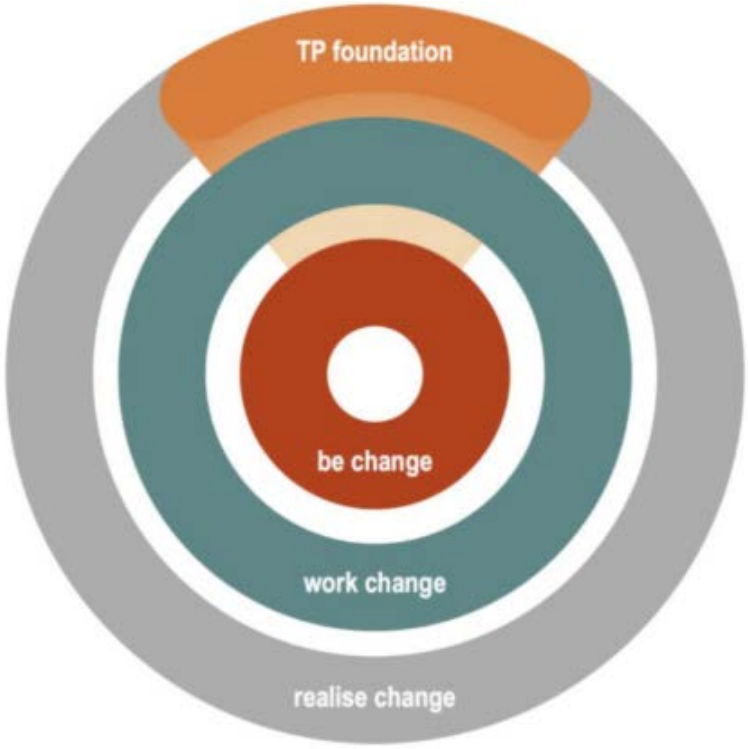

Figure 1. TP framework level

1: change

The TP framework revolves around change. By "change", we do not mean any kind of change, but irreversible or long-lasting change, i.e. transformation. Transformation is an often-used word referring to change. However, the character of this change can be different, depending on the field one is in.

According to the Merriam-Webster dictionary, transformation occurs when one configuration is converted or changed into another, whereby the change is major or complete. In general, transformation is associated with both reversible and irreversible changes. In our framework, we use the term to indicate **irreversible or long-lasting change of values, ethics, and related behaviour of a person, a group or a society**, triggered by the need of tackling a specific societal challenge. Through the transformation, their way of (inter)acting, perceiving, feeling and thinking has been changed and long- lastingly embodied and incorporated in their everyday living.

In the TP framework, we discern three types of change: realise change, work change and be change.

Realise change focuses on the elements necessary to create not merely one design proposal, but even landscapes of designs, that can offer the conditions for people to transform.

Work change focuses on the ways of working towards change. It offers a process for the development team to become competent in the transformation economy and paradigm, and design and research activities to realise designs for transformation.

Be change is about embodying the transformation. Feeling the change, living it and being it. It refers to the people we are designing with and for, to enabling them to transform, to be changed. This will relate to the specific societal challenge we are designing for, but it also relates to general change. Next to this, be change also refers to the members of the development team; to incorporate change, live it, be it and embody the values related to the underlying transformation paradigm.

The TP framework, including the three types of change, is based upon our TP foundation, which stems from the transformation economy paradigm as explained in the previous chapter. On the third, detailed level, we will explain this foundation in more detail.

Second level: Main components towards change

When zooming in, the TP framework shows what the three types of change entail.

Figure 2. TP framework level 2: main components towards change

Be change The middle circle and overall goal of the designs that are developed is transformation. It is about feeling change, living it and embodying it. It is about ***being change***: changing ones' values, related behaviour, whether it is a person, a community or a society.

2

With the DRIving (Design Research and InnoVation) framework for Transformative Practices we aim at tackling wicked problems and complex challenges, by enabling people, communities and society to transform with the help of design. In the end, we aim at pervasive ethics: "*a social praxis aimed at justice and freedom, which pervades society in a capillary way, becoming a universal attitude that makes people aware of their own rights, able and willing to contribute to seeing their own rights and those of all people fulfilled*" (Trotto, 2011). So, we consider it important to start with values and ethics and act accordingly.

"Be change" is not only required to the practice of people we are designing with and for; with and for whom we want to tackle a complex challenge and enable to embody and live this change. It also applies to development teams during their design research and innovation processes. They also have to embrace change, live the new paradigm, and reflect upon their own values. When working towards transformative practices it is necessary to take a first-person perspective along the process, to get personally engaged and to take responsibility. One has to practice what one preaches, and be change oneself.

Work change The TP framework is designed to support design research and innovation teams with new ways of ***working towards change*** and transformation. It consists of a dedicated process, based on a holistic and systemic approach suitable for transformation. This process has two main categories of activities. Firstly, the process entails **design and research activities aimed at the creation of design propositions**, as most design processes do. Due to the wicked and systemic character of the societal challenges that the TP framework addresses, it is necessary to highlight that the activities proposed by the TP framework are effective for processes of research and development that have a mid or long term horizon. To complement these activities and make them suitable for transformation, the TP process also includes activities focused on **collaborating and developing** together; activities focused on learning how to be change, and learning how to develop transformative practices together. So, "work change" is all about the way of working in realising transformative practices and fitting the underlying transformation paradigm. It relates to the way to create design propositions, and the way to support personal and team development towards transformation, so making sure people have tools and can mature their skills to actually practice what they preach.

Realise change How can we design meaningful context-specific propositions, built around long-lasting, profitable, ethical, and fair business practices, and based on multiple stakeholder collaboration and value sharing (Brand & Rocchi, 2011). We see the key in creating and realising design and value proposition landscapes, thus **realising the conditions for change**, for transformative practices and for people to be change. Instead of focusing on traditional designs, we emphasise the systemic, holistic and dynamic perspective of transformation, therefore calling it design and value proposition landscapes. We discern three types of elements to construct such a landscape:

1. Social entities: who are or should be connected to or involved in realising change and being

change? 2. Immaterial social needs, exchange & context: which immaterial elements are, can or should be

exchanged between these social entities? 3. Material (physical-digital) needs, exchange & context: which material elements can or are

necessary to support the creation of these design and value proposition?

Scales When talking about transformation and change, especially when looking at 'be change' and 'realise change', we look at different scales and the interaction between them. We consider the transformations of our societies, by dealing with major societal issues. But we also address local challenges for social resilience, or individual banal activities of the everyday. Our propositions target and deal with different audiences. So, we interweave the ***micro* scale** (the small-scale setting of a person / a small group of people within its direct environment), with the ***meso* scale** (medium scale setting at the level of a community or region) and if possible also with the ***macro***, large cultural and societal scale.

3

Moreover, in a holistic, dynamic and systemic approach, time plays and important factor. Consequently, we explicitly added the ***chrono* scale**, which refers to transformation over time, e.g. long-lasting change, lifetime development, or longitudinal reflection to be aware of your own change. This scale is practically important during the 'work change' phase, since the development team has to make various choices regarding time frames while designing for and researching.

Next to these four scales necessary to realise and be change, we incorporated a fifth and final *meta* scale. This entails that the *be change* and *realise change* elements are also incorporated on the *work change* level, so in the design process. The developer has to *be change*, so embody the underlying paradigm, during the design process. Moreover, the elements needed to design the value landscape are also necessary during the design process itself. One also has to ask oneself, who the social entities are that should be involved, which immaterial social exchange takes place or should be organised, and which material (physical-digital)

context is necessary for design transformative practices. So, the development team should create its own landscape for development. These 5 different scales are represented in the model by the thin black circular lines.

Third level: detailed activities and elements supporting TP When zooming in 1 step closer, the TP framework shows all the detailed activities and elements needed to realise transformation, which we will explain in this section.

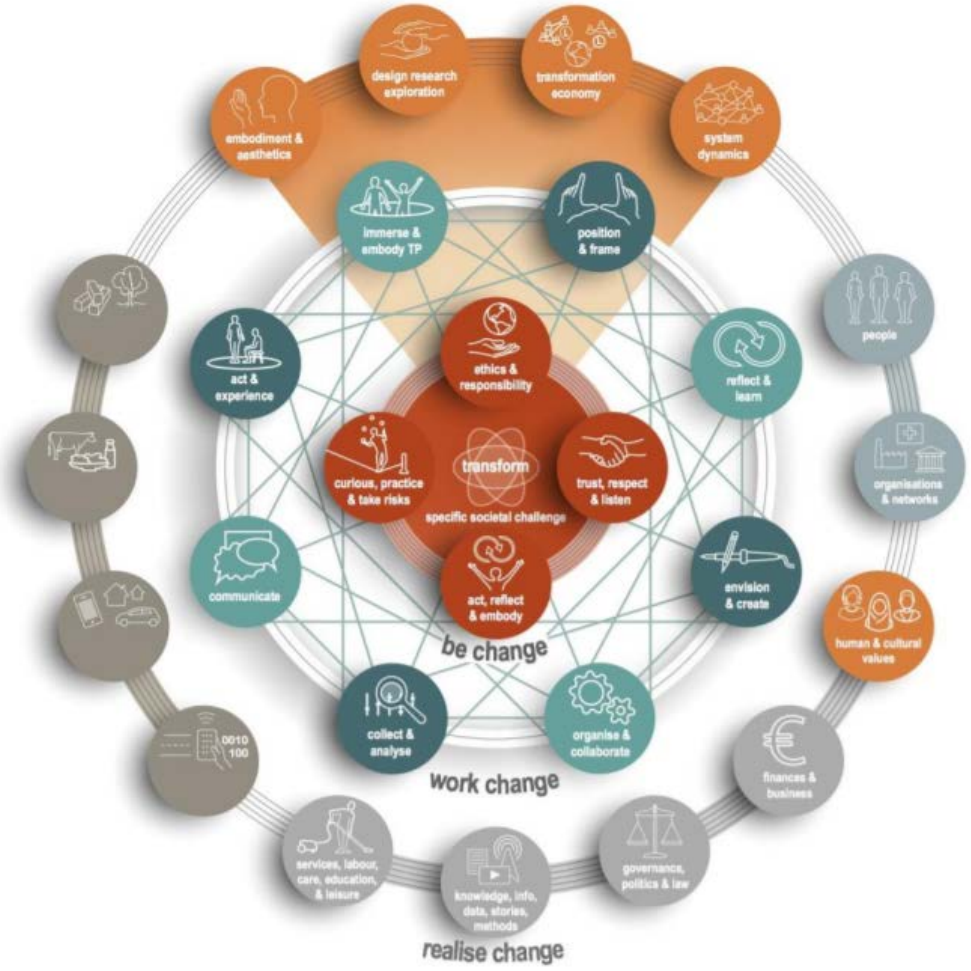

Figure 3. TP framework level 3: detailed activities and elements supporting TP

Transformation Practices foundation (orange) Before we describe the three types of change in detail, let us first explain the positioning of the entire framework. The paradigm in which we position our work constitutes of three elements. Firstly, we place

our work within the Transformation economy, theorised by Rocchi and Brand at Philips Design (Rocchi et al., 2018). They foresee a paradigm build on top of our current paradigms. Our major societal challenges are leading to a growing discomfort and a desire for balance. Consequently, people are looking for ways to move towards a sustainable world. However, true sustainability and wellbeing cannot be created on an individual level only, it requires behavioural change on a societal level too, where the collective is at less as or even more important than the individual. In such a transformation paradigm, stakeholders will work together on local solutions for local issues that stem from greater global issues (Hummels, 2012; Gardien et al., 2014).

Secondly, we embrace system dynamics including complexity theories. As said above, our societal challenges push us towards finding systemic solutions. According to Ball (2012) and Vermeer (2014), this asks for a new kind of science where scientists from different disciplines can address the core of complex systems, including emergent collective behaviour, transitions between system states, and resilient complex systems that can handle external shocks or disruptions. Consequently, we embrace the characteristics of complex systems such as self-organisation, non-linearity, chaos, connectivity, autonomy, adaptation and emergence. The interconnectivity of our global value chains, our communication systems, and other technologies can present challenges, but they also provide an opportunity for new and successful societal interventions Vermeer (2014). According to the World Economic Forum we need interdisciplinary collaboration to understand and tackle the underlying principles of the complexity in our world in order to face our societal challenges like poverty and climate change (Barabasi et al., 2013).

Thirdly, we adopt embodiment and related aesthetics as a necessary notion in all steps of the design and design research process. Based on theories of ecological psychology (Gibson, 1979), phenomenology (Merleau-Ponty, 1962), pragmatism (Dewey, 1938) and various forms of embodied cognition (Van Dijk et al., 2014; Suchman, 2007; Varela, 1991), we assume that humans' understanding of the world is conditioned by their being and acting in it. According to how the sensible is designed, different opportunities for meaning to arise in interaction can be produced. So, meaning is not inside our minds, it is not outside in the world, but it is in-between us human beings and the world. We perceive the world in terms of what we can do with it, and by physically interacting with it we access and express this meaning. To cope skillfully in the world from day to day, we do not need a mental representation of our goals: our body is simply solicited by the situation to find the right balance in order to gain a maximum grip on the situation. (Merleau-Ponty, 1962).

Fourthly and last, we start from a design and research perspective. One of the strength of designing is the ability to create potential futures through prototypes, thus letting people experience and discuss their goals, aspirations, visions and type of interactions. Through prototypes, designers enable people to have access to and express meaning. The wickedness and the systemic character of our challenges, approach and propositions, benefit from the ability of designing to open up the abstract to the sensorial, to connect the intuitive to the analytical, imagination to reason, and making (synthesise and concretise) to thinking (analyse and abstract) (Hummels, 2012). By reflection in and on action during the design process, the team creates insight and knowledge (Dewey, 1938; Schon, 1983). Or, as Schon (1983) suggests, by entering into an experience without judgment, responding to surprises through reflection, people learn from their actions, which can facilitate the search towards transformation. Within the TP process, we make do not merely make use of design, but also of research through design. RtD can be seen as a process in which scientific knowledge is generated through a sequence of cycles of designing, building, and experimentally testing wealthy experiential prototypes in everyday life settings. RtD aims at studying effects in possible futures and does not focus on understanding the world, as is the objective of traditional science (Stappers, 2007).

Be change In the core, we have situated the transformation we like to achieve, which can be on a micro, meso or macro level, i.e. a personal, community or societal level. This transformation focuses on a specific societal challenge, which can be downscaled to the individual or group level. To realise such transformation we see four elements regarding focus and attitude.

Ethics and responsibility Social transformation has obvious connections to ethics. If we are transforming the way that people relate and behave to each other and towards the context surrounding them, what is the direction that leads this transformation, what is the new or renewed set of value that we are eliciting to emerge? What are the consequences that people will have to face? How much control on such consequences can we claim? These are many more questions arise. When a team of people defines a societal challenge and decides to tackle it, ethical questioning needs to be an underlying recurring exercise along the whole process. At the core of transformative practices are ethics, values and our responsibility towards each other as human beings, but also towards all living organisms constituting the ecosystem that we live in. Each human lives in a community or ecology, in which she or he has culturally specific and situated practices that constitute the ecosystem's ethics. All these practices take place in landscape of values, where values feed our norms and attitudes in specific situations (Schwartz, 2012). Through common practices, humans within a community determine what is done and accepted, in opposition to what is not done and is unacceptable. In short, this is about what is considered the norm or "normal" by the individuals performing these practices, within a community. Values are materialised in norms, attitudes, and beliefs of such community. These define wat people are used to, what their patterns of behaviour are, and also what they can tolerate. Differently from a pre- industrial and pre-digitalised era, in our interconnected and globalised worlds, practices of local communities have repercussions on a global scale.

Within transformative practices, we see the urge of the people within a community to take responsibility for our societal challenges such as unhealthy lifestyles, exclusion, poverty, pollution and global warming. TP relates to values such as responsibility, equality, honesty, meaning in life and a world of beauty.

AS said before, our work in transformative practices, is grounded in design and design research and therefore deals with the transformation of practices through an intervention on the physical and digital context that we are dealing with. Through TP, we hack the very essence of the aesthetics of politics, which is what Rancière defines as "the distribution of the sensible", i.e. the system of self-evident facts of sense perception that simultaneously discloses the existence of something in common and the delimitations that define the respective parts and positions within it." (Rancière, 2004)

The form of the world surrounding us, embodies, elicits and supports these situated practices. By form we mean both the physical and the dynamic form (Redström, 2013): the way we interact with each other through material (e.g. our offices and furniture) and non-material artifacts (e.g. facebook). Through the design of this form, we can influence the practices. Through intervening on the "distribution of the sensible" we set the divisions between what is visible and invisible, what can be said and what cannot, what can be heard and what is unheard, what can be understood and what cannot be understood.

Trust, respect and ability to listen Transformation is done is a systemic setting, requiring an entire setting or context to realise the change. It is impossible for an individual to tackle our societal challenges, even if that should not diminish the importance of the role of the individual. As said earlier, one can also change as an individual and consequently influence one's surroundings. Within transformative practices, the field of action is a dynamic system, in all its complexity, where the only way to

address the societal challenge at hand is to collaborate with all relevant stakeholders. This asks for trust and respect for other people's perspectives. It asks for collaboration, by listening to these others and jointly finding ways to tackle the (societal) challenges. It asks for communication, where "*communication [. . .] is not the transmission of information but rather the co-ordination of behaviour between living organisms through mutual structural coupling* (Capra, 2002, p. 46). It requires dialogue and dialogical skills, so TP can be seen as *"systems of co-present human beings engaged in interactivity that bring forth situated behavioural coordination (or a communicative, structural coupling). [...]they co-ordinate with each other, they co- adapt to each other, and they co-regulate their co-ordination and co-adaptation." (*Steffensen, 2012). Or as Sennett (2012) frames it, in dialogic conversations, curiosity and empathy are the main drivers for cooperation and exchange of ideas. In order to understand someone else, the listener has to get out of his/her own perspective, and through dialogue and social coordination become more aware of his/herself, the other and the situation. So, a discussion does not simply resolves itself by finding

common ground, it is a social coordination process, where trust, respect and listening are crucial elements.

Curiosity, practice and ability to take risks Curiosity is not only important for collaboration and dialogue, is it also an essential trait in addressing societal challenges, with the goal of finding new opportunities and solutions. To be able to transform, people benefit from being curious, willing to explore and trying things out. Having to swim in waters of complexity, where the systems that are to be transformed are complicated, unpredictable and everchanging, requires a certain amount of restlessness and daring to take risks. All these qualities benefit cooperation, craftsmanship as well as innovation. Sennett illustrates in his books "The Craftsman" (2008) and "Together"(2012) as mixture of characteristics of which transformative practices can benefit also benefit, including experimenting a lot and practicing hands-on, playing with ambiguities which requires rehearsal, working with resistance, trusting and daring to fail, being curious, using one's intuition, having a desire for quality, being committed and having vocation, playing with rhythm and rituals, being empathic, and practicing everyday diplomacy. Since transformation is a dynamic systemic setting and therefore intrinsically complex, mastering the Transformative Practices means having been trained to navigate this complexity and to embody the abovementioned characteristics.

Act, reflect and embody Transformation is not something that simply happens in a flash moment. As said, it asks for practice, experimentation and iterations. When, as human beings, we take actions in the world that surrounds us, we create insight and knowledge for ourselves, especially when we use the mechanism of reflection in and on our actions (Dewey, 1938; Schon, 1983). Or, as Schon (1983) and Merleau-Ponty suggest, we learn from our actions when we enter into an experience, without pre-judgment, and respond to surprises through reflection.

In order to transform, the change should be based on (the reflection upon ones') values, which are transferred to new attitudes, beliefs, norms and behaviour. Since we define transformation as an irreversible or long-lasting change, it requires a loop of action and reflection, where the transformation is entirely incorporated and adopted by the person, group or society. For example, when someone wants to change his/her unhealthy lifestyle, in order to really transform, the person has to continuously reflect on his/her values, attitudes, beliefs, norms and behaviour, and act upon the preferred values, attitudes, beliefs, norms and behaviour.

Work change Around the core of´*be change*´, gravitate the activities that are necessary to design and produce a transformative practice related to a specific societal challenge. Such activities constitute the process, which has two faces. On the one hand, the process includes activities focused on **designing and researching** propositions to enable transformation. On the other hand, the process includes activities related to **collaborating and developing,** as a person or as a team, towards transformation; so, activities focused on learning how to´*be change*´, and learning how to develop transformative practices together. The two sides of the process have each four groups of activities:

The activities related to design and research are:

1. Position and frame 2.
Envision and create 3. Act
and experience 4. Collect and
analyse

The activities related to collaborating and developing are:

1. Immerse and embody TP 2.
Reflect and learn 3. Communicate 4.
Organise and collaborate

These 8 activities, that are gravitating around the core, are connected to each other. They activities can be carried out more than once and in any order, although we normally start from the 2 activities above: "position and frame" and "immerse and embody

TP". The pace of jumping from one activity to another multiple times can be determined by the team, although a high pace is recommended, especially during the early phases of the design process, since that gives insights into the challenges and opportunities that the assignment has (Hummels and Frens, 2011). But also during the later phases of the design process, a high pace can still be beneficial, to stimulate the process of reflection in and -on action, which produces new knowledge relevant both for the specific project, but for the development of skills and experience in Transformative Practices. The activities can be approached from a 1st, 2nd or 3rd person perspective. A 1st person perspective approach means that the participants of the team address their work from their personal experience, in relation to the challenge at hand. A 2nd person perspective is where designers work instead with tools that leverage empathy with people that have a direct experience with the challenge at hand. A 3rd person perspective attempts to take an objective approach towards the challenge, using more tranditional both quantitative and qualitative approaches, in analysing the situation constituting the challenge.

Changing from one activity to another is necessary to develop propositions that might achieve a transformation, and learn how to transform oneself and to transform as a team, while learning how to develop transformative practices together. Let us first explain the two activities that often kick-off the TP process.

Position and frame The project has a goal: to tackle a specific challenge that has some kind of societal relevance. At the kick-off of the project, it is necessary to (re-)frame this challenge: what is the context surrounding such challenge, what are the elements that form the ecosystem that is affected by such challenge? What are values and drives of the people within the practices and ecosystem we like to transform? What kind of information, knowledge and expertise are needed? Who are the contributing stakeholders, what do they offer and what do they need? What are the drivers and values of these stakeholders and how are they equipped to contribute in the innovation process? How does this project relate to other existing projects, both related and unrelated to the stakeholders' experience?

This activity produces thus a (re)framing of the question that the project tackles. Such framing is not a one-time activity, on the contrary it is ongoing, it is iterative and will evolve in time, as the affected ecosystem becomes apparent and evolves. That is necessary since these societal challenges can be seen as wicked problems, in which both the problem itself and the solution are explored and developed (Rittel and Webber, 1973). This ongoing process of focusing on the scope and the boundaries of the ecosystem where these challenges and design proposals can have effects, entails as well the necessity of a continuous redefinition of the stakeholders to involve.

Immerse and empower Having an attitude that boosts cooperation and innovation for transformative practices, as described above, is not always a natural behaviour. It requires an education. In DRIVing Transformative Practices, the practitioners are trained to be and embody change. By practitioners here we refer to both the innovation team members, as well as all other potential users and stakeholders. All people involved in the process, need to be *activated* and empowered towards transformation. This educational process is done through very many embodied activities, aiming at creating the awareness and developing the sensitivity to activities such as empathise, connect, be comfortable to be vulnerable, be comfortable with staying in the question, be comfortable with not being in control, not knowing and being outside of one's area of expertise or ease. Participants are pushed out of their usual roles, where they are act according to (traditional) norms, according to what is normally done and not done. The aim is to create an open explorative canvas, a shared space, where people can engage from a 1st, 2nd and 3rd person perspective.

All other six activities can be performed in random order, as long as they are iterated in time. They are:

Envision and create Through creating and building design proposals, new opportunities that address the challenge can be envisioned and experienced. While designing and materialising these new propositions, we build on the

concept of technological mediation[1]: everything that is in our environment, mediates the way that we perceive and act upon such environment. Designers are able to operate a material synthesis.

Design produces new forms and manifestations that, with their intentions, influence our perception and understanding. Consequently, design enables to explore alternative ways of embodying values, triggering attitudes, changing behaviours and even norms. Design operates in a propositional way, rather than in an analytic way. Thus design can address our societal challenges in another way than for instance, social scientists or change managers do.

This activity can be considered the trademark, which distinguish DRIVing TP to most of the existing processes addressing change.

Act and experience Another element that characterises DRIVing TP is the "let's get our hands dirty" part of it. Transformative practices have been designed with a goal of addressing societal challenges in a way that it elevates people's ethics and, somehow, improving their life. Transformative practices are not planned in an ivory tower, but rather in the field, in a context where one gets to care about the actual consequences. It is therefore important to experience the context, observe who else perceives the situation and from there, try out design propositions. These activities can all be done through a 1st perspective,

2nd person perspective or 3rd perspective[2]. All participating stakeholders, including users, document their own experience. The dialogue with all these stakeholders opens up terrain for exploring and creating new design proposals.

Collect and analyse During the design process, insights into the situation and overall context are acquired, as well as insights into the behaviour of people involved and their experiences. This is done through qualitative and quantitative methods. Conducting empirical and experimental field studies with design interventions is at the core of this activity. By experiencing these propositions in context, in fact, it is possible to study and describe their impact and potential for transformation.

However, observations can are also be carried out without interventions and through descriptive and desk research. Research is done by all participating stakeholders, including users. Since we are dealing with complex socio-technical systems, even if we prioritise direct experiences, it is necessary to carry out analysis, to spot hidden patterns and opportunities. Through this activity of collecting and analysing, new perspectives are exposed, which open up new design opportunities for transformation.

Reflect and learn Our design process makes use of reflective practice. We learn and grow along the process, reflecting in and on action, on an individual level, on a team level, on a stakeholder level, on the process etc. Reflections trigger the refinement and readjustment of the challenge over time, but they can also urge adaption of the organisation necessary for the project to continue (evolving the governance, adapting the organisation, develop the business model). Due to the intrinsically systemic and dynamic character of societal challenges, which are addressed during the process, it is necessary that all people involved step into a learning curve. This requires respect for each other competences. Since, the transformation paradigm is still in its infancy, we need new formal educational formats and approaches to support these learning processes (Hummels, 2017).

1 The concept of *'technological mediation'* was coined by Peter-Paul Verbeek (2006), indicating that our designed world influences and co-shapes people as actors in the world. When a person interacts with or through a product or system, this product/system changes the way (s)he behaves. This 'translation of behaviour' through technology (in its broadest sense) has a structure of invitation and inhibition, by stimulating certain behaviours and discouraging other behaviours. Next to translating our behaviour, technology also changes our perception when interacting with or through a product or system, by amplifying and reducing specific aspects of reality. Ihde stresses that technology is "*intentional*", i.e. it aims at specific functionality by amplifying and reducing specific aspects of reality. These intentions are never fixed properties of the technology, but their meaning and concrete use are dependent on the context of use; meaning is created in interaction. These technological intentionalities are so-called "*multistable*" (Verbeek, 2006; Ihde, 1990).

2 As explained before: as a developer, you can experience the situation yourself (1st pp), you can empathise with people and try to get as close as possible to their experience (2nd pp) or you can 'objectively' observe people acting and experiencing (3rd pp)

Communicate Since there are so many different stakeholders and consequently expertise around the table, it is important to understand each other's "language". Therefore, the process uses multiple channels of communication, to cover the differences among stakeholders. It is a way to connect all stakeholders, and enable people to participate in an equal way, using the communication skills that they are comfortable with. Moreover, it is also a way to create empathy. Using more frequencies and media (vlog, interviews, prototypes, documentaries, exhibitions) increases the chance of successful broadcasting and receiving. And in doing that, new and rich opportunities can be created together.

Organise and collaborate Running these activities that focus on design for change within the transformation paradigm, requires us to rethink the way of organising these complex collaborations. During the entire process, various assets are offered to support all stakeholders, such as tools, methods, a variety of expertise etc. These assets can be diverse from time to time, since the ecosystems of people involved differ with respect to engagement, competences, needs, contribution, organisational structure etc. The complexity of the challenge, requires a multiple loop process. This entails focusing on developing new design proposals to address the challenge, develop at the same time new approaches and tools to support this design process, involving a variety of expertise and stakeholders to really realise transformation, as well as questioning why it is important to tackle this challenge.

Realise change The outer circle (realise change) shows all the elements that need to be in place in order to design proposals aiming at a transformation. These elements include:

1. all the stakeholders that are involved or related, i.e., the so-called social entities, 2. the immaterial social needs, exchange between these entities and the context of this challenge,

and 3. the material,. both physical and digital, needs, exchanges and context related to this challenge.

These elements too, can be approached from a micro, meso or macro level, i.e. a personal, community or societal level, as well as a chrono level and a meta level. The latter means that during the design process itself, one also has to ask who the social entities are that should be involved, which immaterial social exchange takes place or should be organised, and which material (physical-digital) context and exchanges are necessary for designing transformative practices. So, the development team should create its own landscape for development. This meta-level is tightly coupled to the last described activity 'organise and collaborate'.

These three categories that contribute to building a value landscape, contain various elements:

Social entities

1. People 2. Organisations & networks

Social (immaterial) needs, exchange and context

1. Human and cultural values 2. Finances and business 3. Governance, politics, law and order 4. Knowledge, information, data stories and methods 5. Services, labour, care, education and leisure

Physical-digital (material) needs, exchange and context

1. Infrastructure and high tech 2. Products, systems, building, tools and art 3. Agriculture and consumption 4. Nature, elements and materials

These 11 elements are connected to each other and are necessary ingredients to form a value landscape for the envisioned transformation. During the value creation process, the relationships between these different elements are determined and made specific, in order to develop designs that can lead to transformation. Let us explain all elements.

Social entities

People

When addressing the challenge, it is important to explore who are all the relevant stakeholders that are related to the challenge and the potential transformation. Depending if one looks at a micro, meso or macro level, the term people can refer to individuals, a family, friends, a small group of people, a neighbourhood, a village, city, region, a country, continent or even a culture. What are their important physical/physiological, cognitive, emotional and social characteristics, skills, behaviours and condition? What comprises their identity, their position in and perspective on the world? What drives them and what are their needs?

Organisations & networks

A community of people can also refer to specific organisations with their own identity, ways of working, norms, strategy, vision etc. For example, organisations can refer to businesses, industries, universities and schools, governmental organisations, NGOs, NPOs, health care institution, etc.. Next to single organisations, it becomes more and more important in a transformation paradigm to work with networks of stakeholders and organisations, who can have their own identity, attitudes, norms, strategy, vision etc... Similar questions as addressed with people can be asked for organisations and networks.

Social (immaterial) needs, exchange and context Human and cultural values

Ethical value exchange is positioned at the core of the transformation economy. Consequently, we consider values essential for creating the value landscape and developing propositions. Schwartz (2012) defines values as beliefs that refer to desirable goals and which transcends specific actions and situations, thus distinguishing them from norms and attitudes which do refer to specific actions, objects, or situations. Values serve as standards or criteria. People act upon the relative ordered importance of various values. We base our framework on the work of Shalom Schwartz (1992, 2006, 2017), who created a refined theory and model for human values. . To create the value landscape for a societal challenge, it is important to address the specific values that are or are envisioned to be underlying the interaction between the different stakeholders. It is necessary to reflect, along the process on who values what and which values are expected to underlie the interaction and cooperation among stakeholders

Finances and business

In order to realise change that is irreversible or long-lasting, the value landscape and propositions need to be financially sustainable. Contributing to societal challenges such as described in the Sustainable Development Goals (SDG), doesn't mean that related business models can be weak or superficial. They should be sound as any other business (Hummels, 2018). However, since the transformation will generally be realised by a network of different stakeholders, it will probably require new business models. Such models will build on networks where the investments are not necessarily done by the same partners as those that will benefit from the return of investment. This requires respect, trust and a clear overview of anyone's contribution and benefits, as well as the set up of dynamic agreements along the process, concerning terms of collaboration and terms of financial distribution. This demands an increased number of insights and an improved understanding of the worth of different contributions, both material and immaterial, and their relationships. Emerson (2003) emphasises, for instance the importance of 'blended value' propositions where both financial and social returns are taken into account. According to the International B Corps network, this approach requires at least social and environmental performance, accountability and transparency, next to their financial counterpart (B-corp, 2018).

Governance, politics, law and order

These surface on all levels: on a micro level, they appear in our everyday acting in the world; on a

macro level, they manifest in our policies, laws and governance. Habermas (1984) makes the distinction in his Theory of Communicative Action between the System and Lifeworld. On the one hand he positions *System*, constituted by our regulated environments, such our governing bodies and our institutional laws and judicial system. *Lifeworld* on the other hand, is our everyday living in and dealing with the world, in between these regulated structures. It relates to our complex social interactions and embraces pluralism (Jaasma, 2018). Realising transformation generally requires change within both System and Lifeworld. Besides, all participating stakeholders have to scrutinise their own way of working and their organisations with their norms, attitudes, procedures and regulations. Would it require alterations or even major changes of working to realise change. And who are the stakeholders necessary to make those steps within the organisation, or would the project first run outside of the traditional system?

Knowledge, information, data, stories and methods

People consciously and subconsciously share knowledge, information, data and stories. When designing for and with people, we like to have an understanding of their lives, what matters and what they find important, for which the collection and the dynamic development of stories and information is valuable. Our transformative practices approach is based on continuous research, trying to grasp the emerging interaction with the world, the shift towards the targeted challenge, and the interaction with the designs we are developing. In the framework, this research approach focused at collecting information and reflection on it, is captured under the activities ‘collect and analyse’ and ‘reflect and learn’. Moreover, ‘communicate’ also plays an important role for sharing this information and stories.

All these aspects, Knowledge, information, data, stories and methods, are resources to assist the design of propositions themselves. Part of the design that aims at transformation can collect e.g. data that informs the user about his status, behaviour or goals; the design can visualise information and stories via various media to support people in their transformation. Due the systemic character of our challenge, also the media context in which the societal challenge is situated has to be scrutinised.

Services, labour, care, education and leisure

The last element in the value landscape that relates to immaterial social needs of and exchange between people and organisations is related to our actions. Which services do we provide each other, and what do we require to enable transformation? What is the importance for people of having work, contributing to society and reaching transformation? In which way do we take care for ourselves and other? And how does that relate to transformation? How do we educate ourselves and others? And what is the role of leisure activities for our wellbeing and transformation?

Physical-digital (material) needs, exchange and context

Infrastructure and high tech

Technologies emerge and evolve over time, and in combination with sociocultural forces that change people’s perception of what constitutes value, and that reflect and fit the Zeitgeist. (Gardien et al., 2014). Emerging high technology is ubiquitous in our society, it influences our everyday living and can also support transformation. When creating design proposals, the team has to explore the role of high tech in the addressed (societal) challenge and its potential in shaping new propositions for transformation. With this we mainly refer to core technologies, such contextual sensors, smart materials, internet of things, but also to main infrastructures such as power grids, glass fiber cables and public transport lines and roads.

Products, systems, building and tools

When describing the activity ‘envision and create’, we introduced the notion of technological mediation, stating that everything in our environment, mediates the way that we perceive and act upon the world that we live in. We keep this notion into great account when working to achieve a transformation. In what way can contextual elements such as products, systems, houses, environments, tools, expression of arts etc. support our values, address the challenge at hand and create opportunities for transformation? Particularly, how can the aesthetic and functional qualities embedded in the materiality and in the interactive qualities of these contextual elements, elevate (transform) personal and social ethics and related behaviour? These elements can incorporate high tech (the previous element) and can support along the process of creating propositions for transformation.

Agriculture and consumption

Our core-needs as human beings, are connected to to our physiology, as in the necessity of water and food (Maslow, 1943). This is essential for our survival, but in our current society, no longer only connected to our survival. We can have dinner simply to keep our motor burning, but we can also have dinner for social engagement, bonding and pleasure. In some parts of the world, the abundance and highly processed and manufactured food, contributes to major issues related to eating habits and health. Which at points we try to tackle medicines and other refined food. When creating the value landscape, the team can explore if and how agriculture and consumption play a role in the challenge and somehow influence the potential propositions.

Nature, elements and materials

Our ecology is under pressure, stimulating developments, attitudes and methodologies such as sustainability, green footprints and cradle to cradle (c2c). When creating the value landscape, the team can explore in which way the selected challenge relates to our natural environment and conditions, to our (limited) natural resources or our climate. Moreover, when creating propositions, even when the challenge is not directly connected to nature and sustainability, it is necessary to make an effort to predict consequences and impact on the natural environment and its biodiversity.

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Appendix D - High Tech Campus Interviews
D.1: Consent form

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Toestemmingsformulier

Voor het project 'Human Total Care' van de Technische Universiteit Eindhoven, wordt onderzoek gedaan naar uw mening over de interactie en vorm van een product. Onderdeel daarvan is het opnemen van het gesprek voor transcriptie en mogelijk vertaling in het Engels. U geeft met ondertekening van dit formulier ook toestemming om uw quotes en vertalingen van quotes te gebruiken in verslagen en presentatiemateriaal. Dit is vanzelfsprekend op anonieme basis.

U bent uitgenodigd om deel te nemen aan een onderdeel van deze studie waarin onderzoek wordt gedaan naar ervaringen binnen de werkomgeving met betrekking tot stress. Onderdeel hiervan is een bezoek van studenten aan de focusgroep waarin aan u vragen worden gesteld, daarvan zullen foto's worden gemaakt.

U bent niet verplicht de vragen van de studenten te beantwoorden. Indien u zich wil terugtrekken van het onderzoek kunt u dit ten aller tijden aangeven aan de onderzoeker. Alle informatie zal als vertrouwelijk worden behandeld tenzij u aangeeft dat het publiekelijk mag worden gemaakt.

_____ Ik geef **wel** toestemming, mijn foto's openbaar te publiceren op internet en sociale media daarnaast mag mijn data worden gebruikt ten behoeve van het onderzoek. Mijn data zal anoniem worden verwerkt.

_____ Ik geef **geen** toestemming, mijn foto's openbaar te publiceren op internet of andere media mijn data mag uitsluitend anoniem worden verwerkt ten behoeve van het onderzoek. Ik zal niet in enige foto te zien zijn.

Ik heb het 'toestemming formulier' begrepen, en neem vrijwillig deel aan dit interview. Ik begrijp dat mijn toestemming mijn wettelijke rechten niet beschadig in geval van nalatigheid of andere wettelijke schuld van iedereen die betrokken is bij deze studie.

Datum: ……

Plaats: ……

Naam participant: ……

Handtekening participant: ……

Datum: ……

Plaats: ……

Naam student: ……

Handtekening student: ……

D.2: Interview questions and answers

Interview questions

Q1. What is your job?

Q2. What is occupational stress?

Q3. Is the topic ‘stress’ ever been addressed at your work?

Q4. Do you have certain habbits when you feel stressed?

Q5. How do you notice if your colleagues are stressed and what do you do about it?

Interview answers interviewee 1

Q1. manager bij ASML

Q2. Niet meer weten wat te doen, teveel werk. Gerelateerd aan de baas! Dingen waar je geen controle over hebt. Dus fysieke omstandigheden op kantoren zoals kunstmatig licht op de werkplek,

Q3. Extra stichting die hier zich mee bezig houdt. Weet het niet zo goed want ik werk er nog maar 1 maand. Moet ook allemaal van de wet.

Q4. Ja kort lontje, chagrijnig, prikkelbaar, heeft iedereen wel denk ik

Q5.

Interview answers interviewee 2

Q1. manager Philips

Q2. Teveel werk op gelegd. Geen controle

Q3. Ja, workshops, lezingen, wordt door een aparte instantie op zich genomen

Q4. Ja heb ik ook voor iedereen geldt dat, koffie halen, maar ook voor iedereen anders.

Q5.

Interview answers interviewee 3

Q1. Field tester at Tomtom

Q2. Several different projects, with uneven load

Q3. Take a vacation, negotiate between supervisors [of different porjects]

Q4. Tomtom atmosphere is quite relaxed. “I could talk to them [managers]”. Especially welcomed by HR, also through help portal. They offer programs, but he never made use of them.

Q5. A bit nervous, pen clicking of others. Don’t dare to distract them.

Appendix E – Observations Human Total Care
E.1: Consent form

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Toestemmingsformulier

Voor het project 'Human Total Care' van de Technische Universiteit Eindhoven, wordt onderzoek gedaan naar uw mening over de interactie en vorm van een product. Onderdeel daarvan is het opnemen van het gesprek voor transcriptie en mogelijk vertaling in het Engels. U geeft met ondertekening van dit formulier ook toestemming om uw quotes en vertalingen van quotes te gebruiken in verslagen en presentatiemateriaal. Dit is vanzelfsprekend op anonieme basis.

U bent uitgenodigd om deel te nemen aan een onderdeel van deze studie waarin onderzoek wordt gedaan naar ervaringen binnen de werkomgeving. Onderdeel hiervan is een bezoek van studenten aan de focusgroep waarin aan u vragen worden gesteld, daarvan zullen foto's worden gemaakt. U wordt gevraagd naar uw mening over een app. Tevens zal u worden gevraagd een band om uw arm te doen.

U bent niet verplicht de vragen van de studenten te beantwoorden. Indien u zich wil terugtrekken van het onderzoek kunt u dit ten aller tijden aangeven aan de onderzoeker. Alle informatie zal als vertrouwelijk worden behandeld tenzij u aangeeft dat het publiekelijk mag worden gemaakt.

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Ik heb het 'toestemming formulier' begrepen, en neem vrijwillig deel aan dit interview. Ik begrijp dat mijn toestemming mijn wettelijke rechten niet beschadig in geval van nalatigheid of andere wettelijke schuld van iedereen die betrokken is bij deze studie.

Datum: ……

Plaats: ……

Naam participant: ……

Handtekening participant: ……

Datum: ……

Plaats: ……

Naam student: ……

Handtekening student: ……

E.2: Observation notes

Het kantoor is een “open ruimte”; deuren staan open of ontbreken en het is goed te horen wat iedereen aan het doen is in de hal en op andere kamertjes.

- Gesprekken gaan vooral over werk, anders is het stil. Er worden ook telefoongesprekken gevoerd. Verder is typen ook te horen.
- Ondanks de rumoerigheid hebben weinig mensen een koptelefoon op of een dichte deur.
- Mensen lopen regelmatig heen en weer tussen de verschillende kamertjes, dit maakt geluid.
- Stillere periodes en rumoerigere periodes volgen natuurlijkerwijs op elkaar, bijvoorbeeld in de koffiepauze of op een dag met veel mensen op kantoor is er meer lawaai.

Lampen zijn geel, luxaflexen zijn grotendeels gesloten.

In de hal is een soort “woonkamer” ingericht die nauwelijks gebruikt wordt. De woonkamer heeft comfortabele stoelen, tafeltjes, en ander decor. Ook zijn er tijdschriften en legoblokjes aanwezig.

- Alleen als men geen andere plek heeft gaan ze er wel eens zitten
- Mensen maken wel gebruik van de kantine

Door het kantoor heen hangen dingen aan de muur die werkgerelateerd of van het personeel zelf zijn. Veel to-do lijstjes en agenda’s, maar ook foto’s van huisdieren, tekeningen, etc.
Op bureaus zijn ook persoonlijke voorwerpen te vinden zoals origami-figuurtjes, plantjes, pennenpotjes, lunch/snacks (zoals bananen of een pot snoepjes), kannen water en een waterkoker om thee te maken, en een zandloper.

- Zandloper is van een werknemer die in beweging wil blijven. Na een test met een fitbit kwam hij er achter dat hij beter meer kan gaan bewegen, daarom probeert hij elk half uur (wanneer de zandloper leeg is) een rondje te lopen. Hij ervaart de zandloper als minder storend dan een wekker.
- “Squiggle birds” staan op een groot vel papier, en zijn een poging van een werknemer om mensen te motiveren iet creatiefs te doen. -> Mirelle is het “creatief brein” van de afdeling, neem contact op voor interview

Werkdruk wordt ervaren als redelijk hetzelfde elke dag.

Bedrijfsarts is aanwezig op een andere verdieping en staat los van de afdelingen.

Er zijn geen initiatieven voor een gezonde werk/levensstijl vanuit werknemers of werkgevers. Er is in het verleden wel een project van Fontys geweest om mensen even te laten bewegen.

Geobserveerde stress habits

- Iemand in een meeting zat “nerveus” met de voeten te wiebelen

- Huiskamersfeer
- Kastje met drank zoals schrobbelèr, wereldbol. Is dit van een borrel of versiering?
- Knus en ruimtelijk ingedeeld
- Sommige kamers hebben geen deuren
- Afgeschermd met muren
- Huiskamer in het midden; 2 sofastoelen, kastje, grote lamp, bank, beetje kitchachtige stijl
- Hoekbanken
- Boekenkast
- Er zijn kamers met verschillende doelen, bv software, secretariaat

- Mensen lopen redelijk veel rond
- In de kantine ging 10:15 een groepje van software samen koffie halen en kletsen over de Chinese muur
- Er zin meerdere koffiemachines (3), een basic en waar je het zelf moet maken en een luxere
- Fruitschaal
- Soep
- 2 hoge tafels in de gang met hoge stoelen
- Indeling verschilt per kamertje
- Kantoor met hoge tafel en fietsstoel
- Scrumbord
- 2 printers
- Scheiden alleen papier afval
- Aan de voorkant vergader kamers en hogere mensen
- Mensen reageerden toen Gijs ons onderwerp stress and mycare aankaarten zo van stress hebben wij niet. Is dit een taboe?
- Kantoortje met allemaal getekende dieren
- Planten
- Blauwig, bruin, zwart
- Je kunt veel horen van elkaar

- Tijdens de pauze gaan ze beneden naar de kantine
- De meeste mensen gaan tijdens de lunch een rondje lopen en beneden naar de kantine
- Sommige internationale werknemers
- Verstelbare tafels
- Schaakbord
- Less rules! Framework
- Whiteblock borden
- Hoe hoog kan jij vandaag
- When nothing goes right, go left
- Swiggle birds; use your imagination to create birds
- Ledachtige artificial lampen
- Ronde lampen
- Licht is niet sfeervol, feel, kantoorachtig
- Vloerbedekking sommige mensen lopen gehaast
- Voetstappen hoor je goed op de vloerbedekking

- Veel overleg en geklets
- De schoonmaakster loopt aan het einde van de ochtend ongeveer nog rond

Vragen aan 2 vrouwen

- Wisselen niet van kantoor alleen voor overleg
- Drankkastje is meegenomen uit d eoude kantine, puur versiering, geen borrel
- Werken meestal buiten de deur

Interview 3 data guys:

- Only there for 3 months
- No pressure yet but will come
- Work on the core, linked to many other project people.
- New cres no big picture
- Someone is drawing specialist makes drawings of the systems- zien er professional uit
- Allemaal geinteresseerd aan het luisteren
- Toen ik over stress begon, begonnen zij over walks in het Philips en degene die wilden konnen joinen
- Lopen naar het philips de jongh park
- Een iemand zei alleen ik vorige week niet want ik was too lazy
- Balans tussen gezonde stress en teveel stress
- Weten niet goed of er een soort van stress presentatie is geweest omdat ze er nog mar net zitten
- Nummer hartslag kun je niks mee

- Meeste mensen komen sociaal en vriendelijk over en zijn willling to help
- Veel rumoer en geklets gelach
- Deur halverwege dicht gedaan- belangrijke meeting?
- Niemand bij de printer geweest
- 3 deuren dichtgegaan; nee of ja communiceren

- Ongeveer om 11:15 rustiger in de werkplek ,meer deuren dicht
- Nerveuze voet wiebel bij meeting of werk achter deur dicht
    - Luxaflex van 2 kamertjes bedoeld om af te schermen? Voor computerscherm?

- Over 10 minuutjes ineens weer rumoeriger

- Zodra mensen rondlopen weer onrustiger

- Geen gebruik zitplekken

- Buitenplein

10:00 “zullen we even koffie halen?” ”Nee ik heb nog”

10:20 5 people talking about vacation with groups from different rooms. Standing around in circles. Cultural differences.

Lady casually walks by to blow her nose

Walk away by group agreement.

10:25 “met vragen stellen haal je de ontspanning van de pauze weg”

Most people choose for mid-range waiting for coffee.

Young man sits by himself on phone

10:35 2 talking about finishing their studies, 3 rd comes in, but does not interfere, just observes and takes a piece of fruit.

10:40 2 talking about a planning someone else made more difficult on them. “komt wel goed hoor”

10:45 takes fruit and washes it

10:50 2 talking about their health. “Hoe gaat het? Met je been dan.””Ik heb een masseur in huis.”

Man gets two coffee and a water, probably for colleagues or visitors, asks me where to find the milk.

Nobody sits down. Is it because of me?

The office is warm and the lighting very yellow, despite sunlight from outside.

Many notes between colleagues about the kitchen or jokes, some anonymous, some named.

11:00 “Wat is het hier rustig.”

2 ladies cut a cake

3 rd comes in for fruit

“Wie is er jarig?”

“Niemand, hij was meegenomen door …”

“niet hoeven zeggen, tast toe”

“moeten we voor … nog meenemen?”

“vinden ze denk ik wel leuk”

People seem uncomfortable with my presence.

11:05 lady comes alone and waits for a quick coffee.

11:20 “Er staat tart bij de coffee

E.3: Environment sketch

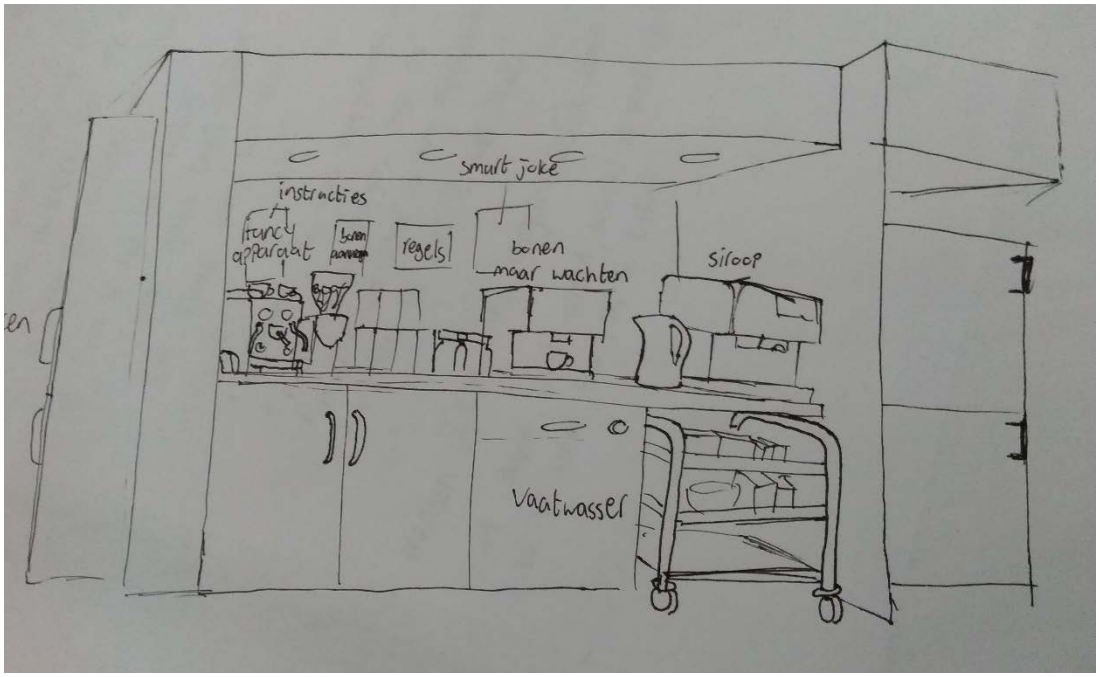


Figure 1 Environment sketch

Appendix F – Market analysis

"If you want your own personal escape from the never-ending stream of incessant noise, chaos and even your own thoughts that bombard your life at the office, this tabletop zen garden is a fabulous way to find inner peace when you have little in the way of space. One of the primary benefits of a mini zen garden like this is stress relief. By methodically arranging the stones and combing the sand, it will help your body begin to relax. Focusing on repetitive physical movements helps to quiet the mind, enabling you to experience the present moment, rather than worrying about the past or the future.You can also use this zen garden to stimulate creativity, as placing it on your desk may even help you to find a new perspective or solve a problem plaguing you at work. Research has shown mindful meditation like this promotes more "divergent thinking," an important type of thinking through which lots of new ideas are generated. When the brain is too busy dealing with stress, it's unable to allocate resources to creative thinking."

Figure 1

Patterson, S. (2016 Dec 6th) *11 Genius Gadgets To Keep You Healthy In The Office.* Retrieved from https://www.naturallivingideas.com/healthy-office-gadgets/

"The Calmingstone is a hand-held device designed for people who experience anxiety and panic attacks. Breathe in time with the responsive pulse, follow guided meditations and track your heart rate and session progress on the Calmingstone app."

Figure 2

Telfer, R. (2016 nov 17th) *Calmingstone- the ultimate calming experience.* Retrieved from https://www.behance.net/gallery/45336963/Calmingstone-the-ultimate-calming-experience

“Simone schramm’s stress ball visually communicates stress levels. The ball can determine the stress level by measuring the skin conduction with an external sensor. by touching the surface the measurement can be experienced in a haptic way. the transformation is created by miniature nobs, which move out of the ball’s surface. the length of the nobs reflect the intensity of the stress levels. through actively touching, pressing or stroking, the user quickly starts to sharpen his or her tactile perceptual capacity and to associate different surface conditions with their own individual stress. when the coloured nobs expand, their movement changes the uni-coloured surface into a multi coloured sculpture. the effect underlines the emotional accessibility and the three-dimensionality of the product.”

Figure 3

Schramm, S. (2016 March 5 th) *simone schramm's stressball visually communicates stress levels. R*etrieved from https://www.designboom.com/design/simone-schramm-stressball-03-05-2016/

“’Desktop fireworks’ by tomomi sayuda is an alternative office stationary with an extra function. having spent time stressfully working, the designer has created a series of objects that enable employees to take a moment out of their day and escape the fact that they are away from home in their cubicle. by pressing a red emergency-style button, an orchestra of colour lights, loud music, floating bubbles, sparkling confetti are released into the air to clear the mind of any negative thoughts. the set includes: a material cabinet, two bookends, a coffee mug, a tape dispenser, a pen holder, and a bulletin board.”

Figure 4

Sayuda, T. (2014 July 2nd) *tomomi sayuda ignites desktop fireworks to relieve stress. R*etrieved from https://www.designboom.com/design/tomomi-sayuda-desktop-fireworks-07-02-2014/

"'niceballs' is a dangling prosthetic accessory that allows users to discretely de-stress under their desk. designed by Spanish creative agency imaginarte, the malleable object sticks easily and efficiently to any workspace, carefully suspended beneath any solid surface. its irregular shape and undulant curves encourage relaxation and provide a few moments of escape during a hectic work day."

Figure 5

Azzarello, N. (2016, Sept 7th) *niceballs dangle beneath your desk so you can discretely de-stress.* Retrieved from https://www.designboom.com/design/niceballs-imaginarte-stress-ball-desk-09-07-2016/

Figure 6

"Depression, concentration problems and stress. Three of the biggest health issues of modern time. It is estimated that almost half of the population suffer at least once in their lifetime from one of these problems. Making milestones visible with the hourglass could help depressed people to look brighter towards the future. Concentration problems are just as common. Taking a certain amount of time (for example 1 Hour to do a specific task) could make it easier to concentrate, and less stressful."

S, M. (2015, Oct 23rd) *SOOON; The smart hourglass by Maarten S. from Netherlands. R*etrieved from https://www.designboom.com/project/sooon-smart-hourglass/

“Robin Skynner considered anticipation as one of "the mature ways of dealing with real stress. People reduce the stress of some difficult challenge by anticipating what it will be like and preparing for how you are going to deal with it. This is why anti-stress games have become very popular in recent years.During the design process, we firstly have analysed what elements that bring people's anticipation. They are mainly : Expectation, Excitement, unpredictable result, Interaction and stimulation from 5 senses.Secondly we came up with our Lenga out of Jenga (typical anti-stress game),and fully amazed by this simple idea that involves all the essential factors to the topic : Anticipation.”

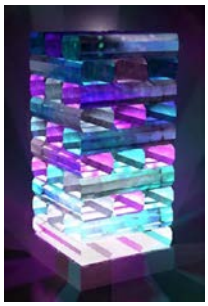


Figure 7

Zhang, Y.Z. (2015 Oct 23rd) *LENGA by YIHAN ZHANGQIANQING ZHANG from japan.* Retrieved from https://www.designboom.com/project/lenga/

“Developed by INTERFACE in collaboration with organizational psychologist, professor sir cary cooper, the human spaces report and website and report demonstrates how design and the incorporation of natural elements into their immediate office setting can change the way employees feel to the point where they are actually more stressed or, conversely, more productive.”

Figure 8

Chin, A. (2014 Dec 11th) *office employees desire natural light in their workplace.* Retrieved from https://www.designboom.com/design/biophilic-design-human-spaces-interface-12-11-2014/

"'anti stress chair' by bashko trybek is composed of hundreds of rearrangeable stress balls 'anti stress chair', the work of polish designer bashko trybek and in production by paris-based outdoorz gallery, is a customizable wireframe furniture piece that utilizes hundreds stress balls to create its cushioning. Produced in a large (240 ball) 'low chair' and a small (128 ball) model, the chair itself consists of a steel wire grid powder-coated in a range of colours. users place stress balls in each of the spaces of the wireframe, arranging them as desired into stripes, motifs, or patterns. the colours of stress balls were selected as magenta, cyan, yellow, black, and white to match the printing raster, turning the entire piece into a playful and interactive interpretation of printing pixels."

Figure 9

Filippetti, J. (2011 Aug 29th) *bashko trybek: anti stress chair.* Retrieved from https://www.designboom.com/design/bashko-trybek-anti-stress-chair/

"Graduate designer Rui Sun created an Emotional First Aid Kit, comprised of five objects designed to provide comfort in times of mental distress. The project aims to demonstrate that our emotional wellbeing is just as important as our physical health. Each of the objects are intended to comfort the user in a particular way – the Purple Breathing Mask gives off calming scents when the user breathes in, allowing them to clear their mind when in overwhelming situations, and the Green Meditating Stethoscope helps stressed users tune into their breath and meditate."

Figure 10

Hitti, N. (2017 Oct 10th) *Eight thought-provoking design responses to mental health.* Retrieved from https://www.dezeen.com/2017/10/10/eight-of-the-most-thought-provoking-design-responses-to-mental-health-world-mental-health-day/

“British furniture studio Another Country has teamed up with design agency Ekkist to create a series of health-focused furniture pieces, including a table with a tray for a surface and a multi-use daybed. They are designed to follow a set of guiding principles defined by Ekkist, which encourage a consideration of light, water, adaptability and longevity, mindfulness, environment and the creation of biospheres.”

Figure 11

Klee, K. (2018 Sept 19th) *Another Country launches Ori furniture that promotes health and wellbeing.* Retrieved from https://www.dezeen.com/2018/09/19/another-country-ekkist-ori-furniture-health-wellbeing/

“This little sensor measures the skin’s ability to conduct electricity, a biological response to stress. Hold it between your fingertips to see stress levels in real time on different apps. The device, by Irish startup Galvanic, turns into a handheld controller for stress-busting games.”

Figure 12

Ferro, S. (2015 June 4th) *5 Design Ideas To Help Combat Stress.* Retrieved from https://www.fastcompany.com/3043406/5-design-ideas-to-help-combat-stress

“This app developed by Playlab London (still in beta) turns breathing exercises into a nautical game. By taking deep, calming breaths in coordination with tapping the screen, you help guide a stranded sea captain back home–and, the thinking goes, reduce your likelihood of having a panic attack in the process. The game is designed to exploit tactile feedback to adjust your focus from your anxiety to what’s happening on-screen.”

Figure 13

Ferro, S. (2015 June 4th) *5 Design Ideas To Help Combat Stress.* Retrieved from https://www.fastcompany.com/3043406/5-design-ideas-to-help-combat-stress

“Stress and anxiety can do a number on your ability to get a good night’s rest. Created by a University of Oxford sleep researcher, this app guides you through cognitive behavioural therapy techniques to combat insomnia–sort of like a digital therapist for insomnia. It dispenses advice based on your sleep diary and answers to questionnaires, helping you reduce the negative thoughts that keep you awake.”

Figure 14

Ferro, S. (2015 June 4th) *5 Design Ideas To Help Combat Stress.* Retrieved from https://www.fastcompany.com/3043406/5-design-ideas-to-help-combat-stress

“The Relax-O-Ring’s coils are designed to give your fingers a little massage and stimulate your reflex points and energy zones. It may be perfect for when you’re at work and want to avoid that post-lunch crash, or if you’re in need of a meditative pick-me-up before a big meeting.”

Figure 15

Aiglon, K. (2018 June 15th) *Spotlight: 12 Useful Products to Help Combat Stress and Anxiety.* Retrieved from https://www.healthline.com/health/best-products-to-fight-stress-and-anxiety#1

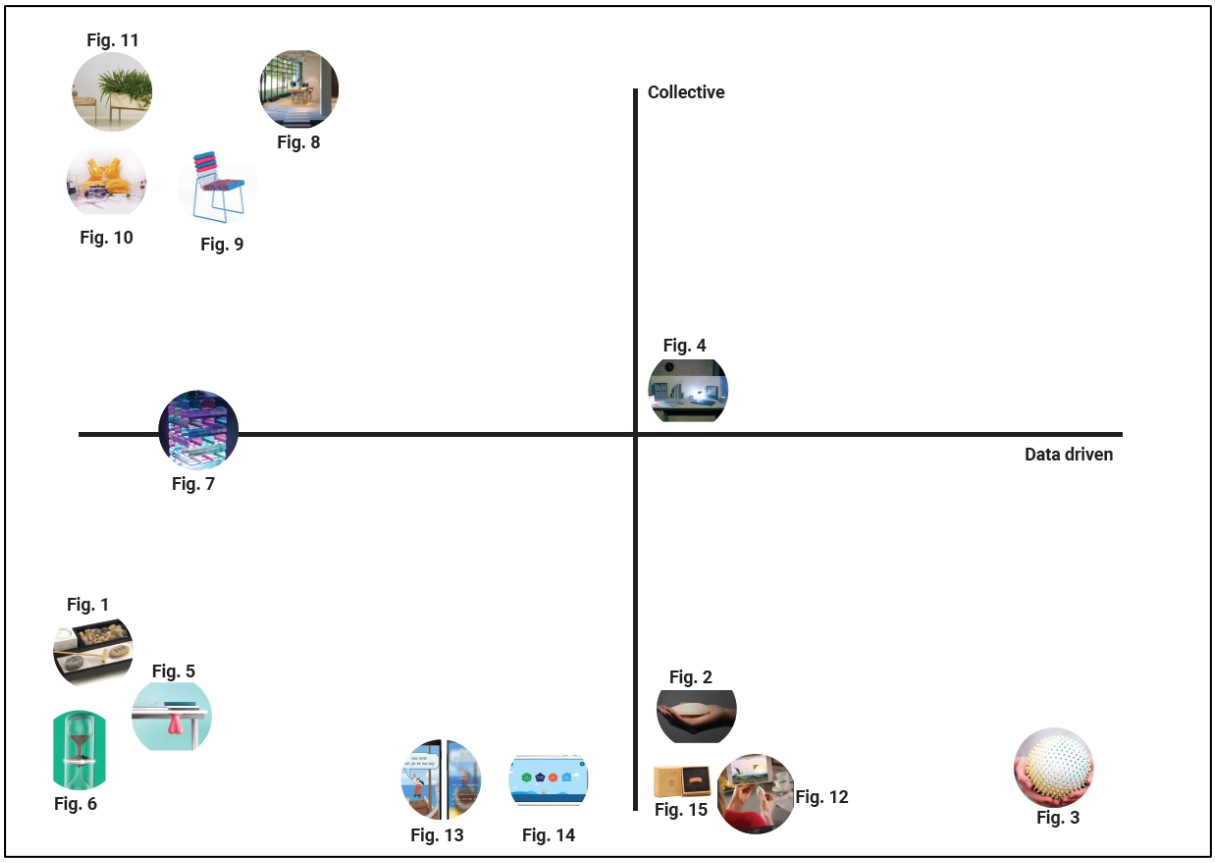
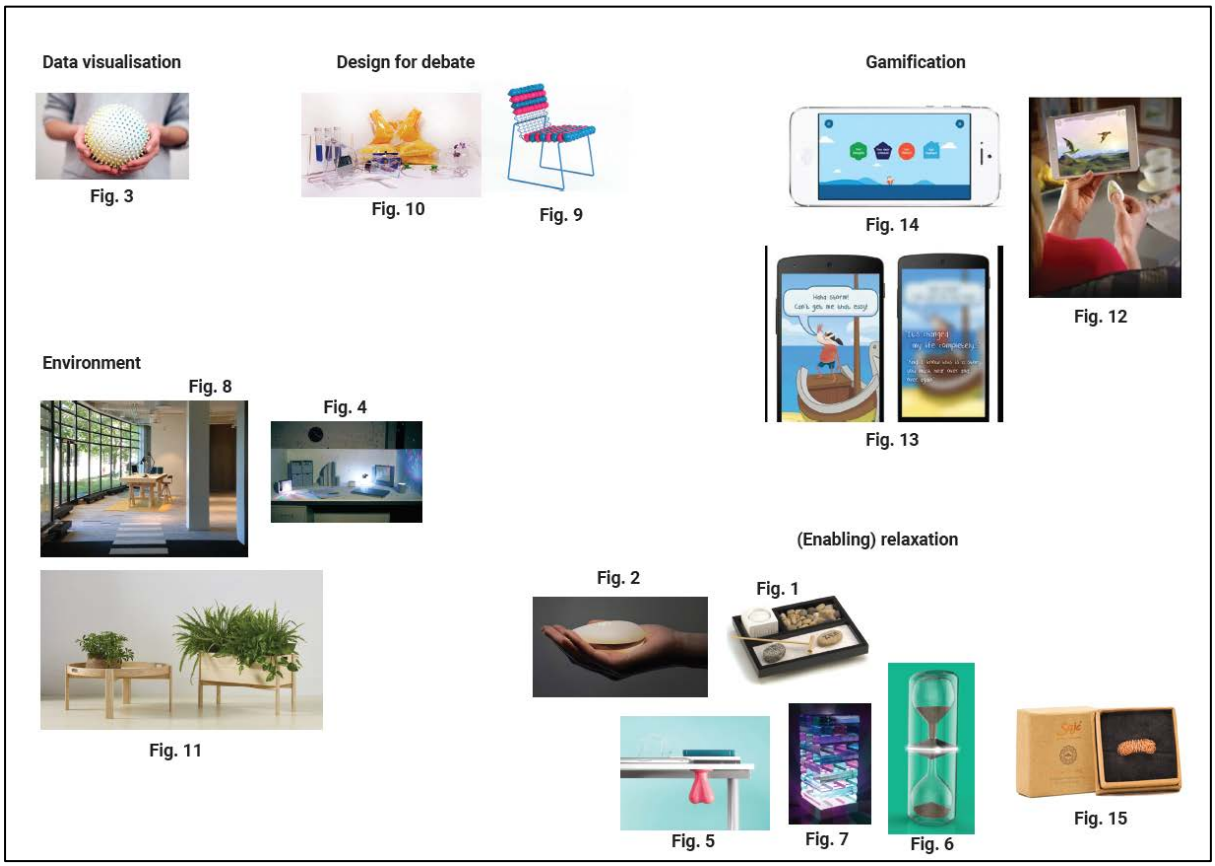


Fig. 11
Fig. 8
Fig. 10
Fig. 9
Collective
Fig. 4
Fig. 7
Data driven
Fig. 1
Fig. 5
Fig. 6
Fig. 2
Fig. 13
Fig. 14
Fig. 15
Fig. 12
Fig. 3


Data visualisation
Fig. 3
Design for debate
Fig. 10
Fig. 9
Gamification
Fig. 14
Fig. 12
Fig. 13
Environment
Fig. 8
Fig. 4
Fig. 11
(Enabling) relaxation
Fig. 2
Fig. 1
Fig. 5
Fig. 7
Fig. 6
Fig. 15

Appendix G – Chicken app interviews
G.1: Consent form

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Toestemmingsformulier

Voor het project 'Human Total Care' van de Technische Universiteit Eindhoven, wordt onderzoek gedaan naar uw mening over de interactie en vorm van een product. Onderdeel daarvan is het opnemen van het gesprek voor transcriptie en mogelijk vertaling in het Engels. U geeft met ondertekening van dit formulier ook toestemming om uw quotes en vertalingen van quotes te gebruiken in verslagen en presentatiemateriaal. Dit is vanzelfsprekend op anonieme basis.

U bent uitgenodigd om deel te nemen aan een onderdeel van deze studie waarin onderzoek wordt gedaan naar ervaringen binnen de werkomgeving. Onderdeel hiervan is een bezoek van studenten aan de focusgroep waarin aan u vragen worden gesteld, daarvan zullen foto's worden gemaakt. U wordt gevraagd naar uw mening over een app. Tevens zal u worden gevraagd een band om uw arm te doen.

U bent niet verplicht de vragen van de studenten te beantwoorden. Indien u zich wil terugtrekken van het onderzoek kunt u dit ten aller tijden aangeven aan de onderzoeker. Alle informatie zal als vertrouwelijk worden behandeld tenzij u aangeeft dat het publiekelijk mag worden gemaakt.

_____ Ik geef **wel** toestemming, mijn foto's openbaar te publiceren op internet en sociale media daarnaast mag mijn data worden gebruikt ten behoeve van het onderzoek. Mijn data zal anoniem worden verwerkt.

_____ Ik geef **geen** toestemming, mijn foto's openbaar te publiceren op internet of andere media mijn data mag uitsluitend anoniem worden verwerkt ten behoeve van het onderzoek. Ik zal niet in enige foto te zien zijn.

Ik heb het 'toestemming formulier' begrepen, en neem vrijwillig deel aan dit interview. Ik begrijp dat mijn toestemming mijn wettelijke rechten niet beschadig in geval van nalatigheid of andere wettelijke schuld van iedereen die betrokken is bij deze studie.

Datum: ……

Plaats: ……

Naam participant: ……

Handtekening participant: ……

Datum: ……

Plaats: ……

Naam student: ……

Handtekening student: ……

G.2: Interview questions and answers

Q1. What do you think when you see this?

Q2. Would you like to have some advice?

Q3. Would you do something?

Q4. Would you share this and with whom?

Interview answers interviewee 1

Q1. Ik zou na gaan denken of dit door mijn werk zou komen of door iets anders. Op zoek gaan naar de oorzaak.

Q2. Ik zou wel advies willen hebben maar zou ook wel weer sceptisch zijn.

Q3. Ik zou wel actie gaan ondernemen want voel me wel met mn neus op de feiten gedrukt. Deze info zou wel soort van de 'laatste' druppel kunnen zijn.

Q4. Ja ik zou het wel met iedereen delen. Behalve als ik een tijdelijke baan oid zou hebben en het geld echt nodig zou hebben. Of alleenstaande moeder ofzo zou zijn geweest, dan is het risico op het verliezen van je baan misschien toch groter. Delen met mijn collega's zou ik nooit een probleem vinden, alleen delen met baas zou ik alleen maar doen als het een ondersteunende begripvolle baas is.

Interview answers interviewee 2

Wat is Skin conductance? (Deze vraag stelde ze al voordat ik uberhaupt kans had om een vraag te stellen, data begreep ze dus niet echt)

Q1. Het eerste dat in me opkomt is, wat moet / doet mijn werkgever met deze info?

→ ik heb gezegd: nee is alleen voor jou op jouw telefoon.

In dat geval zou ik het super interessant vinden, maar dan zou ik alsnog zoiets hebben van: waarom zet mijn werk dit dan op. Wat willen ze er mee bereiken? Niet echt transparantie

Q2. Ja ik ben wel nieuwsgierig

Q3. Ik zou eerst naar mijn privé situatie kijken. Daarnaast is in mijn geval het advies dat ik meer moet sporten. Kan ik dan nu een sport abbo van mijn werk eisen? Aangezien zij dit opzetten. Dat soort dingen vind ik er dan ook bijhoren. Misschien kan ik dan samen met mn collega's gaan sporten of kijken hoe we iets aan onze data kunnen doen.

Q4. ik zou het het liefst met mn huisarts delen. En dus ook met mn collega's zodat we samen kunnen kijken hoe we dit aan kunnen pakken. Manager + bedrijfsarts, hmmm. Daar zou ik toch nog wel wat langer over na moeten denken. Misschien gaan bepaalde mensen hier ook wel misbruik van maken. Dat ze bijv. zeggen: kijk mijn data, ik moet echt minder werk krijgen want dit is niet goed voor me.

Interview answers interviewee 3

Is bloeddonor en wist wat zijn waardes waren, dus dat deze niet klopten

Q1. Ik zou als ik jullie was iets serieuzers dan een kip kiezen, maar ik neem de informatie die hij me vertelt wel aan. Er staat niet bij wat normaal zou zijn voor mijn gewicht en leeftijd, ik heb geen idee hoe ik dit moet interpreteren.

Q2. Ja maar het advies lijkt niet toegepast op mij, dit moet iedereen wel doen.

Q3. -

Q4. Mijn collega's en baas hebben niet veel te maken met mijn gezondheid. Als iemand ziek is en niet kan werken zou deze eerst met de huisarts en pas later met de arbodienst te maken hebben, zo'n app zou daarom minder passen bij de arbodienst.

Ik zie wel het nut wel in van zo'n app als je ziek bent geweest en weer aan het werk gaat. Dan kunnen jij en je arts(en) goed bijhouden hoe het met je gaat.

Ik zou graag zelf willen filteren wat ik deel met mijn baas en collega's. Delen met een professional vindt ik niet erg wegens beroepsgeheim.

Interview answers interviewee 4

Q1. Eigen waarden moeten wel ok zijn. Over het algemeen denk ik dat alles wel goed zit. Ik ken de termen maar heel oppervlakkig.

Is dit veel of niet veel? Ik denk als het 95% zou zijn dat ik dan niet zou weten wat ik er mee aan zou moeten

Q2. Niet persé want de kans op een hartaanval wordt lag ingeschat

Q3. Misschien niet slecht om dit te weten, zeker als je op je gezondheid moet letten. Niet elke dag, maar 1x per maand bijhouden is wel handig.

Q4. Zou de metingen niet willen laten zien aan collega's/baas, wel aan huisarts/bedrijfsarts. Ik ken mijn bedrijfsarts niet, maar het is ook prima om het te delen met hem. Ik vind het niet super belangrijk om mijn gegevens geheim te houden. Ik ben niet zo iemand die niet wil dat men weet wat mijn toestand is. Maar wat hebben mijn collega's en baas hier aan?

Interview answers interviewee 5

Q1. Gek als je alles moet monitoren. Weet niet wat het huidgeleiding is of wat goed of slecht is. Kleurtjes en icoontjes mooi en goed gekozen. Stresskip leuk maar heeft een negatieve lading. Gaat uit van stress.

Q2. Super basic advies.

Q3. Wat voor sport dan? misschien is het geen bedoeling dat ik een marathon ga lopen. Beter melding wanneer het tijd is voor een wandelingetje en optie om het in mijn agenda toe te voegen.

Q4. Met familie en vrienden zou ik het graag willen delen. Voor mij misschien niet zo relevant maar wel voor mijn oma om het met mijn ouders te delen oid.

Bedrijfsarts hoeft niet. Zelf huisarts wanneer het echt nodig is. Weet niet eens wie mijn bedrijfsarts is.

Niet naar baas. Weet niet of die er naar kijkt waarom wel. Extra stress verergert. Als die het weet.

Collega's hebben er niets mee te maken. Ik zou het persoonlijk houden. Wat doe je als je een popup van collega krijgt. Moet ik dan tegen Floor zeggen dat ze dat broodje eigenlijk niet moet moet opeten.

Interview answers interviewee 6

Q1. Aan de ene kant positief. Want weet wat ik aan mijn gezondheid moet doen om in betere banen te leiden als ik bijvoorbeeld te hard werk.

Heel duidelijk beeld. Zegt veel. Wel als je weet wat de waardes zijn van cholesterol. Als je er geen weet van hebt dan snap je het niet.

Q2. Heel direct advies. Heel duidelijk dat er iets aan gedaan moet worden.

Q3. Het is maar een moment opname. Houd het liever heel de week bij om te kijken of het advies hetzelfde blijft. Gelijk iets beters. Neem aan dat op feiten is gebaseerd. Maar kan ik hier niet uit maken. Inleiding, moet iets voor worden geschreven. Welke dingen neemt ie mee.

Q4. Als iedereen zo'n bandje draagt met alle collega's delen. Als het pas echt vervelend is de huisarts maar niet gelijk.

Liever niet de baas zou ik niet zo fijn vinden. Ja nee, als het meerdere keren voorkomt, ik houd het liever voor mezelf. Collega's is prima. Bedrijfsarts is pas in beeld als er echt iets aan de hand is.

Interview answers interviewee 7

Q1. Waarom wertel je niet meteen aan demensen dat het nep is? Levert denk ik dezelfde inzichten op. Over de app; ben niet zo van de pps maar er zijn wel een paar goede bij. Data is goed gerpesenteerd maar zou nog op veel meer dingen gaan zitten, BMI enzo. Iedereen weet tegenwoordig wel wat.

Q2. Adviezen vind ik een goeie. Zou ik nog specifieker maken en
mensen echt tot die behaviour change laten gaan. Ook triggeren met meerdere reminders.

Q3. -

Q4. En voor het delen van data voor mij geen probleem. Het is misschien belangrijk om nog meer mensen hierbij te betrekken zoals fysio enzo. Huisarts doet niet aan terugkoppeling. Wel belangrijk. Maar eigenlijk juist ook de inner circle betrekken. Die zijn het effrectiefst en belangrijkst. Bij het delen. Niet bij je hartslag bedoel ik dan, maar als dat ding bv. Doorheeft dat je kanker hebt. Dan wil je het delen met je vrienden en familie. En dit is bij depressie misschien nog wel belangrijker. Echt die inner circle.

Appendix H – Co-creation
H.1: Consent form

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Consent form

Co-creation is being conducted for the project “Human Total Care” of the Eindhoven University of Technology. This co-creation is for gathering values and ideas for reducing collective stress. Recording this session for the purpose transcription and processing is a part of this. By signing this form you also give us permission to use information, ideas and quotes from the interview in reports and presentation materials. Naturally, this is done on an anonymous basis.

You have been invited to participate in a part of the study where we research experiences in the work environment involving stress. This includes a visit from students to the focus group, where you will be interviewed. Pictures, videos and recordings will be taken during this visit.

In case you want to withdraw from this session, you can communicate it to the researcher at any time. All information will be treated as confidential, unless you explicitly state your permission to make it public. We are taking video materials in which you might be recognizable. If you do not want this we can discuss ways to anonymize this.

_____ I **do** consent to gathering my drawings, pictures, recordings and film for research and internal presentation purposes. I know that the ideas I create during this session are not my intellectual property and that I have no claim to them in the future. My data may be used for the purpose of this research and is exclusively processed anonymously.

_____ I **do not** consent to my drawings, pictures, recordings and film for research and internal purposes. I know that the ideas I create during this session are not my intellectual property and that I have no claim to them in the future. My data may be used for the purpose of this research and is exclusively processed anonymously.

I have understood the ‘consent form’, and voluntarily participate in this interview. I understand that my consenting does not harm my legal rights in case of neglectance or legal fault of everyone involved with this study.

Date: ……

Place: ……

Name participant: ……

Autograph participant: ……

Date: ……

Place: ……

Name student: ……

Autograph student: ……

H.2: main insights from Co-creation

- Ze vonden de **richting van het project leuk en interessant**
- Eerste brainstorm was onduidelijk ; How can we integrate data visualisation in your domain?
- Ze ervaren allemaal wel stress in hun werk (behalve Gabriel), denken dat erover praten een oplossing is; **stress is ook subjectief**; hoe zie je aan iemand dat deze persoon gestresst is; **doing fun activities and relaxing activities helps; finding the right work-private balance**
- **stress is not always negative can also give you energy** to do something
- consider work environment itself; there might be some things that affect stress such as noise.
- **stress is about the timespan** not about a particular moment
- **stress is different for everyone**
- what is already there from psychologists in company: treatments are mostly focused on looking into setting their boundaries, coping skills to better deal with stress, how to deal with for example 'piekeren'
- **Clock**; **do people look at it**? what does it do? **important to reflect on it; but when they are very busy they might ignore it, they know they are stressed already**.
- **Highly stressed people do not want to see Hi you are all very stressed**. Maybe you can then do the intervention maybe visuals on this, like meditation, smooth audio, **clock itself is kind of intervention tool**
- whole idea of what we see now with wearable devices; make us aware of something is not working. So I like the way of having **an unobtrusive environmental system**
- **Gabriel wants to have a digital solution**. something hanging on the wall can become invisible. Maybe something on your computer mouse. **Something close to you**.
- But that it is **something from the environment I like**
- Factors that we can score the ideas on:
    - **personal data**
    - **unobtrusiveness**
    - **visual**
    - **easy to interpret/understandable**
    - **adaptable**
    - **costs**
    - **social**

Appendix I – Test 1 Woonkwartier
I.1: Consent form

Toestemmingsformulier

Voor het project 'Human Total Care' van de Technische Universiteit Eindhoven willen wij graag uw mening weten over de interactie en vorm van een product wat ontwikkeld wordt door studenten.

U bent uitgenodigd om deel te nemen aan een onderdeel van deze studie waarin onderzoek wordt gedaan naar de het ervaren en het meten van stress binnen de werkomgeving. Dit is een bezoek van studenten aan de focusgroep waarin u tijdens uw werk aangeeft hoe u zich voelt op een schaalverdeling en een aantal vragen aan u worden gesteld. Hiervan zullen foto's worden gemaakt.

Onderdeel daarvan is het opnemen van het gesprek voor transcriptie en mogelijk vertaling in het Engels. U geeft met ondertekening van dit formulier ook toestemming om uw quotes en vertalingen van quotes te gebruiken in verslagen en presentatiemateriaal. Dit is vanzelfsprekend op anonieme basis.

U bent niet verplicht de vragen van de studenten te beantwoorden. Indien u zich wil terugtrekken van het onderzoek kunt u dit ten aller tijden aangeven aan de onderzoeker. Alle informatie zal als vertrouwelijk worden behandeld tenzij u aangeeft dat het publiekelijk mag worden gemaakt.

_____ Ik geef **wel** toestemming, mijn foto's openbaar te publiceren op internet en sociale media daarnaast mag mijn data worden gebruikt ten behoeve van het onderzoek. Mijn data zal anoniem worden verwerkt.

_____ Ik geef **geen** toestemming, mijn foto's openbaar te publiceren op internet of andere media mijn data mag uitsluitend anoniem worden verwerkt ten behoeve van het onderzoek. Ik zal niet in enige foto te zien zijn.

Ik heb het 'toestemming formulier' begrepen, en neem vrijwillig deel aan dit interview. Ik begrijp dat mijn toestemming mijn wettelijke rechten niet beschadig in geval van nalatigheid of andere wettelijke schuld van iedereen die betrokken is bij deze studie.

Datum: ……

Plaats: ……

Naam participant: ……

Handtekening participant: ……

Naam student: ……

Handtekening student: ……

I.2: Interview questions and answers

Q1. Please describe the overall stress in the office today on the graph.

Q2. Please rank yourself among your colleagues. (>/=/< than your colleagues)

Q3. How were your answers influenced by colleagues?

Afterwards the users are presented with the collective answers of their office's answers for each hour, and asked the following questions:

Q4. From this visualization, when was the most stressed moment for the group in the day? Could you describe/guess why? (meeting? deadline?..)

Q5. Please compare your stress with your colleagues in each hour, does it match with your expectation? (yes/no) Why?

Q6. Does this visualisation make you more aware of the collective stress in the moment? Also over time?

Q7. Does this motivate you to work on your own stress level? What would you do? (try to manage/..)

Q8. Does this motivate you to work on the office ambiance? What would you try?

Interview answers interviewee 1

Q1. -

Q2. -

Q3. Not infleunced

Q4. In between half past 1 and half past 4. I think because people had a meeting or had phone calls. I myself didn't feel stressed at that moment.

Q5. No it's higher than I expected

Q6. It makes me aware. Yes also over longer time.

Q7. Yes to walk away from my desk or to stand up or take a different position. I prefer to only focus on myself and not so much on my colleagues.

Q8. -

Interview answers interviewee 2

Q1. -

Q2. -

Q3. Not influenced. I find stress a relative understanding.I think it's mainly task/event related and that we are not stressed in general.

Q4. Between half past 1 and half past 2. It depends what everyone has been doing. I

cannot say it specifically. I don't know. For myself, I had a deadline.

Q5. I don't know

Q6. I am totally not busy with these kind of things. I recognize the results but there are so many people and so many tasks so I cannot really get insight in the collective whole. From my close environment I can get an impression, but from the rest I don't know. I think stress is closely related to the specific work that you have to do.

Q7. No this won't motivate me. Maybe it will help others that are suffering. By thinking about it more (by means of these notes, or speaking with someone) could help.

Q8. If I notice that others are stressed, I ask my close colleagues to help them out.

Interview answers interviewee 3

Q1. -

Q2. -

Q3. Not infleunced

Q4. The most stressed moment of the day would be the end of the day for me. Though, this doesn't show in the graphs. It also has to do with the activities of that day (meetings or so) Especially on Thursdays I would expect stress to increase during the end of day. I think if everyone would be at the department and placed a stickers, there would be more stickers in the stressed quadrant.

Q5. This sort of matched my expectation I guess. There is a small slope, hmm yes I was expecting that as well. I was also expecting the majority to be in the positive relaxed quadrant.

Q6. I think this says something the atmosphere of Woonkwartier yes. I think that is confirms what we are all experiencing. Ofcourse you don't know exactly what specific function-groups have filled out because everyone is sitting mixed.

Q7. Now that I had to fill out these notes, I immediately started tot hink about what I had to do today. I had to prepare for a meeting for example, perhaps I wil experience some more stress at that point. But as times are visible, it becomes more meaningfull.

Q8. I think it's bad if the ambience is negative. It will damage the work quality. If that would have been the case it would definitely have been a trigger to action. I would first research why there is such a high negative stress level.

Interview answers interviewee 4

Q1. -

Q2. -

Q3. Not infleunced

Q4. Just after the break. I'm not sure what the cause of that is. I thought it would have been more stressfull at the end of the day like 'ohhh I still need to finish this and this and this'. So hmm I don't know actually. Maybe because people have appointments for which they still need to do something for.

Q5. I think everyone is always very positive and therefore this pattern fits within my Expectations

Q6. I think this overview gives me insight in what the current state of the department is. I feel like everyone has enough to do, not too much and not too little and therefore feels this way. And I also believe everyone deals with this in a positive way.

Q7. If the trend stays like this no, then I wouldn't do something. But if it goes more towards the negative side, I would want to do something.

Q8. If the the stickers would be
in the negatively stressed quadrant, I would be influenced. Then everyone will walk around grumpy and I wouldn't dare to ask something to anyone. What I would do about that? That depends on who it is and if I could actually do something for them. I would always try to help in a social way (ask them 'hey how are you? What are you up to?') but I cannot help people by taking over their work.

Interview answers interviewee 5

Q1. -

Q2. -

Q3. Uhh, nee. Niet eigenlijk. Ik heb er wel met een collega hierover gehad maar nee. Nee niet uitvoerig ofzo. Heeft ook geen invloed gehad op hoe dat ik uhh me eigen gedragen of gevoeld heb

Q4. Uuuhm. Zo te zien hier een beetje denk. Een beetje rond, ja dat is een beetje rond de lunchpauze he. Ja toen heb ik hem trouwens ook ingevuld als iets meer gestrest. Dat is puur om op tijd een beetje dat je snel snel naar alle winkels en terug en en dan kom je hier

Q5. Met de algemene tendens ja want ik zat hier maar die heb ik niet ingevuld en toen zat ik in ieder geval ook in deze uh dus ja zoals ik het hier zie zit het over het algemeen wel. Ja hier zat ik wel weer hier net in het gestreste vakje maar de meeste juist ontspannen. Dus over het algemeen gewoon tijdens echte werk dingen wel.

Q6. Jaja, ja maakt het me daar meer bewust van. Meestal merk je het wel. Gewoon als je ergens zit een beetje zoals iedereen doet en klinkt en snel of een beetje relaxed rondloopt dan dan krijg je wel

een beetje een indruk van wat is de stemming en wat is de sfeer wel het gedrag van anderen dat, ja het gedrag van mensen.

Q7. Ja je staat er natuurlijk wel even bij stil, dat je even na moet gaan hoe eh hoe gestrest of ontspannen je bent terwijl ik dat normaal eigenlijk eigenlijk niet bij stil sta want gedurende de dag ga je door en eh in die zin wel dat je even een momentje hebt van reflectie van hoe staat het ermee, dat wel ja

Q8. Nee om het erover te hebben uh. Nou ik denk niet dat zo'n overzicht daar ik denk dat als je echt ziet meer qua waar je zit dat je dan eh als je ziet dat mensen echt over hun toeren of druk of dit of dingen ofzo dan zou ik misschien wel zeggen van goh uh he uh is er iets waar ik eventueel even mee kan helpen of wat dan ook maar ik denk dat zo'n overzicht opzich ik denk niet dat dat uh de trigger zal zijn om eh het is meer dat je iemand ziet gedrag en houding enzo. Dan heb je misschien iets van ha die gaat misschien een beetje overlopen ofzo of wat dan ook. Zo'n puntje zegt wel wat maar ik weet niet of ik dan echt acuut een actie zal nemen. Want ja het zijn allemaal puntjes maar ja dat is een beetje abstract. Ik zeg ja het ligt er ook aan of er iemand aan die kant een beetje gestrest is ja en je zit hier dan heb je daar toch minder mee.

Interview answers interviewee 6

Q1. -

Q2. -

Q3. Not infleunced

Q4. More 'relaxed' than I thought. Almost everything is on the right. Hmmmm Just that is really negative, and I did not expext that. It begins relaxed, then it becomes more and more stressed and then relaxed again. So I guess somewhere in the middle. Between 12:30 – 14:30
I can only guess what have caused this from my own perspective. I guess it just has to do with moments. To me, it could have been at 9:00 as well if something would have happened. I see no clear cause.

Q5. -

Q6. I start to think 'what do certain things with me'. What causes that 'more stressed feeling' and does that make any sense or not? It makes me think more than usually.
If you are relaxed and positive then I think you will easily accept it but if you are getting more stressed it makes you wonder why. I don't think about my colleagues, didn't pay close attention to what they did.

Q7. Yes it motivates me because I think about it more deeply. If the dots would be more negative, I think it would be more a point of discussion during the day. Then, I would ask them things like: where did you put your sticker and why?

Q8. I'm not sure what I could do for everyone.

Interview answers interviewee 7

Q1. -

Q2. -

Q3. No not really

Q4. Some people had meetings, or maybe just a phone call (…), so the last timeslot was busiest

Q5. No it's higher than I expected

Q6. I'm not sure about that

Q7. No,I don't get much [motivation or triggers to deal with stress] out of it.

Q8. When we would all be in the same [negative] quadrant I would do something about it. I would be less likely to say for instance "Piet,Karel, come talk to me"

Interview answers interviewee 8

Q1. -

Q2. -

Q3. No but I was probably quite positive

Q4. I don't think that if you are really stressed you will put the sticker more positive because others are there. I don't know how others experienced it. I think that because it was hanging in the open, it was less pleasant for others to use it.

Q5. -

Q6. I was more aware of my stress throughout the day. How am I feeling at the moment?

Q7.. If you are really busy, you cannot do much yourself.

Q8. Depends, but if I notice [someone stressed] I will ask how they are and if I can help them. I think there is already a lot being done here but If it is bad for longer, that's a signal to do something about it.

Interview answers interviewee 9

Q1. -

Q2. -

Q3. Not really. They did make jokes about it, just to make fun. It might have made the scores more positive.

Q4.

Q5. I was stressed all the time. I had little variation. The variations were the same as colleagues.

Q6. I guess it does

Q7. What was nice was that I took a few seconds to think about it. That's good.

Q8. What I learned myself, is that it really helped to walk around. (…) I talked to people, also about this, and it released some stress.

Interview answers interviewee 10

Q1. -

Q2. -

Q3. My colleagues were OK, they are quite relaxed.

Q4. Two weeks ago there was more stress, because we were hitting a deadline. Now it was quite relaxed.

Q5. I expected this. I knew today was a relaxed day.

Q6. At the moment not because I'm relaxed.

Q7. I usually discuss stress with my managers. They notice when I am stressed.

Q8. Yes we can discuss what to do. Yeah, discuss, or give advice or even help them.

I.3: Observation notes

T1_general: Oh, [name] is coming. I feel my stress levels rising.

T1_general: [none participants also use the system]

T1_general: [there's a lot of casual talk about the system and stress]

T1_general_A: Bit of reflection on the card and stuff like that …

T1_general: Are you stressed already?!

T1_general_A: Those cards cause it [more stress, joke]

T1_general: [after being the laughing stock] I will revise my card now

T1_general_A: That's private, anonymous

T1_general: That conversation sucked. I would have filled in my card much higher.

T1_general: I was relaxed, but not anymore

T1_general: It's our shared responsibility

T1_general: Did it go down again?

T1_general_B: [talking to herself before getting coffee] Did I put my sticker up? No, not yet [does not stick one anyways]

Vleugel A: blackbox

Vleugel B: graph

'Nu kan ik precies zien wat jij aan het doen bent' 'Oeh daar word ik nu wel zenuwachtig van' zegt een

mevrouw die recht tegenover de opgehangen poster werkt in vleugel B tegen een mevrouw die een stickertje aan het plakken is.

Binnen 5 minuten hingen er al 7 stipjes bij vleugel B, misschien ligt dit eraan dat mensen het gauw wilden doen voordat ze gingen lunchen?

Kwart voor 1: 2 vrouwen kletsen over waar ze pauze gaan nemen. 3 zitten er nog zelfstandig te werken. Rustig op de afdeling B

Leidinggevende:

Liberaal bedrijf. Iedereen laat hier gewoonzien wat die wil zien. En dat is bedrijfscultuur. Zal bij andere bedrijven ook weer anders zijn. Dus daar moetje ook naar kijken. Werknemers zijn hier vrij. Vrij om te gaan zitten waar ze willen en vrij in tijden.

‘Mag je er ook meer invullen?’ Ik heb er al een ingevuld -? Heeft geen formulier ontvangen maar doet

toch mee en vult weer een kaartje in bij de blackbox.

In vleugel A; lijken veel vaste bureaus te zijn en clubjes mensen; zit iedereen hier echt vrij te werken waar ze willen of zijn het toch soort van vaste plekken?

Bovenste verdieping; grote ruimte met een pingpongtafel, lange tafel met computers, een keuken, sofa’s en stoelen, tafeltjes. ‘flex’ ruimte. Hier houden ook mensen pauze en vergaderen ze.

Whiteboard met daarop project/actiepunten. Er hangt ook een digibord.

Floor B; ‘Je moet nog een sticker plakken hoe jij je voelt’ ‘ja ze zijn een onderzoek aan het doen’ ‘heb ik inderdaad wel op intranet gezien maar ik zat in een bespreking ‘ bij het weglopen zei een mensje dit tegen een meneer.

Floor B; 1 uur lijkt pauze over te zijn. Veel geklets en geprint.

Floor B; ‘Je doet het ook op de hele, wij op de halve wel goed doen he’ zegt een meneer tegen een meneer

Floor B; ‘Hoe gestrest ben je? Hahaha. Ja, gevonden in het dames toilet, hahaha, zo werkt het wel.’

Lacherig gesprek over de kaartjes

Meneer; ‘wat ik me afvroeg he, waarom zo analoog? Je kunt heel makkelijk een hightech optie maken. Wel verwacht van jullie opleiding.

Floor B; ‘Ik voel weer stress’ hahaha

Floor B; Ja hoe zit het met je stress’’ Ja al 2 ingevuld ik lig op schema. Nee niet invullen! Nee dat moet

je zelf doen.

Floor A; Door jouw gesprek wed ik nu alleen maar gestrest. Andere man deed niet mee maar samen wel voor het bord gaan staan.

Floor A; ‘Ja is het nu negatief of positief?’

Floor A; doos achterkant 6 14:05, doos voorkant 1 14:05

Ruud: - multipleindusi-

Meneer: ‘een tool platform, interessant om te zien wat de verschillen zijn van de verschillende afdelingen. Kijk erna met een IT perspective. Cool om wel te zien wat jijzelf erin bijdraagt’.

F

Tijd: 11:30 - 12:30 Afdeling: B

Doing	Walks in	sees Hans strickering	sticks sticker	tells other colleagues	
Thinking		I want to do that. as well	knows right away where to put it	"Aan mij hebben ze alleen niks, gaat harstikke goed met mij"	
Feeling	Happy bubbly	enthousiasm ~~Vreselijk~~	relaxed & positive	not useful	
Pain points				"Ze hebben niks aan mij" (miss denkt ze dat wij focussen op de negativiteit?)	
Opportunities				huge opportunity dat ze andere collega's wil stimuleren	

F

Tijd: 12:30 - 13:30 Afdeling: B

Doing	liep naar lunch	sees poster	sticks sticker		
Thinking		shit, ik moet 'm nog invullen	~~no~~ no thinking just doing		
Feeling	relaxed	relaxed	relaxed		
Pain points		forgets that she has to stick			
Opportunities					

F

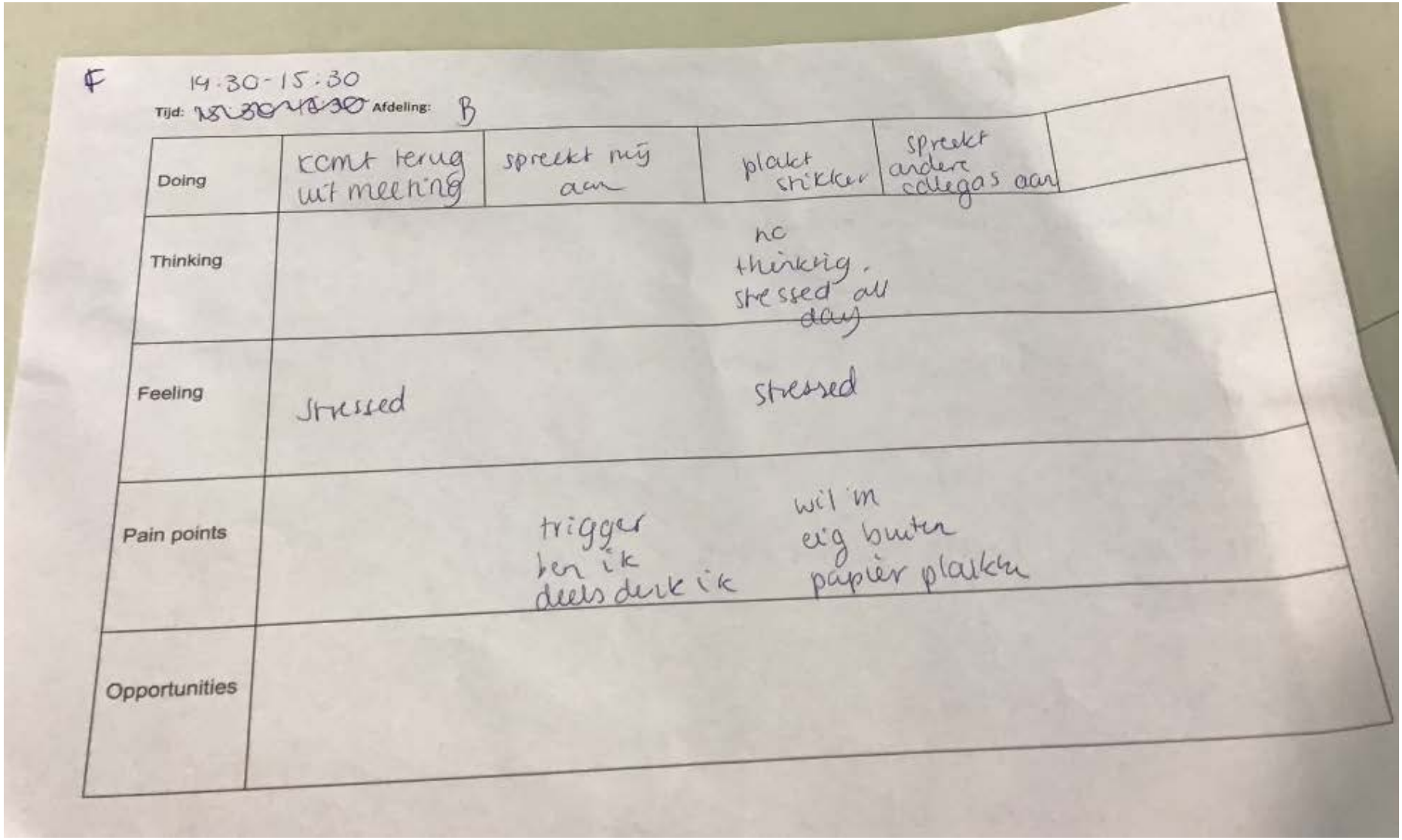
Tijd: 13:30 - 14:30 Afdeling: B

*

Doing	loopt langs (opmerking)	loopt naar buiten	loopt naar binnen	loopt langs	plakt sticker
Thinking	wordt er aan herinnerd		nou I want to share because it's a new feeling →		no thinking just doing (before, she had to think about it)
Feeling		gets positive news.	happy		
Pain points	wordt herinnerd door mij / de nieuwe poster		deelt pas als het nieuw is.		
Opportunities			↓ je eigen "pion" verplaatsen als er iets verandert.		

Soort van spel met jezelf. Bewustwording, challange.

idee van Mengru schilderij *



F

14:30 - 15:30

Tijd: ~~14:30 - 15:30~~ Afdeling: B

Doing	komt terug uit meeting	spreekt mij aan	plakt stickers	spreekt andere collega's aan	
Thinking			nc thinking. stressed all day		
Feeling	stressed		stressed		
Pain points		trigger ben ik deels denk ik	wil in eig buiten papier plakken		
Opportunities					

Appendix J – Test 2 Woonkwartier
J1: consent form

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Toestemmingsformulier

Voor het project 'Human Total Care' van de Technische Universiteit Eindhoven willen wij graag uw mening weten over de interactie en vorm van een product wat ontwikkeld wordt door studenten.

U bent uitgenodigd om deel te nemen aan een onderdeel van deze studie waarin onderzoek wordt gedaan naar de het ervaren en het meten van stress binnen de werkomgeving. Dit is een bezoek van studenten aan de focusgroep waarin u tijdens uw werk aangeeft hoe u zich voelt op een schaalverdeling en een aantal vragen aan u worden gesteld. Hiervan zullen foto's worden gemaakt.

Onderdeel daarvan is het opnemen van het gesprek voor transcriptie en mogelijk vertaling in het Engels. U geeft met ondertekening van dit formulier ook toestemming om uw quotes en vertalingen van quotes te gebruiken in verslagen en presentatiemateriaal. Dit is vanzelfsprekend op anonieme basis.

U bent niet verplicht de vragen van de studenten te beantwoorden. Indien u zich wil terugtrekken van het onderzoek kunt u dit ten aller tijden aangeven aan de onderzoeker. Alle informatie zal als vertrouwelijk worden behandeld tenzij u aangeeft dat het publiekelijk mag worden gemaakt.

_____ Ik geef **wel** toestemming, mijn foto's openbaar te publiceren op internet en sociale media daarnaast mag mijn data worden gebruikt ten behoeve van het onderzoek. Mijn data zal anoniem worden verwerkt.

_____ Ik geef **geen** toestemming, mijn foto's openbaar te publiceren op internet of andere media mijn data mag uitsluitend anoniem worden verwerkt ten behoeve van het onderzoek. Ik zal niet in enige foto te zien zijn.

Ik heb het 'toestemming formulier' begrepen, en neem vrijwillig deel aan dit interview. Ik begrijp dat mijn toestemming mijn wettelijke rechten niet beschadig in geval van nalatigheid of andere wettelijke schuld van iedereen die betrokken is bij deze studie.

Datum: ……

Plaats: ……

Naam participant: ……

Handtekening participant: ……

Naam student: ……

Handtekening student: ……

J.2: Interview questions and answers

Q1. Please describe the overall stress in the office today on an empty graph.

Q2. Please rank yourself among your colleagues by drawing on the same graph.

Show them visualisation of their own space. The users asked the following questions:

Q3. Was this what you were expecting?

Q4. When and how did you decide to enter another submission? What were the influences? What held you back?

Q5. How were your answers influenced by the graph next to the box?

Q6. From this visualization, when was the most stressed moment for the group in the day? Could you describe/guess why? (meeting? deadline?..)

Q7. Does this visualisation make you more aware of the collective stress in the moment? Also over time?

Finally they are also presented to the graph(s) from the other space, without taking their own away. They get a short explanation of how the other was constructed.

Q8. Which one do you think is more useful? Why?

Q9. Do you think your answers during the day would have been different if you had the other visualization?

Interview answers interviewee 1

Q1. -

Q2. Oh sorry this was mine, of all the people. Yeah, yeah I saw the pictures on the wall and thought like oh a bit negative

Q3. yes, I guess so, because lot of people are a bit negative and a bit stressed not that much

Q4. Oh because I think it is important for your study, that's why I did it, I think it is important people participate with that.

Q5. Oh it is on the other side, I sat with my back to it, so I didn't see it

Q6. Pooh, ehm, I think after lunch, after lunch.

Q7. Yeah

Q8. Ah this one is better for me, works more for me, you can see it better. It's more clear (one with colour dots)

Q9. no, this is the one with the stickers on it right? Oh I like this better. Yeah I like the stickers because I just like stickers. So I don't think my answers would be different but I like this one more

Interview answers interviewee 2

Q1. I think it is relaxed and positive, I think between

Q2. the same, in the circle yes haha

Q3. My experiences are here, so more positive.

Q4. Ehm when I had meeting and left

Q5. Eh No

Q6. ehm maybe it was because we had a meeting at half past one. With the whole vastgoed group. So they have to finish this, their work. You know what I mean? I think it was because they want to finish their work, that this is more negative.

Q7. I don't understand

Q8. I would go for this one because it's the bigger picture. When you see it with colours you can see it in one picture

Q9. No

Interview answers interviewee 3

Q1. Uhm dan denk ik dat we wel positief waren maar toch wel een beetje hier

Q2. Ja ik zit nog steeds aan de onderkant, positief ontspannen wel

Q3. Mwah, ik zat toch eerder hier te denken hoor, omdat mensen toch wel een beetje gestrest waren, heel veel meetings op de agenda zag ik staan en eh heel veel deadlines zag ik staan vanwege het MT enzo dus ik had meer hier verwacht dan hier.

Q4. ehm bedoel je de tijdstippen? Ik heb het niet gered ieder half uur, maar ik ben bezig geweest met begrotingen en iedere keer als ik dan een begroting af had dan dacht ik van okee ik ga even koffie halen ofzo, dan loop ik er toch langs en dan vul ik m gelijk even in.

Q5. Nee, nee, voor mij niet. Nee gewoon echt aan mezelf gedacht en eh ingevuld

Q6. hm, ja inderdaad wel na de middag hoor, dat is meestal. Ja dat je toch denkt dit moet nog af vandaag ofzo of eh ja hier moeten we nog aan werken

Q7. Het is echt heel erg tegenovergesteld he, nee eigenlijk niet denk ik. Maar het is zoals ik het nu zie dat mensen toch negatief en toch gestrest zijn dat ik denk van nou eh niks van meegekregen

Q8. Ja hier zie je het echt tijdgebonden en hier is het echt een groot geheel. Ja hier zie je echt een goed overzicht over ja de gehele dag, maar ja voor mij is deze dan fijner want je ziet het gewoon over een dag en ik hoef het per tijd niet te zien. Vind ik. Misschien dat iemand anders het per tijd wil uitzoeken maar ik ja.

Q9. Nee ik denk het niet nee

Interview answers interviewee 4

Q1. Beetje bij hetzelfde denk ik he, positief, hier ongeveer.

Q2. Beetje hier denk ik

Q3. Eh nou wat me opvalt dat van vorige week toen ik ook betrokken was bij jullie onderzoek, valt het me op dat het meer negatief is, maar ook weer positief, dus dan zie je dat iedereen met zn eigen ding bezig is gewoon. Hier kan je volgens mij niet een gemiddelde uittrekken. Volgens mij heeft dat gewoon mee te maken dat iedereen in zn eigen hoedanigheid iets aan het doen is en iedereen zit hier door elkaar heen dus dat eh ja ik ben met iets heel anders bezig dan degene die naast mij zit

Q4. Op het moment dat ik er even aan dacht. Ja eentje werd er wel aan mij gegeven. En de andere liep ik gewoon langs en toen pakte ik er eentje.

Q5. Ik heb daar helemaal niet naar gekeken, nee. Nou ik heb het wel gezien maar niet naar gekeken bij het oordelen van mn eigen eh.

Q6. Ehm, ja, ehm, nou tussen half 12 en 12 denk ik voor mij, ja toen heb ik denk ik mijn briefje ook niet ingevuld

Q7. Ehm, najaah, ik zie het nu, alhoewel ik het wel beperkt vind want ja het zijn maar 4 en beperkt aantal mensen die het ingevuld hebben ehm dus ja ik zie het hier maarja ik kan er niet echt een trend uithalen omdat het erg divers is en het per moment verschilt en de vraag is ook of het relevant is voor mij omdat ik al zei dat iedereen hier zn eigen werk heeft. Ja, het geeft meer inzicht dat ik het hier zie maar de vraag is of ik dat inzicht ook nodig heb wat ik hier zie. Ik weet niet wat je vraag concreet is er zou ook interesse moeten zijn om daar echt iets mee te kunnen dan zou me dat echt iets moeten opleveren ook.

Q8. Nou dat vind ik de manier waarop je het presenteert vind ik het toch duidelijker. Het overzicht met alle kleurtjes. Visueel heb je dit voor mij helderder gepresenteerd hierin dan hierin

Q9. Nou nee want het is een samenvoeging van alle antwoorden. Nouja hier hangt natuurlijk deze versie die hebben jullie elke keer ververst. Ja dat weet ik niet zo goed eigenlijk want ik heb deze ook niet bekeken weet niet of ik die gezien zou hebben. Lastig te beantwoorden, ja.

Interview answers interviewee 5

Q1. Nou ik denk wel redelijk hier.

Q2. Ja nee ik voelde me wel zo, ja wel iets hoger.

Q3. Ik zit hem even te interpreteren hoor, want je ziet een verschuiving in de tijd dat blijkt, ja. Nee er zit gewoon een verschil ik bedoel die kleuren zitten niet allemaal, het begint niet positief of het eindigt negatief zegmaar. Nee dit had ik niet zo verwacht eigenlijk nee.

Q4. -

Q5. -

Q6. Ja blijkbaar naarmate de dag vordert.

Q7. Ja dat ja want je rekent het toch natuurlijk vaak naar jezelf af.

Q8. Deze, want dat is leuker dan het verloop te zien dat is eigenlijk wel grappig. Alhoewel hij is nog mooier in kleur natuurlijk want het is even zoeken naar welke. Maar het zou grappig om te zien of daar inderdaad dagelijks een curve in zit. Je begint op een bepaalde manier en het verplaatst dan naar een andere.

Q9. -

Interview answers interviewee 6

Q1. De algemene? Ik vermoed dat dat zo hier zit.

Q2. Zelf? ik zat denk ik twee keer, drie keer dit ingevuld deze

Q3. Pfoeh, nee nee, toch een hoop negatief.

Q4. De eerste keer was toen jullie hier waren geweest heb ik meteen mijn blok eh een kaartje gegeven. En toen heb ik hem een uur later nog een keer gedaan. En na de lunchpauze

Q5. Ehm nee, echt gewoon bij mn buikgevoel gebleven.

Q6. Ja ik dacht ja meestal na het weekend als mensen gelijk na half 9 9 gelijk beginnen is het vrij rustig, iedereen gelijk opstarten en dan daarna komen alle mails en dan wordt het werk ingezet. Dus dan lijkt het me logisch dat het rond 11 uur 12 uur dat dan even de stress oplaait. Als dat er dan ook is bedoel ik.

Q7. Ja, ik denk het is wel een goed instrument om te, om te toetsen op deze manier, omdat ik er eigenlijk vanuit ga van nou, iedereen zit hier en die zal allemaal wel eh, niet gestrest en gespannen zijn, maar dat is dus niet het geval.

Q8. Ja toch meer uit elkaar de tijdlijn inderdaad. Ja deze is overzichtelijker maar deze geeft natuurlijk gelijk een goed beeld van de dag omdat dat, alhoewel, het kan natuurlijk van het ene op het andere moment veranderen maar ik zou inderdaad als ik een zou moeten kiezen dan zou die beter zijn.

Q9. Nee, als ik zie dat iedereen is negatief waarom zou ik dan ook negatief zijn, gewoon het individu, ik denk gewoon puur vanuit mezelf.

Interview answers interviewee 7

Q1. Ja ik denk wel een beetje er tussenin. Ik denk een beetje tussen positief en gestresst in. Dat het wel okee is, maar ehh, ja waar kom je dan uit, zo, een beetje hier ja zo.

Q2. Ik denk toch wel hierzo.

Q3. Eh, nou het is best wel negatief eigenlijk ook he? Maar ook wel weer veel ontspannen. Ja, het is wel verdeeld, ja ik weet niet, ik denk dat dat wel een beetje bij een normale maandag hoort. Dan start het allemaal wel weer op en dan eh is het wel gewoon druk dan start alles weer op en eh dan is het vanuit eh, ja ik zit vanuit woonzaken dus dan is het vanuit beneden vanuit de telefoon ook heel erg druk, meestal, maandag is wel altijd een drukke dag. Dus ehm dan start alles op en dan wil je natuurlijk alles wel zo snel mogelijk terug doen maar je wordt ook gebeld vanuit beneden en je komt niet aan je dingen toe, niet altijd zegmaar dus ja ik kan me er wel ja ik denk wel dat het daar een beetje aan ligt.

Q4. -

Q5. -

Q6. Ja zo te zien qua tijd was het tussen die in zegmaar he. Ergens aan het begin.

Q7. Nou is wel leuk om t een keer inzichtelijk inzichtelijke eh te hebben zegmaar. Te zien hoe jullie dat zo eh hebben gedaan. Ik verbaas me wel hierover zo eh dat is wel eh dat wist ik niet. Dat het zo erg was zegmaar. Maar eh, zo doet iedereen niet namelijk. Het is allemaal toch wel een vrolijkere bedoeling Ja het kan zijn als je het echt los ziet hoe je met een collega bent en hoe je je over je werk voelt.

Q8. Ja opzich dit is natuurlijk wel weer interessant als je het echt per tijden wilt weten maar ik denk als je uiteindelijk echt iets wilt weten over het stressniveau binnen je bedrijf denk ik dat dit overzichtelijker is want ik weet niet of je echt aan die tijden ook iets zou kunnen hangen. Snap je wat ik bedoel? Ik denk dat dit dit het belangrijkste overzicht hebt en wil je daar heel diep op ingaan dan kun je nog eens naar die tijden kijken van joh het valt eigenlijk wel heel erg op dat tussen die en die tijd mensen meest gestrest zijn ofzo, ja maar dit geeft in een keer wel een duidelijker beeld.

Q9. -

Interview answers interviewee 8

Q1. I think right here

Q2. Here

Q3. I was expecting this. I guess, I was expecting more people to join though.

Q4. I have only put in one card. I saw the box and I liked to join but after that I left my spot many times and the I forgot again about the box.

Q5. Not influenced. Looked at the poster afterwards

Q6. I think there will be a very specific reason for the stress peak. Though I don't know because I don't know who's it is.

Q7. Difficult to answer because of the little response. I don't know if its representative. Maybe you as a researcher can tell me how many people need to respond before all of the responses become more meaningful.
I am very curious what the collective stress level would be and I am interested in this experiment.

Q8. Yes way more useful, One overview of a full day. More visual.

Q9. It would have made a difference. Because in our overview you see a dot every now and then but in the other visual there's way more data so I think also way more interesting to look at. I think then people will think about it more and more.

Interview answers interviewee 9

Q1. Pfff I don't know, maybe this.

Q2. That's easier, somewhere here.

Q3. Ohh it changes much. Maybe because of the different people? I was not expecting these results. The changes make sense I guess but the negative dots surprise me a little bit.

Q4. My colleagues addressed it. I missed the information at the beginning of the dday, but later on I saw the paper and my colleagues told me and then I did it.

Q5. Not influenced. I didn't see the overview at first.

Q6. I think 11:00. I don't know what has caused this. Monday is more stressed than Thursday I guess.

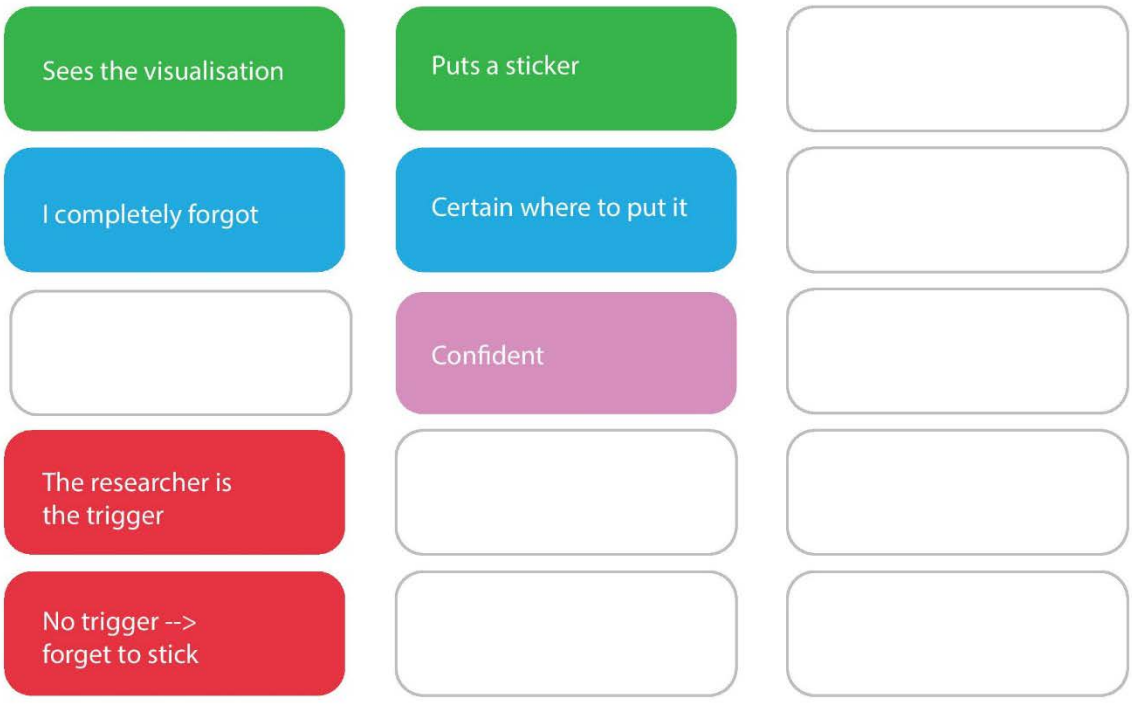
Q7. Yes but it changes sooo much that it becomes less meaningful. This tells me that people have stress moments every now and then but we all know that right. More input will make it more meaningful. It's silly because some of my colleagues walked past and said: I don't fill this out because I'm too stressed for that. Well, then you certainly should have to fill it out. That's what I thought. It shouldn't matter how you feel right.

Q8. The B one gives a better overview. Though, most usefull I think the A one. Because with the 6 sheets, you will not be influenced by how you felt before. But the B one is clearly more clear.

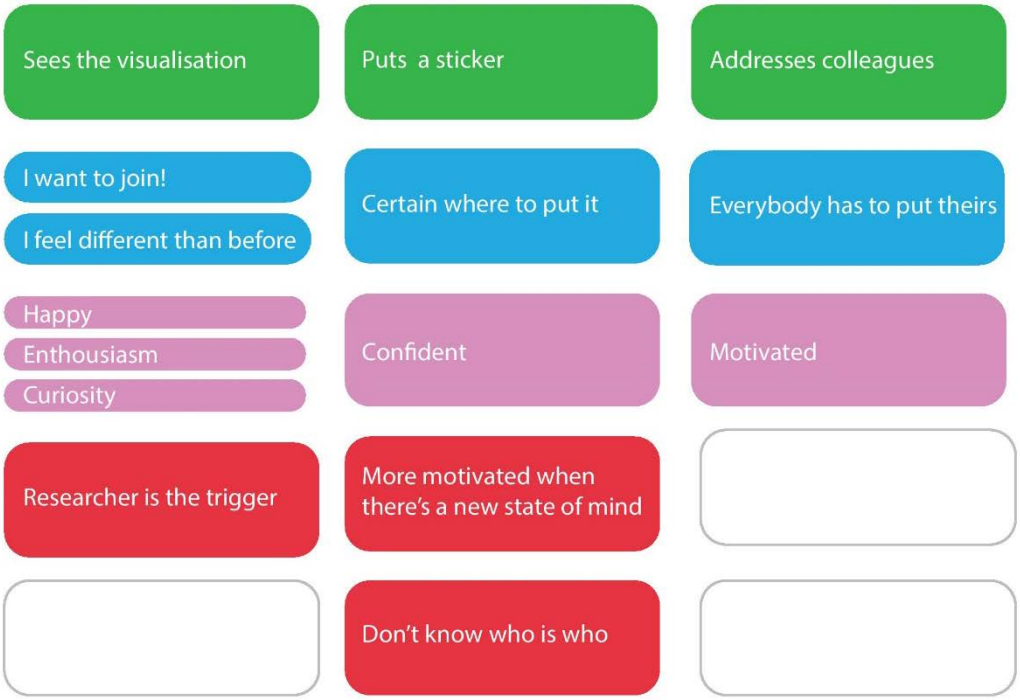
Q9. Looking at the colleagues that were sitting near me todat, they don't get easily influenced I think haha. I think it would have influenced everyone a little bit though. It will maybe let you compare your current state of mind to the prior state of mind.

J.3: User jouneys

Scenario 1



Scenario 2


Sees the visualisation
Puts a sticker
Addresses colleagues
I want to join!
I feel different than before
Certain where to put it
Everybody has to put theirs
Happy
Enthousiasm
Curiosity
Confident
Motivated
Researcher is the trigger
More motivated when there's a new state of mind
Don't know who is who

Scenario 3

Scenario 1: scared to share

Scenario 2: researchers are considered as trigger

Scenario 3: Employees motivate their colleagues to join

Appendix K – Field study Woonkwartier
K.1: consent form

Technische Universiteit Eindhoven, 10 december 2018

Toestemmings Formulier

Voor ons project, 'Human Total Care' en de Technische Universiteit Eindhoven, wordt onderzoek gedaan naar uw mening over en beleving van de interactie en vorm van het product 'MyShare'. Onderdeel daarvan is dat u bepaalde handelingen uitvoert met het product en dat wij u observeren, enkele vragen stellen en evenetueel foto's en video's maken.

U bent uitgenodigd om deel te nemen aan een onderdeel van deze studie waarin onderzoek wordt gedaan naar de gebruiksvriendelijkheid en de gebruikers ervaring van MyShare. Onderdeel hiervan is één werk dag lang MyShare gebruikt op de manier en de momenten naar wens. Op het einde van uw werkdag willen wij u vragen enkele open vragen te beantwoorden. Hier willen wij, mits u toestemming hier voor geeft, een audio opname van maken.

U bent niet verplicht onze vragen te beantwoorden. Indien u zich wilt terugtrekken van het onderzoek kunt u dit ten aller tijden aangeven. Alle informatie zal als vertrouwelijk worden behandeld tenzij u aan geeft dat het publiekelijk mag worden gemaakt.

☐	Ik geef **wel** toestemming, mijn video's en foto's openbaar te publiceren op internet en sociale media daarnaast mag mijn data worden gebruikt ten behoeve van het onderzoek. Mijn data zal anoniem worden verwerkt.
☐	Ik geef **wel** toestemming om mijn video's, foto's en data te gebruiken ten behoeve van het onderzoek (presentaties, demonstraties) maar dat zal binnen de Technische Universiteit van Eindhoven blijven. Ik geef **geen** toestemming om mijn video's, foto's en data openbaar te publiceren op het internet en sociale media.
☐	Ik geef **geen** toestemming, mijn video's en foto's openbaar te publiceren op internet of andere media mijn data mag uitsluitend anoniem worden verwerkt ten behoeve van het onderzoek. Ik zal niet in enige foto of video te zien of te horen zijn.

Ik heb het 'toestemming formulier' begrepen, en neem vrijwillig deel aan dit onderzoek. Ik begrijp dat mijn toestemming mijn wettelijke rechten niet beschadig ingeval van nalatigheid of andere wettelijke schuld van iedereen die betrokken is bij deze studie.

Datum: ……

Naam participant: ……

Handtekening participant: ……

Datum: ……

Naam student: ……

Handtekening student: ……

K.2: map office space B and setup

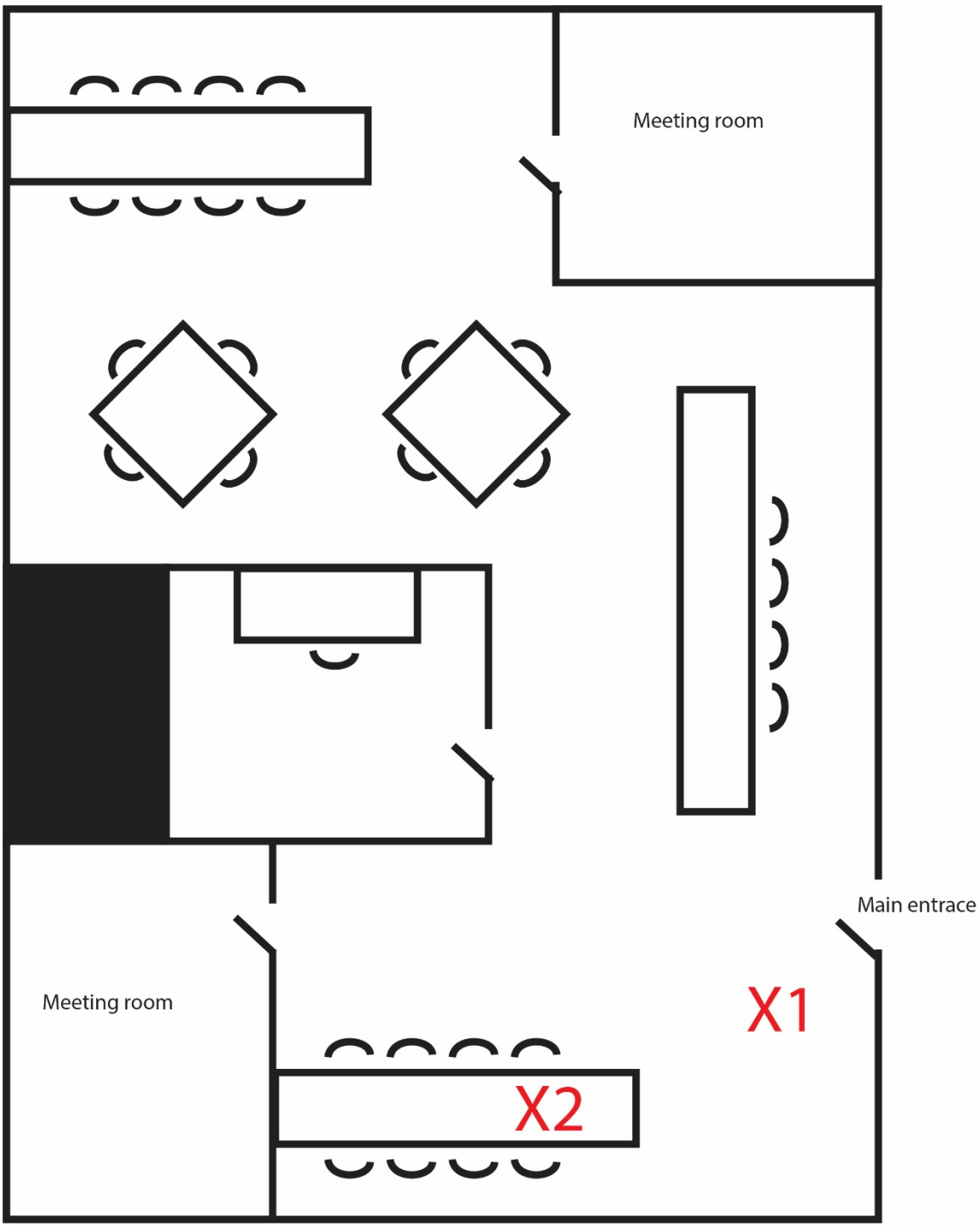


Figure 1: Map of office space B

Figure 2: set up of MyShare

Figure 3: text 'Hoe gaat het?' on the balls

Hoe gaat het met jou?

Dit is MyShare en met de hulp van MyShare kun jij aangeven hoe je je vandaag voelt.

Stop de bal in het corresponderende gat aan de achterkant en bekijk aan de voorkant hoe het met jou en je collega's gaat. De bal rolt er van zelf weer uit zodat je hem door kan geven aan een van je collega's.

Figure 4: note next to MyShare

K.3: Interview questions and quotes

Q1: How was your experience with MyShare?

What do you think about the ball?
When did you insert a ball?
Based on what did you decide to insert a ball?
What do you think about the visualisation?
When did you look at the visualisation?
Based on what did you decide to take a look at the visualisation?

Q2: In what way could MyShare fit within your routine?

At what moments would you be interested in sharing your data?
At what moments would you not like to share your data?
At what moments would you be interested in looking at the visualisation?
At what moments would you not be interested in looking at the visualisation?
What would hold you back to use MyShare?
What would benefit you the most to use MyShare?
How would you feel about taking a look at the visualisation every once in a while together with your colleagues?

Q3: What went through your mind when you were in front of MyShare and Inserted a ball?

Q4: How would you feel about saving your personal information on a private platform in order to see your personal trend?

Why or why not interested in this?

Interview quotes (selected transcriptions) Interviewee 1

I think it is a nice experiment to know how everyone is experiencing their day_D2P1

For that matter I experienced it in a positive way_D2P1

You do notice it varies a bit every day how you feel and it is nice to also know this from

others so you can take this into account_D2P1

When I sa wit was turned around or something, I did not understand it for a little while_D2P1

Further everything was clear_D2P1

I had tot hink about it and then I thought; it is already 10:45 let's insert my first ball then it is a

bit spread out over the day_D2P1

But basically fine (about the interaction with the ball)_D2P1

So then I thought is something going to happen? I had a kind of expectation, that something

was going to happen afterwards_D2P1

I took a look at the axis and then I felt pretty relaxed but also busy so it was pretty easy to

make my choice_D2P1

It is a very simple overview because it is not complex or incomprehensible_D2P1

I think it might be made a bit more clear by mentioning the more intense the colour, the more often the ball dropped_D2P1

I think that a location is very important, where you put it. If you maybe put it at the entrance, than people can do it immediately while entering in the morning and see it when leaving_D2P1

For sure somewhere everyone passes and has to go outside or inside_D2P1

I would prefer to do it in the morning and to see it at the end of the day_D2P1

If you are really busy and have to do a lot of stuff, that would obstruct me_D2P1

Well the result itself of course doesn't result in something, there has to be someone who does something with it, who interprets it and gives advice about it or does something with it_D2P1

If there is a employee meeting then I would show it for sure to everyone_D2P1

If it is always the same than I would not do it every week, then you do not have to do it, but if it differs a lot than it might be interesting_D2P1

Well you make it easy and negotiable if you do it that way. Because then you have something to hold on to_D2P1

I think it a relatively simple action to get more insight, so I think it is no problem (link to MyCare) _D2P1

Maybe if the results are always the same then I think that you already know it after a couple of months, but when it differs then it is nice to take t into account_D2P1

The company is also for this, discussion_D2P1

Interview quotes (selected transcriptions) Interviewee 2

P2: Easy in use, but a bit vague.

P2: The Lights were not visible enough.

P2: I thought the ball was too complicated for what it delivered.

P2: I didn't have any expectation, but I thought it was too much for what it's worth.

P2: The LEDs were unclear.

P2: The visual was easy to understand, as it was the same as previous tests.

P2: The mechanism was simple, I knew what to do.

P2: I don't have a need for this.

P2: To what extend is the measurement pure. People who are busy, while the others have time. I wonder if it will be used like that.

P2: I went when I thought about it. When I went to the toilet. We don't have set breaks, but whenever I was headed there I would quickly stop by.

P2: I wanted to help you guys.

P2: I had to look where I had to put it in.

P2: I never think about how stressed I am.

P2: I think stress levels are low here, quite manageable. It might work better at places where it is a bigger problem. It's not a problem here.

P2: There is a lot of room to use the tool here, as there is already a focus on health and wellbeing.

P2: I think there needs to be a relation of trust before talking about stress. Here we have it, but at other organisations.

P2: I don't know if this tool would help. Not for me at least.

P2: at companies with a bad culture, where there is no safety to talk, this tool might not be enough.

P2: I think the tool does not add much here.

P2: I think it is important to talk about stress and work life balance.

P2: I normally self-evaluate, but not about stress.

P2: I did not think more about it.

P2: I have no ethical problems [with coupling to MyCare), but it wouldn't bring me much, so I wouldn't do it. I also never look at my patient dossiers.

P2: I think it depends on the person. If they have problems it could help, but if there are none you don't want advice.

Interview quotes (selected transcriptions) Interviewee 3

P3: When I saw it I was naturally curious how it worked, so I might have stopped there longer than was intended.

P3: What did you think of the working with the ball?

I thought it was very clear in use.

P3: I was doubting whether you had to mirror the backside.

P3: I first read the instruction in the front, then in the back. I noticed they were the same. Would it

go right if I throw in the ball in this side?

P3: I did not think much before putting it in. It was intuitive.

P3: I assumed you were researching the work ambiance and work experience, I like being a part of that. [1:58 – 2:07, may be used for videos]

P3: I notice that the work ambiance is important at Woonkwartier. There are several tests and I think this could be one of them.

P3: I wasn't more aware of my own stress.

P3: You notice from colleagues when they are busy, but not from yourself.

P3: I would think about it more often. If you visualize it, people take more conscious action.

P3: I notice that when the product is used, people really look: OK, where are the lights on?

P3: I think it takes a lot of getting used to, to do it more often.

P3: It would help if it was next to the coffee machine […] because it fits in the routine. When people get a drink they stumble upon it. And when you are there anyways …

P3: I went when I thought about it: Oh maybe I should throw in a ball again.

P3: I think it has no immediate value, but it gives insight and food for thought.

P3: If it shows that everybody is really stressed, that should not be the case.

P3: I think you have to research what the cause is. I think it is difficult because you see the entire company, you don't know in which department the problems are.

P3: I don't know what group size would fit best, but the group today was fine.

P3: I think you shouldn't make it more complex. Then it becomes less attractive to participate.

P3: I wouldn't look at it together every day, but it would be nice to look at every week, or two weeks.

P3: I think the lights make people think and discuss about it. When people see it as a problem they could implement interventions. I think the insight is the most valuable.

P3: You would need to give input more often and more structured, but that is difficult to implement in the daily routing. That's why a coffee machine would be a good place.

P3: I wouldn't have any problems with making it personal.

P3: Maybe you forget more quickly about yourselff that you have been stressed quite often. Looking back [through MyCare] could help. If you haven't been doing well or made mistakes because of stress, you can look back on it.

Interview quotes (selected transcriptions) Interviewee 4

What was on my mind in the beginning, was that at the backside was the same instructions as at the frontside.
I was considering do I have to follow the raster like it is on the inside or like it is on the inside.

Because otherwise it would have to be mirrored.

I have to say I did not look at it that much (about the visualisation)

Yes, but you have to make sure it is always on the same place (about the routine)

I think just close to my desk

Today I was not at the phone so really on the moments when I thought now is convenient.

Yes I think it is difficult because you do not know who inserted a ball where. You do not know the cause and also not the moment.

I can imagine it depends on the moment.

A personal ball, I think if it is visible for co-workers, co-workers are less inclined to use it.

I think it is something for the employer to do something with it.

It is not the case I wouldn't indicate it to my supervisor but would do it on this, it doesn't work like that for me.

No not really, more a general feeling. Of course there are days where there is all trouble, difficult conversations on the same day.

I am at the phone so we sit pretty close to each other. Then you do have an idea about how your colleagues are feeling.

Interview quotes (selected transcriptions) Interviewee 5

I thought it was pretty funny

Good thinking and assembling

A different way to do something, often you put a cross somewhere. This is more playful.

I have to say I was standing there once until it lighted up the other times I walked away.

That can be useful (together looking at the visualisation)

Yes it has to do with the well-being of people and I think it is very important.

Yes I think where it is placed now. You walk by regularly in and out the room and those are moments that you stand still and realise how do you feel. A place where you pass by often.

When I walked towards it I inserted a ball.

I would do this during a department meeting. I think we have those 1x in the 4 to 6 weeks. That would be a good moment to think about how everyone is feeling.

You can place it in one space for a while and a while in the other space. You maybe can swap it. That everyone can use it.

No I would not link my data.

Interview quotes (selected transcriptions) Interviewee 6

P6: It was a bit messy. I was sitting right next to it, so I noticed some things.

P6: What's happening here? I was curious. What is this thing? So I threw in a ball.

P6: I looked at the lights and they were on, but now they arent'I thought I got it, but apparently not.

P6: I thought all the balls came to the left, where it was a bit reddish, so what happened? [about the red echo of the last day.

P6: I think you can quickly see what the mood is at a certain moment.

P6: It's just the moment of course, but it gives insight. I am curious, what if you would do it every day at 3 o'clock. What would come out of it? Do people always have dip around 4? I am curious.

P6: Pure and honest. Not that people thwart the game. Or well… game … it's more serious than that.

P6: What is the result? What can we do with it? What can you do with it?

P6: Just participating, whether it is with a ball or not.

P6: I don't know much about electronics, but it was clear to me that where I throw the ball, I light will lit up.

P6: I talked to some people. Some of them really don't feel like using it. "No, I won't."

P6: There is probably a reason why you put it here. So I would like to participate. I like trying new things.

P6: I think it's a bit general. At what time do you start? End? When do you get energy. For some people they start at 9 full energy and then have some meetings with clients that suck energy. The tool would show that.

P6: Wednesday is relaxed here.

P6: I would do it first in the morning. Then Lunch, somewhere in the afternoon and about an hour before closing. It would give a good overview. I don't know why…

P6: If I see scores from different departments I would like to see the reasons why. They all have differences. It's individual as well, but also for larger groups.

P6: I had to look: what is it actually? You need to throw it in a corner. Where do I put it? How do I

feel now.

P6: breaks are times for yourself to reflect. Lunch, a call, maybe even smoking breaks.

P6: If it would be very negative, I would like to know why?

P6: If it would be always positive I would not believe the results.

P6: It is a very simple of inquiry.

P6: I think it helps to change it.

P6: There is already so much they could know about you. I wouldn't share this [with MyCare].

Interview quotes (selected transcriptions) Interviewee 7

P7: It was quite easy.

P7: I wonder how it was visualized, it wasn't that clear to me. I am curious about it.

P7: I did itt because you asked it.

P7: I did it twice to see what would happened, but it wasn't clear.

P7: I entered a ball in positive, but that was it then. Alight should have start lighting up, but it didn't.

P7: It did not give a signal as a reaction.

P7: It could be a little cube as well.

P7: Once a colleague was in front of me and he gave it to me. After me there was someone as well. That was the only time we gave it to each other.

P7: If you are positively in the game, there is not much reason to put it in. Otherwise it would, but I didn't feel like that.

P7: once or twice a day would be fine. Whenever you get up, you can do this as a distraction. I don't think there is a set time.

P7: If you go through the door to get coffee you would look at it, but first the visual should become more clear what it means.

P7: Maybe there is more information on the website. I did read the instructions, but it doesn't tell what the LEDs do. Sometimes they are more white or more red and sometimes the one side sometimes the other.

P7: I think it would have to fit into everybody's workflow. When you get up you just look at it.

P7: You would not necessarily go together. That would be difficult.

P7: If it would be red and up there, what would I do? I would probably ask my colleagues about it.

P7: Is the smiley only about how I feel at work? I feel good at work, but my private life is more

difficult. Where do I put it then?

P7: For me there is not much neeed [of MyCare].

P7: I do see the need now, WoonKwartier can see how they can use it to research employee satisfaction. This does not need to be personal.

P7: I think an overview is good for the supervisors. We have a weekly update, so that would be a good moment to use this as input. “Guys, we have been in the red for some time, what can we do about it?”

Interview quotes (selected transcriptions) Interviewee 8

First looking at how does it work exactly but pretty clear and easy legible so you do not have tot hink for a long time about where to insert the ball.

Not a specific mood as cause or something no (about motivation).

When do you see effect, that was a bit surprising.

It would be pretty if you would be able to see a direct effect.

It is funny to see, but in what way it would benefit me I wouldn’t know that for now.

I do not see it directly as I will look at it on a daily basis or something.

I can imagine that you reflect upon it on certain times during the day or during the week, for a meeting for instance.

Then you can better empathize how your coworkers are feeling.

You first have to look oh this is the backside and this is the frontside. At first you are looking at the frontside. Because this side is prettier and it is the first thing you see. It is mirrored ofcourse.

At which quadrant it can be inserted and at which place at the quadrant.

Not very consciously thinking about it in any case (about thinking about their mood).

Sometimes you already see the mood of coworkers because they are very open about it, very extravert about their mood for instance.

I think it will mainly be a conversation about it, will encourage this. When it is in extremes.

I think it gives insight into what moments you have which mood. Maybe that you can redirect the activities that you like to do or think are annoying, that maybe might help.

The privacy is a point to consider I think (about the platform).

Interview quotes (selected transcriptions) Interviewee 9

My experience was actually absolutely not good, no. I just inserted how I felt on that moment and nothing happened.

There was no feedback.

I really thought okay… The experiment failed for me.

It would have maybe helped if I was introduced to it, introduced to what happens.

Not much happened actually.

I think the disadvantage of the system is that it is very generic and that it is for myself and that it should measure other colleagues.

When it is generic you do not benefit from it directly as employee.

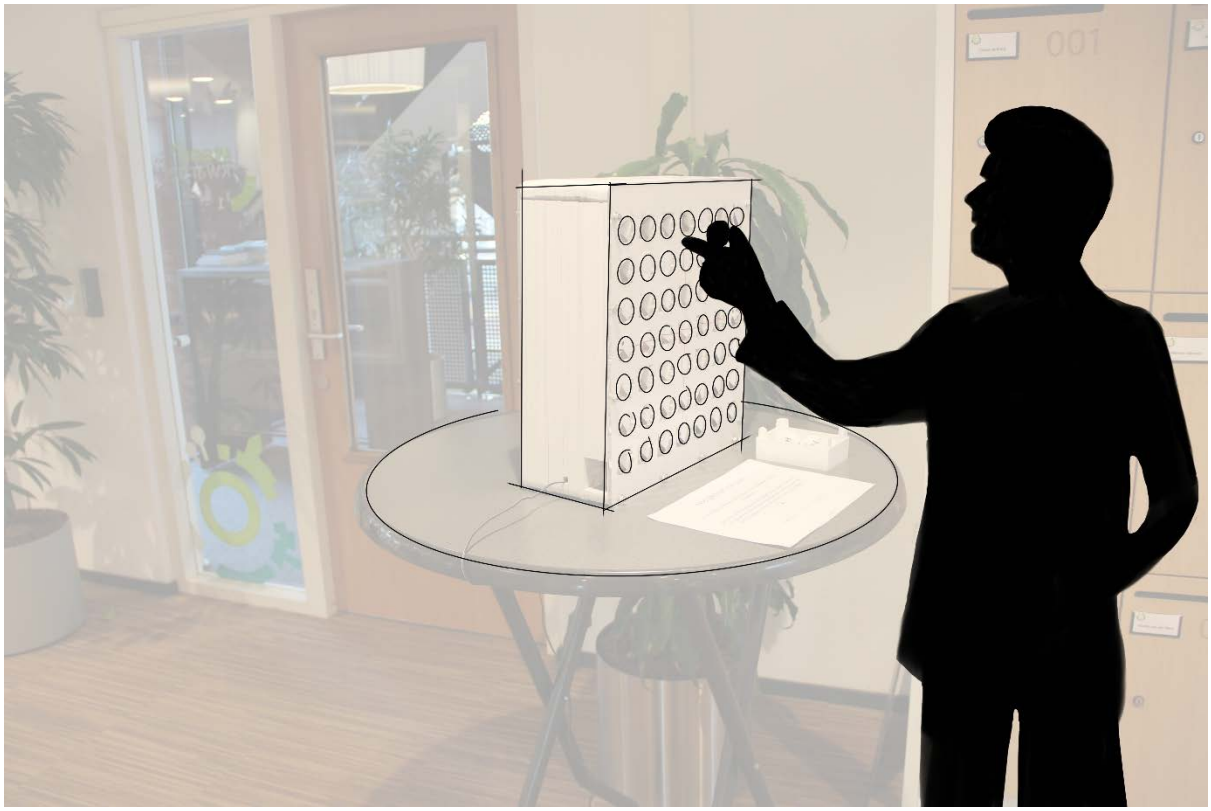
So you basically ask whether an organization should measure it continuously the atmosphere? Yes actually that already happens during meetings.

No, I do not really see how this is going to be a success.

I think it is very vulnerable yes. Depends on what you do with it (about the link to private input).

K.4: User Journey

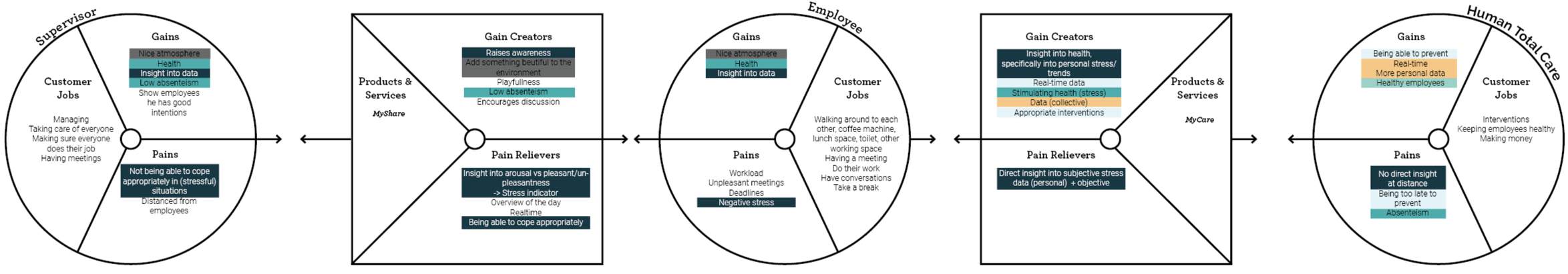
Scenario 1: Intrinsic motivation



Scenario 1: Employees understand what to do and easily insert a ball

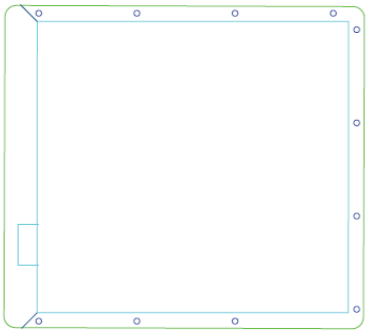
Scenario 1: Visualisation is not clear

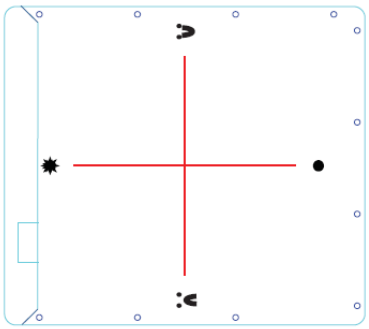
Scenario 2: MyShare could be implemented during meetings

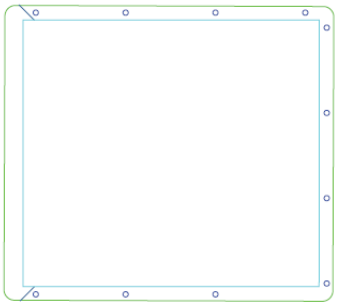

Supervisor
Gains
Nice atmosphere
Health
Insight into data
Low absenteism
Show employees he has good intentions
Customer Jobs
Managing
Taking care of everyone
Making sure everyone does their job
Having meetings
Pains
Not being able to cope appropriately in (stressful) situations
Distanced from employees
Products & Services
MyShare
Gain Creators
Raises awareness
Add something beutiful to the environment
Playfullness
Low absenteism
Encourages discussion
Pain Relievers
Insight into arousal vs pleasant/un-pleasantness
-> Stress indicator
Overview of the day
Realtime
Being able to cope appropriately
Employee
Gains
Nice atmosphere
Health
Insight into data
Pains
Workload
Unpleasant meetings
Deadlines
Negative stress
Customer Jobs
Walking around to each other, coffee machine, lunch space, toilet, other working space
Having a meeting
Do their work
Have conversations
Take a break
Gain Creators
Insight into health, specifically into personal stress/ trends
Real-time data
Stimulating health (stress)
Data (collective)
Appropriate interventions
Pain Relievers
Direct insight into subjective stress data (personal) + objective
Products & Services
MyCare
Human Total Care
Gains
Being able to prevent
Real-time
More personal data
Healthy employees
Pains
No direct insight at distance
Being too late to prevent
Absenteism
Customer Jobs
Interventions
Keeping employees healthy
Making money

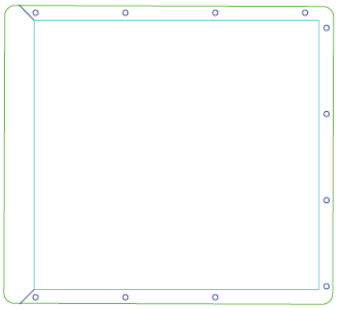
Appendix M – The Prototype

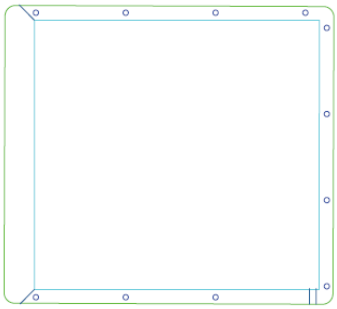
M.1: Laser cut files

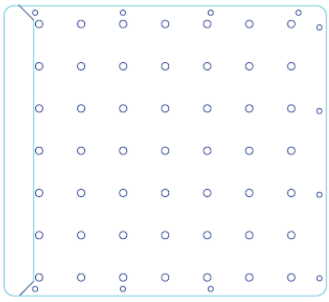


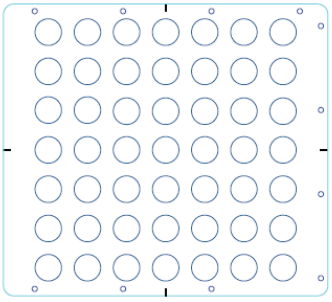


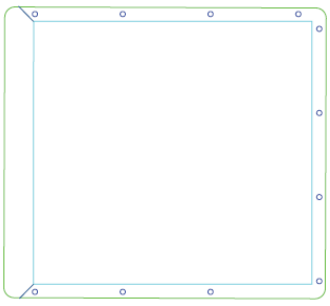


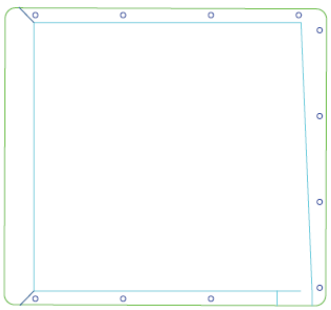


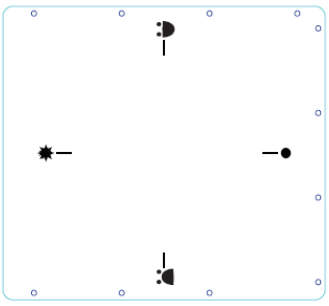




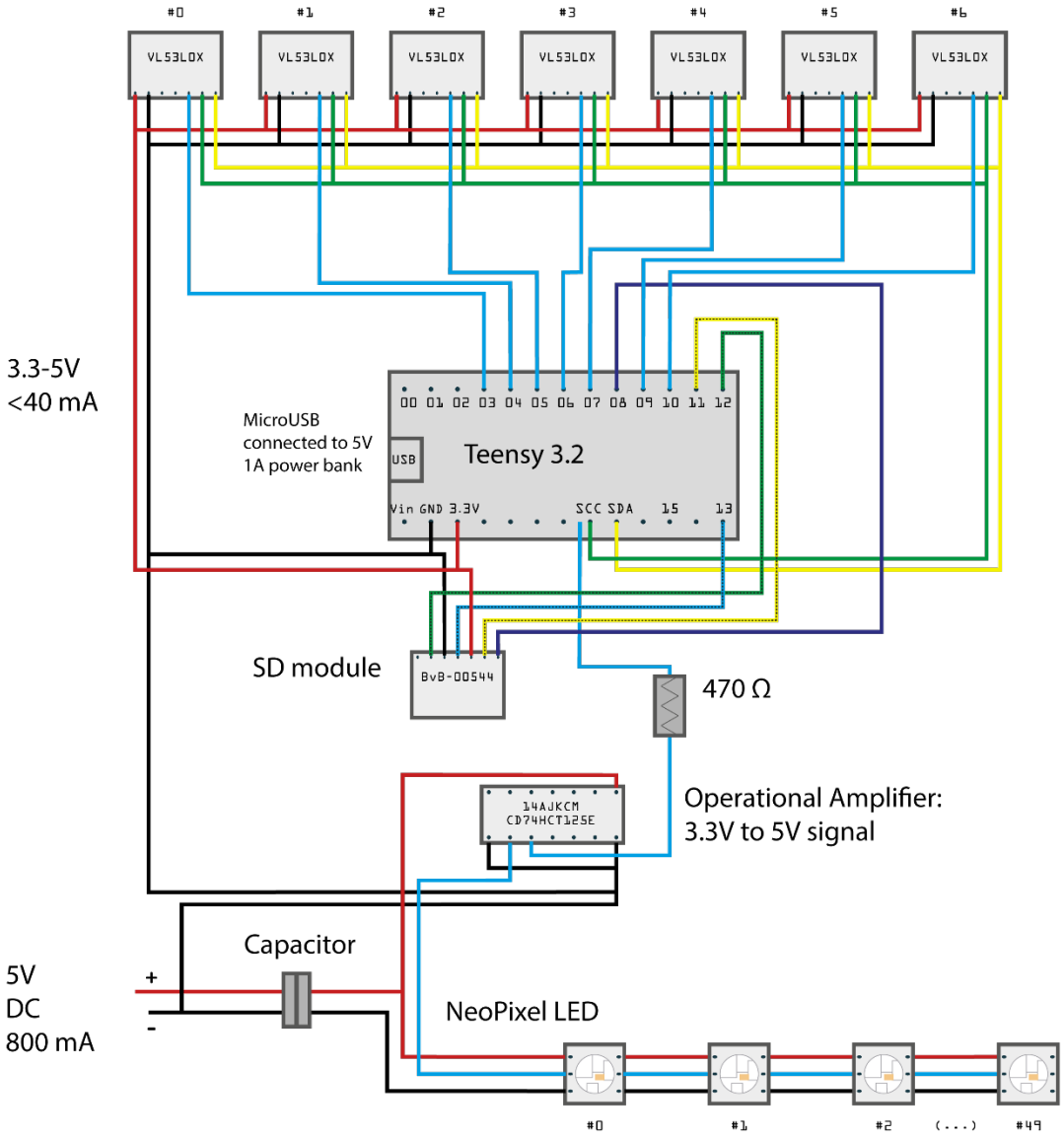








M.2: Electronics diagram



M.3: Arduino code

```
/*MyShare 1.1 by Stern Hutjes  This code processes data of time of flight
sensors measuring where a ball is thrown in a grid of holes.   From the
measurements, coordinates are calculated and stored on an sd card.   The
coordinates are used to update a grid of the amount of balls thrown in at
each point and how recent the last entries were.  These grids are
represented in a string of LEDs, more balls means brighter and older balls
means more saturated.*/

  for assigning I2C adresses, parts from Kevin Polulu were used that can be
found here:
  https://github.com/pololu/vl53l0x-arduino/issues/1

  for the sd card, parts fromsparfun's tutorial were used that can be found
here:
  https://learn.sparkfun.com/tutorials/microsd-shield-and-sd-breakout-
hookup-guide?_ga=2.147052532.2131381095.1544024736-
1501349720.1528291891#sd-card-breakout-boards

//include libraries
#include <Wire.h>
#include <VL53L0X.h>
#include <SPI.h>
#include <SD.h>
#include <FastLED.h>

//name sensors
VL53L0X sensor0;
VL53L0X sensor1;
VL53L0X sensor2;
VL53L0X sensor3;
VL53L0X sensor4;
VL53L0X sensor5;
VL53L0X sensor6;

//set all starting times and delays for multi tasking
uint32_t lastSensReading = millis();
uint16_t sensReadDelay = 100;
uint32_t lastGridUpdate = millis();
uint16_t GridUpdateDelay = 10000;
uint32_t lastLEDWriting = millis();
uint16_t LEDWriteDelay = 100;
uint32_t lastFeedback = millis();
uint16_t FeedbackDuration = 2000;


//define parameters for grid
bool firstVal = true;
int firstDist;
int DistNr;
uint32_t timeStamp;
int DistY;

/* for debuging with visible grid data  int sensorData [30][3] = {0};  int
dataPoint = 0;*/

//define pin for SD card
const int chipSelect = 8;

//define empty grids of 7 by 7 where the input comes in
```

```
int outputGridSpread [7] [7] = {{0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 1, 0, 0,
0}, {0, 0, 0, 2, 1, 0, 0}, {0, 1, 1, 3, 1, 0, 0}, {0, 1, 0, 1, 4, 2, 0},
{0, 0, 2, 2, 3, 1, 1}, {0, 0, 1, 3, 2, 0, 2}};
int inputGridSpread [7] [7] = {0};
int outputGridAge [7] [7] = {0};
int inputGridAge [7] [7] = {0};
int LEDPhase [7] [7];
int gridMax = 4;

//define parameters for the LEDs
#define LEDPin     23
#define NumLEDs    49
CRGB leds[NumLEDs];

/* parameters for having the LEDs fluctuate  uint16_t LEDIncrement =
0.1;  uint16_t LEDCurPhase = 0;*/

//parameters for feedback LED
int feedbackLED = 17;
bool feedbackOn = false;


void setup() {
  /*start Serial monitor for debugging    Serial.begin
(9600);    Serial.println("Start");*/

  //initiate FastLED for the LEDs
  FastLED.addLeds<WS2812, LEDPin, GRB>(leds, NumLEDs);

  //define shutdown pins of sensors
  pinMode(2, OUTPUT);
  pinMode(3, OUTPUT);
  pinMode(4, OUTPUT);
  pinMode(5, OUTPUT);
  pinMode(6, OUTPUT);
  pinMode(7, OUTPUT);
  pinMode(9, OUTPUT);

  //set all shutdown pins LOW
  digitalWrite(2, LOW);
  digitalWrite(3, LOW);
  digitalWrite(4, LOW);
  digitalWrite(5, LOW);
  digitalWrite(6, LOW);
  digitalWrite(7, LOW);
  digitalWrite(9, LOW);

  //let it settle in and start wire
  delay(50);
  Wire.begin();

  /*debug    Serial.println("Begin rewriting address");*/

  //set all shutdown pins HIGH
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);
  digitalWrite(5, HIGH);
  digitalWrite(6, HIGH);
  digitalWrite(7, HIGH);
  digitalWrite(9, HIGH);
```

```
delay(50);

//set all but 1 sensor LOW,so sensor0 can get an adress
digitalWrite(3, LOW);
digitalWrite(4, LOW);
digitalWrite(5, LOW);
digitalWrite(6, LOW);
digitalWrite(7, LOW);
digitalWrite(9, LOW);
delay(50);

//initialize sensor 0 and set adress
sensor0.init(true);
delay(50);
sensor0.setAddress(0x30);
sensor0.startContinuous();
delay(50);

/*debug    Serial.println("sensor0 set");*/
leds[0] = CRGB(0, 255, 0);

//1.set sensor1 HIGH,so sensor1 can get an adress
digitalWrite(3, HIGH);
delay(50);

//2.initialize sensor 0 and set adress
sensor1.init(true);
delay(50);
sensor1.setAddress(0x31);
sensor1.startContinuous();
delay(50);
//debug LED and Serial
//Serial.println("sensor1 set");*/
leds[1] = CRGB(0, 255, 0);

//repeat step 1 and 2 for sensors 2-6
//1.set sensor1 HIGH,so sensor1 can get an adress
digitalWrite(4, HIGH);
delay(50);

//2.initialize sensor 0 and set adress
sensor2.init(true);
delay(50);
sensor2.setAddress(0x32);
sensor2.startContinuous();
delay(50);
//debug LED and Serial
//Serial.println("sensor2 set");*/
leds[2] = CRGB(0, 255, 0);

//1.set sensor1 HIGH,so sensor1 can get an adress
digitalWrite(5, HIGH);
delay(50);

//2.initialize sensor 0 and set adress
sensor3.init(true);
delay(50);
sensor3.setAddress(0x33);
sensor3.startContinuous();
delay(50);
//debug LED and Serial
```

```
  //Serial.println("sensor3 set");*/
  leds[3] = CRGB(0, 255, 0);

  //1.set sensor1 HIGH,so sensor1 can get an adress
  digitalWrite(6, HIGH);
  delay(50);

  //2.initialize sensor 0 and set adress
  sensor4.init(true);
  delay(50);
  sensor4.setAddress(0x34);
  sensor4.startContinuous();
  delay(50);
  //debug LED and Serial
  //Serial.println("sensor4 set");*/
  leds[4] = CRGB(0, 255, 0);

  //1.set sensor1 HIGH,so sensor1 can get an adress
  digitalWrite(7, HIGH);
  delay(50);

  //2.initialize sensor 0 and set adress
  sensor5.init(true);
  delay(50);
  sensor5.setAddress(0x35);
  sensor5.startContinuous();
  delay(50);
  //debug LED and Serial
  //Serial.println("sensor5 set");*/
  leds[5] = CRGB(0, 255, 0);

  //1.set sensor1 HIGH,so sensor1 can get an adress
  digitalWrite(9, HIGH);
  delay(50);

  //2.initialize sensor 0 and set adress
  sensor6.init(true);
  delay(50);
  sensor6.setAddress(0x36);
  sensor6.startContinuous();
  delay(50);
  //debug LED and Serial
  //Serial.println("sensor6 set");*/
  leds[6] = CRGB(0, 255, 0);

  /*Read all sensor adresses    Serial.println ("I2C scanner. Scanning
..");*/
  byte count = 0;


  for (byte i = 1; i < 120; i++)
  {

    Wire.beginTransmission (i);
    if (Wire.endTransmission () == 0)
    {
      //Serial.print ("Found address: ");
      //Serial.print (i, DEC);
      //Serial.print (" (0x");
      //Serial.print (i, HEX);
      //Serial.println (")");
```

```
      count++;
      delay (1);  // maybe unneeded?
    } // end of good response
  } // end of for loop
  //Serial.println ("Done.");
  //Serial.print ("Found ");
  //Serial.print (count, DEC);
  //Serial.println (" device(s).");
  if (count == 7) {
    //if all sensors have signal put LED on for debug
    leds[7] = CRGB(0, 255, 0);
  }

  delay(3000);

  //Serial.print("Initializing SD card...");
  //make sure that the default chip select pin is set to output, even if
you don't use it:
  pinMode(10, OUTPUT);

  // The chipSelect pin you use should also be set to output
  pinMode(chipSelect, OUTPUT);

  // see if the card is present and can be initialized:
  if (!SD.begin(chipSelect)) {
    //Serial.println("Card failed, or not present");
    // don't do anything more, but return a red light for debug
    leds[8] = CRGB(255, 0, 0);
    return;
  }
  //Serial.println("card initialized.");

  File dataFile = SD.open("datalog.txt", FILE_WRITE);

  if (dataFile) {
    dataFile.println("[Timestamp(ms), x, y]");
    dataFile.close();
    //print to the Serial port and return green light
    //Serial.println("tada!");
    leds[9] = CRGB(0, 255, 0);
  }
  //if the file isn't open, pop up an error and return a red light
  else {
    ////Serial.println("error opening datalog.txt");
    leds[9] = CRGB(255, 0, 0);
  }

  /* randomize the phase shift between LEDs for fluctuation    for (int i
=0; i < 7; i++) {    for (int j =0; j < 7; j++) {      LEDPhase [i][j] =
int(random(49));    }    }    ////Serial.println("Grids filled");*/

  //set pin for feedback to output
  pinMode(feedbackLED, OUTPUT);
}

void loop() {
  //read the sensors each time after the time interval has passed
  if (millis() - lastSensReading > sensReadDelay) {
    //read out all sensors
    uint16_t val0 = sensor0.readRangeContinuousMillimeters();
    uint16_t val1 = sensor1.readRangeContinuousMillimeters();
```

```
    uint16_t val2 = sensor2.readRangeContinuousMillimeters();
    uint16_t val3 = sensor3.readRangeContinuousMillimeters();
    uint16_t val4 = sensor4.readRangeContinuousMillimeters();
    uint16_t val5 = sensor5.readRangeContinuousMillimeters();
    uint16_t val6 = sensor6.readRangeContinuousMillimeters();

    //if we didn't see the ball before, but we do now, read out the first
sensor data
    if (firstVal) {
      //1. if sensor 0 is in reach and smaller than all the others:
      if (val0 < 305 && val0 < val1 && val0 < val2 && val0 < val3 && val0 <
val4 && val0 < val5 && val0 < val6) {
        firstVal = false; //2. for next loop we have seen the ball before,
so we don't have to look at them again
        firstDist = val0; //3. the value that should be recorded is sensor
0
        DistNr = 0; //4. sensor 0 measured this, so is the x-coordinate
        timeStamp = millis() / 60000; //which minute was it measured on
      }

      //repeat step 1-4 for each sensor
      else if (val1 < 325 && val1 < val2 && val1 < val3 && val1 < val4 &&
val1 < val5 && val1 < val6) {
        firstVal = false;
        firstDist = val1;
        DistNr = 1;
        timeStamp = millis() / 60000;
      }
      else if (val2 < 320 && val2 < val3 && val2 < val4 && val2 < val5 &&
val2 < val6) {
        firstVal = false;
        firstDist = val2;
        DistNr = 2;
        timeStamp = millis() / 60000;
      }
      else if (val3 < 220 && val3 < val4 && val3 < val5 && val3 < val6) {
        firstVal = false;
        firstDist = val3;
        DistNr = 3;
        timeStamp = millis() / 60000;
      }
      else if (val4 < 330 && val4 < val5 && val4 < val6) {
        firstVal = false;
        firstDist = val4;
        DistNr = 4;
        timeStamp = millis() / 60000;
      }
      else if (val5 < 290 && val5 < val6) {
        firstVal = false;
        firstDist = val5;
        DistNr = 5;
        timeStamp = millis() / 60000;
      }
      else if (val6 < 325) {
        firstVal = false;
        firstDist = val6;
        DistNr = 6;
        timeStamp = millis() / 60000;
      }
      //if none of the sensors saw the ball, go through the loop again next
time
```

```
    }

    //if the sensors are in reach but it is not the first time we see the
ball (meaning it is still in the prototype)
    else if (val0 < 305 || val1 < 325 || val2 < 320 || val3 < 220 || val4 <
330 || val5 < 290 || val6 < 325) {
      //do nothing
    }

    //if we don't see the ball anymore, record the first sensor values
    else {
      /* report the first sensor data for debugging        Serial.print("at
");        Serial.print(timeStamp);        Serial.print("ms,
sensor");        Serial.print(DistNr);        Serial.print(" measured
");        Serial.print(firstDist);*/

      //see what hole corresponds with the distance measurement, this will
be the y-coordinate. Not all sensors are calibrated equally, so the clauses
are not always the same.
      if (firstDist < 45 || (firstDist < 120 && DistNr == 3) || (firstDist
< 150 && DistNr == 6)) {
        DistY = 0;
      }
      else if (firstDist < 95 || (firstDist < 180 && DistNr == 3) ||
(firstDist < 185 && DistNr == 6)) {
        DistY = 1;
      }
      else if (firstDist < 195 || (firstDist < 220 && DistNr == 3) ||
(firstDist < 245 && DistNr == 6)) {
        DistY = 2;
      }
      else if (firstDist < 260 || (firstDist < 290 && DistNr == 6)) {
        DistY = 3;
      }
      else if (firstDist < 290 || (firstDist < 300 && DistNr == 1) ||
(firstDist < 305 && DistNr == 4) || (firstDist < 310 && DistNr == 6)) {
        DistY = 4;
      }
      else if (firstDist < 303  || (firstDist < 315 && (DistNr == 1 ||
DistNr == 2)) || (firstDist < 323 && (DistNr == 4 || DistNr == 6))) {
        DistY = 5;
      }
      else {
        DistY = 6;
      }

      firstVal = true;

      /*save the data in an array so you can debug with them
later        sensorData [dataPoint][0] = timeStamp;        sensorData
[dataPoint][1] = DistNr;        sensorData [dataPoint][2] =
DistY;        dataPoint = dataPoint + 1;*/

      //count the balls with x and y coordinates in the grid
      inputGridSpread [DistNr] [DistY] = inputGridSpread [DistNr] [DistY] +
1;

      //since this point is recent. the age should be 0 after the
iteration.
      inputGridAge [DistNr] [DistY] = -1;
```

```
      //turn on the feedback LED, we have seen your ball
      digitalWrite(feedbackLED, HIGH);
      feedbackOn = true;
      lastFeedback = millis();

      /* print sensor data for debuging        //Serial.print("at
");        //Serial.print(timeStamp);        //Serial.print("ms,
sensor");        //Serial.print(DistNr);        //Serial.print(" measured
");        //Serial.print(firstDist);        //Serial.print(" mm,
corresponding with Y-coordinate : ");        //Serial.println(DistY);*/

      /* print the grids for
debugging        //Serial.print("{");        for (int i =0; i < 7; i++)
{        //Serial.print("{");        for (int j =0; j < 7; j++)
{          //Serial.print(inputGridSpread[i][j]);          //Serial.print("
,");          //Serial.print(inputGridAge[i][j]);          //Serial.print("
");        }        //Serial.println("}");        }*/

      /*print all first sensor data up until this point        for(int i =
0; i < 30; i++){        if(sensorData [i][0] !=
0){          //Serial.print("{");          //Serial.print(sensorData
[i][0]);          //Serial.print(",");          //Serial.print(sensorData
[i][1]);          //Serial.print(",");          //Serial.print(sensorData
[i][2]);          //Serial.println("}");        }*/

      //enter the coordinates in the SD card
      File dataFile = SD.open("datalog.txt", FILE_WRITE);

      if (dataFile) {
        dataFile.print("{");
        dataFile.print(timeStamp);
        dataFile.print(",");
        dataFile.print(DistNr);
        dataFile.print(",");
        dataFile.print(DistY);
        dataFile.println("}");
        dataFile.close();
      }

      else {
        //Serial.println("error opening datalog.txt");
      }
    }

    //set the reading interval back
    lastSensReading = millis();
  }

  //update the grids each time after the time interval has passed
  if (millis() - lastGridUpdate + 50 > GridUpdateDelay) {
    //Serial.println("time for an update");
    //set gridMax back as we want to find the new one
    gridMax = 0;

    //loop through the grid
    for (int i = 0; i < 7; i++) {
      ////Serial.print("{{");
      for (int j = 0; j < 7; j++) {

        //update the grids with all data and increase the time
        outputGridSpread[i][j] = inputGridSpread[i][j];
```

```
        inputGridAge[i][j] = inputGridAge[i][j] + 1;
        outputGridAge[i][j] = inputGridAge[i][j];
        /* print all the new grids for
debugging          //Serial.print(outputGridSpread[i][j]);          //Seria
l.print(",");          //Serial.print(outputGridAge[i][j]);          //Seri
al.print(" ");*/

        //if this number is higher than the previous max, make it the new
one
        if (outputGridSpread[i][j] > gridMax) {
          gridMax = outputGridSpread[i][j];
        }
      }
      //Serial.println("}}");
    }
    //Serial.println(gridMax);
    //set the updating interval back
    lastGridUpdate = millis();
  }

  //update the LEDs each time after the time interval has passed
  if (millis() - lastLEDWriting + 25 > LEDWriteDelay) {
    //loop through the grid
    for (int i = 0; i < 7; i++) {
      for (int j = 0; j < 7; j++) {
        //calculate LED number
        int LEDnr = i * 7 + j;

        //with the maximum the LED should be brightest and otherwise
proportionally less
        int intensity = outputGridSpread [i][j] * (248 / gridMax);

        //a nice twinkle to catch attention
        int spark = int(random(-7, 7));
        int signalR = intensity ;
        int signalB = intensity;
        int signalG = intensity;

        //if there have been balls thrown in at this coordinate and it is
older, overwrite the green and blue values to have the LED become orange.
        if (outputGridSpread [i][j] != 0 && outputGridSpread [i] [j] > 0) {
          //with the newest points blue values should be as high as the
rest. at the end of the day there should be no blue anymore.
          int colorB = intensity - (outputGridAge[i][j] * (intensity /
2160));
          int signalB = colorB + spark;

          //the green should be inbetween the blue and red to create the
nice shade of orange
          int signalG = (0.7 * intensity + 1.3 * colorB) / 2 + spark;
        }
        //show the LED
        leds[LEDnr] = CRGB(signalR, signalG, signalB);
      }
    }
    FastLED.show();

    //for flctuating LEDs:  LEDCurPhase = LEDCurPhase + LEDIncrement;
    //set the LED interval back
    lastLEDWriting = millis();
  }
```

```
  //the feedback LED should switch off after a while
  if (feedbackOn && millis() - lastFeedback > FeedbackDuration) {
    digitalWrite(feedbackLED, LOW);
    feedbackOn = false;
  }
}
```

Appendix N – My-care visual