THE PENSIVE POCKET PROJECT

Making space for Consciousness and Connectedness to Garments through a tangible Data Experience

Isa, M.G., Jansen
1448196
Department of Industrial Design,
Eindhoven University of Technology,
i.m.g.jansen@student.tue.nl

Stephanie, C.J., Kohnle
1531115
Department of Industrial Design,
Eindhoven University of Technology,
s.c.j.kohnle@student.tue.nl

Jeannette, A., Stekelenburg
1565052
Department of Industrial Design,
Eindhoven University of Technology,
j.a.stekelenburg@student.tue.nl

Florine, J., Westen
1554077
Department of Industrial Design,
Eindhoven University of Technology,
f.j.westen@student.tue.nl

Project coach: Kristina Andersen

Site: Demoday.id.tue.nl/projects/0bpXvd2yWq

ACM Reference Format: Isa M.G., Jansen, Stephanie C.J., Kohnle, Jeannette A., Stekelenburg and Florine J., Westen. 2022. The Pensive Pocket Project - Making space for Consciousness and Connectedness to Garments through a tangible Data Experience.

ABSTRACT

This study is an investigation into how pressure data can be translated to a (tangible) experience such that it creates consciousness of and connectedness to pockets. Experiencing a lack of garment connection in a fast-fashion society, it was set out to research the possibilities in designing through emotional attachment with on-body materials. For this, pockets are used as a guiding tool because of their familiarity, function (keeping valuables) and existing literature on the design.

By observing when a garment is valued and why, this study embraces the concept of Research through Design, inspired by data enabled design, taking a mixed methods approach. A small First Person Perspective study is conducted to track the researcher's practices related to pockets, followed up by two user studies; one to investigate the current connection participants had with their pockets, the other connecting pockets to data experiences with prototypes. It mainly concluded that the personal adaptation of data experience is important for the experience effectiveness and how this can be utilised. This can help future data-focused designs to elevate the connection to their user(s), and form a guideline on how to design for emotional attachment with on-body materials.

KEYWORDS

CCS CONCEPTS • Design guidelines • Pockets • On-body materials • Connecting with garments • Data Experience

Additional Keywords and Phrases: Crafting Wearable Senses, First-person perspective research, Research through Design, Data embodiment, Data experiencing

The Pensive Pocket Project: Making space for Consciousness and Connectedness to garments through a Tangible Data Experience

INTRODUCTION

'The Pensive Pocket Project' is a research project dedicated to analysing awareness and attachment through the means of pockets. With this research, the goal is to dive into emotional attachment and awareness of using said pockets through data experiencing, and how this influences an individual. From there, it is looked into how attachment can be created or visualised, and whether this is personal or can somehow be defined.

Through the research study Making Secret Pockets by Nachtigall and Andersen [1], the inspiration of the use of pockets emerged. In the paper, pockets are mentioned to be the part of a garment that evokes a lot of emotions, for example the frustration that comes from fake pockets or no pockets in your clothing. Since pockets already evoke an emotional connection with the wearer, pockets will be used as a guiding design in this project to investigate how people can become more connected with their garments.

In the current fast-fashion industry, clothing consumption has continued to rise around the world [2]. It is here also mentioned that this has a lot of impact on our society. From environmental to social, it is notable that our daily lives are unbeknownst influenced by the way we handle our clothes.

Garments integrated with HCI (Human Computer Interaction) and the relation with the wearer has been an extensive part of research already, as well as in the field of pockets, for example in the Tasca Project [3], who designed in a very similar field. However, this research is taking mainly the inspiration of I Don't Want To Wear A Screen by Devendorf et al. [4]. Our inclusion of technology is not going to be the main focus like in the Tasca Project, more likely just for research purposes only and not for everyday use. Although this is the case, these material-centric research through design approaches and techniques are relevant for this research as well in terms of the methods used.

To collect the data, the research is conducted in collaboration with Sefar, a company that has been developing technical fabrics for around 190 years, setting standards worldwide with, among other things, their precision fabrics. In particular, they developed a pressure sensing piezoresistive fabric that now mainly is used for industrial purposes [5].

The findings of how people perceive the different kinds of feedback designed in this research will offer a guideline to design a data experience that explores emotional connection to garments. By enhancing this connection, practices with clothing could be changed from an individual point of view in which consciousness and connectedness are central. The goal of this research is to generate findings on how a user can become more connected to wearables through a data experience.

Figure 1: the Haptic Pocket Belt

RELATED WORK

Some clothes with holes or tears in it can easily be fixed, but this is not always done for many different reasons. Collins [6] researched young consumer's (in)tolerance for visibly old clothing. One reason that withholds people from repairing clothes is lack of confidence in their skills, being afraid to do it incorrectly. Furthermore, she argues that culture greatly influences this. Where in some cultures repairing clothes is the standard, in other cultures it is seen as uncool. Fast fashion industry makes it cheap and easy to replace any slightly damaged piece of clothing, making it less appealing to spend time and money on repairing clothes.

Even though fast fashion has become a standard in some cultures [2], awareness of the negative consequences on the environment is increasing [7]. Adding value to a garment has been practised in several ways before such as upcycling clothes [8] and personalising designs [9].

A similar project that already utilises data from pockets in a similar context to this research is Project Tasca [3] as previously mentioned in the Introduction. They designed a pocket-based textile sensor that detects user input and recognises everyday objects that a user carries, and indicates how this system was designed. As they focused more on the technical implementations and creation, it lays a good foundation for pocket data collection and shows a functional design to measure this.

This research project uses a data-enabled design approach [10], in which pressure data from the Sefar pressure-sensing fabric is used as a creative material to create a data experience. In this research, this creative approach to data aims to leave room for the user's interpretation of the design [11]. This way, the designer does not decide how the user should use a design but the users themselves can take ownership, which makes space for a bond between the product and the user. The work of Bogers et al. [12] shows an example of using a data-enabled approach for a different research direction.

Personal informatics systems strive to improve self-understanding for which I. Li, A. Dey, and J. Forlizzi [13] proposed a model of personal informatics systems that consists of five stages, namely: preparation, collection, integration, reflection, and action. The Pensive Pocket Project covers the first three stages of that model where people collect and transform information about themselves, briefly touching upon the reflection stage. The data experiences created aim to create awareness (collection and integration) and encourage reflection on how people handle their clothes. The action stage, in which people choose how they use the new self-understanding found, is not yet included in this research.

This investigation focuses on existing products rather than new designs or altering current designs. Therefore, the focus lays on the emotional connection a user can have with their pockets. The scope of this study focuses on the first step of creating awareness of the clothing people already own, reflecting on what they mean to them and how they handle their garments.

METHODS

To conduct the research, the process has gone back and forth between 4 main stages, each having their own form of user testing, see Figure 1.

Different papers formed the base of the research method. The main part is conducted as research through design (RtD), a method that uses prototypes to enrich already available research. It aims to generate knowledge that is interesting and relevant beyond this project [14]. Data enabled design was chosen as the method to create the prototypes to communicate the insights of the study. It is a design approach that uses data as the creative material [10]. Through the prototypes, based on data and research, two user tests were conducted alongside a small first-person perspective study and two feedback sessions. These studies and feedback sessions then function again as the main data source that triggered a new way of making prototypes and their respective user study/studies.

During this research it was specifically aimed to generate qualitative data as this approach seemed the most appropriate while investigating one's emotional connection with garments. Therefore within the first-person perspective study the focus layed on the feelings and experiences from the researchers. This way of acting entails self-reflexive activation as the researchers try to understand themselves in the context of investigation. During the user studies and feedback sessions the emphasis was on how the participants and visitors of the Demo Day felt, what their opinion was and how they experienced the setup of the studies. The user tests conducted in this research are ethically approved with the use of an Ethical Review Board (ERB) form (see Appendix F), signed by Andersen, the supervisor of this study. Moreover every participant signed a consent form ahead of the study and were given the option to retract their participation at any time.

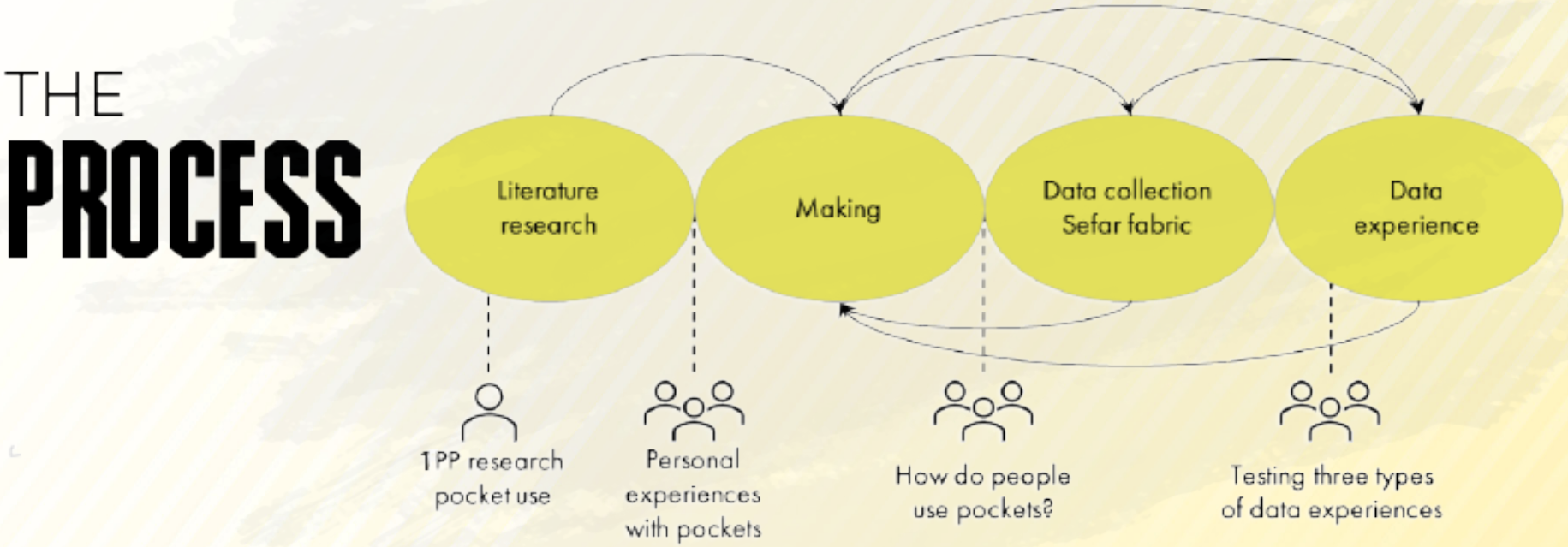


Figure 2: Visualisation of the project process.

USER STUDIES

FIRST-PERSON PERSPECTIVE USER STUDY

Setup

In the early exploration phase of this research, a small First-person perspective (1PP) study was conducted. Each team member carried a tiny paper booklet, displayed in figure 8, with them in their pocket (if available) for five days straight. When no pockets were included in the garments of the researchers, the booklet still had to be worn on the body. At the end of every day, the researchers had to write a small reflection on how they used their pockets and interesting findings they had come across. This study was conducted in order to get familiar with the practices the researchers themselves have with their own pockets.

Findings

At the end of the five days of investigation, one booklet was missing, another booklet went in the washing machine and the other two were preserved. However, before the Midterm Demo Day, one of these booklets went missing as well. Based on the content of the booklets and on the memories of the reflections in the missing booklets, it was found that the same alternatives for pockets were used when lacking them. These alternatives were; a bra, the waistband of trousers/skirts, socks… When pockets were included in the garments of the researchers, it differed per team member into which pocket the booklet was put.

Insights

If the alternative for pockets was comfortable with carrying the booklet on the body, pockets were not missed. Furthermore, when using these alternatives, it was often forgotten that the booklet was in that place and caused a surprise when undressing. This also indicates that the paper booklet could easily fall out of the alternatives for pockets which might be the reason why a booklet went missing. When using pockets this was different, as the booklet would not fall out of the garment. This led, nevertheless, to unawareness of the booklet still being in there causing it to go in the washing machine. When the alternative for pockets was not comfortable, the awareness of carrying the booklet increased, causing more appreciation for pockets.

MIDTERM DEMO DAY

Setup

During the exploratory phase of the project, the Midterm Demo Day was an opportunity to present the research direction thus far. From peers, coaches and experts, personal stories about pockets and feedback on how to continue this research was collected. The topic of the project was introduced by a pitch. In order to receive feedback, the way of pitching purposely was very open for questions and interpretation, giving the listeners the opportunity to lead the conversation. Moreover, to attract people to the stand and further engage them, a poster with a variety of pockets was displayed. Post-its and a pen were provided for written feedback which then could be put in the pockets on the poster, see Figure 9 and 18.

Findings

Figures 10 and 11 show the most interesting findings of the Midterm Demo Day.

Insights

Everyone had something to say about pockets. One of the things that stood out is that mainly women experienced pockets as frustrating because of the lack of pockets or the size of them in their clothing. However, the stories showed that they found very creative ways to still carry around all their essentials.

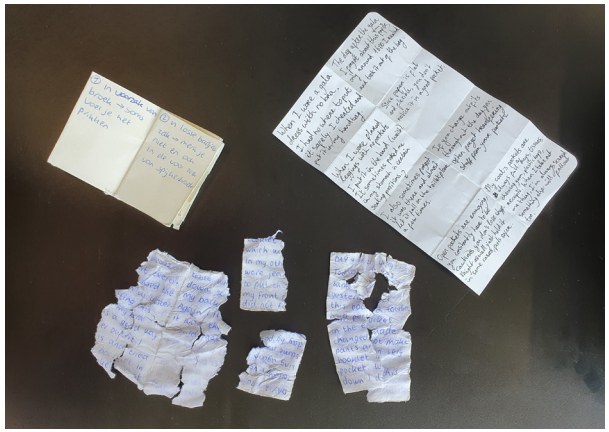


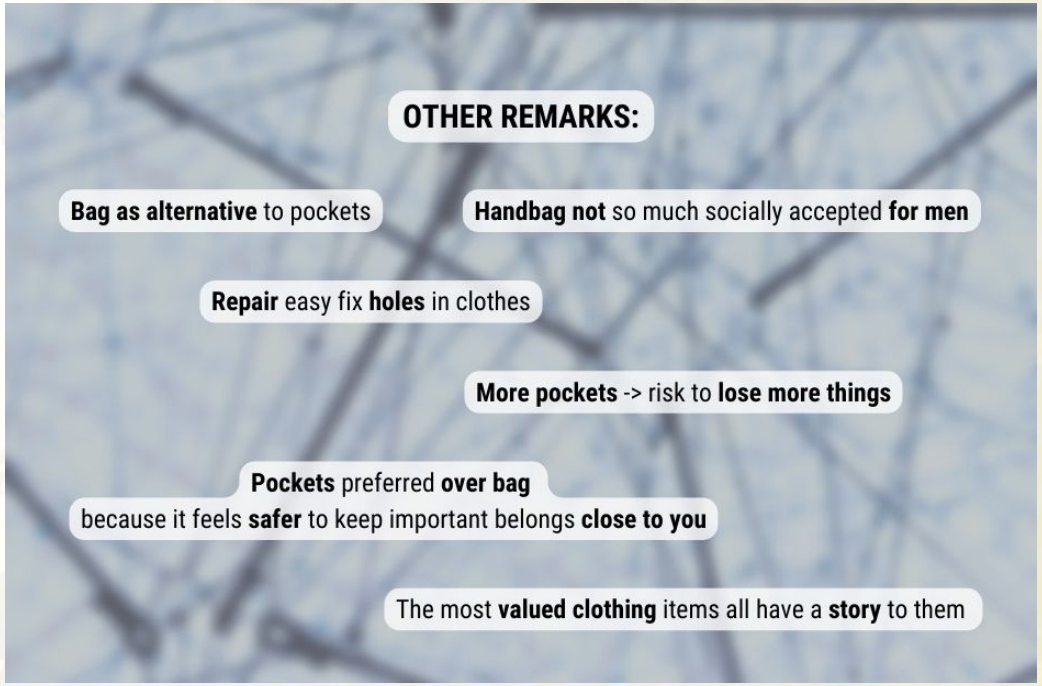
Figure 8: The remains of the booklets of the 1PP Study.

Figure 9: Poster Midterm Demo Day

Furthermore, many people indicated to repair their clothes when needed. It seemed like most people were already quite conscious of how they handled their clothes. Worth mentioning is that the insights gathered on the Midterm Demo day might not be representable for the target group (students from 18 to 25 years old), since the group of people attending the Demo Day of the Crafting Wearable Senses squad quite likely have a strong interest in fashion and materials.

Figure 10: Feedback on how to continue with the project after Midterm Demo Day.

THE MOST INTERESTING PERSONAL STORIES SHARED ABOUT POCKETS/GARMENTS:



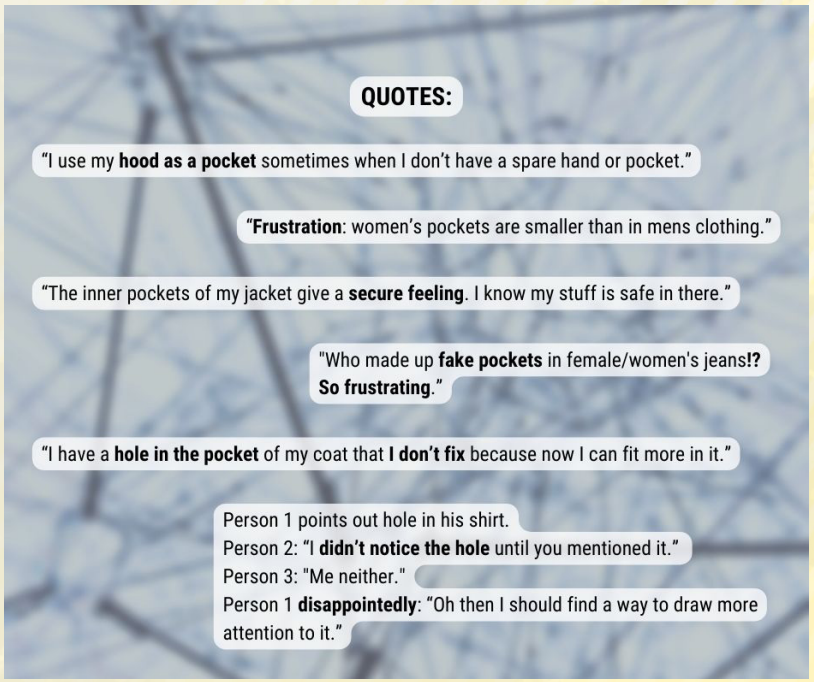


Figure 11: The most interesting personal stories and other remarksshared about pockets/garments during Midterm Demo Day.

POCKET REFLECTION STUDY

Setup

After the project took form during the Midterm Demo Day, this research was set out to confirm assumptions based on finding out to what extent people already have awareness of their pockets. Standing with a mannequin in Atlas at the TU/e, see Figure 12, random pass-byers were asked to participate in the study. While laying their hands upon a pedestal, without touching or looking at their pockets, a list of questions was asked, see Appendix C. After the questioning, the participants could check whether they had listed everything correctly, and if they had missed/added things, or assumed they were in another pocket. Afterwards, the participant could stick a label onto the mannequin on the area of the pockets they carried their possessions. A total of 10 people participated in this research.

Figure 12: Setup of Pocket Reflection Study.

Findings

Looking at the participants who were included in this research, most of them seemed to have patterns and different levels of awareness of their pocket use. Most of them indicated that they always carry possessions in their pockets, which for most of the participants were the ones in the front and back of trousers/jeans. Afterwards this became visible through the places on the mannequin with the most stickers, see Figure 13. In the cases that these pockets were not available in their garments, the participants always responded that in that case they actively look for alternatives, to always have some form of pocket or bag available. Most mentioned alternatives were wearing a jacket or purse, mainly to carry around certain items that they always want to have on hand, such as their keys, wallet or smartphone.

Figure 13: Mannequin with stickers indicating the placement of participants' possessions.

Insights

A lot of the participants seemed to have strong opinions on pockets, which is interesting to mention as this can indicate awareness. Based on earlier assumptions, a surprisingly large number of participants could actually name the possessions they were carrying correctly in amount and placement. Most of these participants pointed out that they had some kind of structure in their day-to-day pocket use, always having certain pockets in their garments carrying the same things in the same places as forms of habit. This included never having their keys and smartphone in the same pocket to prevent scratching, or carrying their wallet always in their right-side pocket knowing it could not be anywhere else. Yet, also a large part of the participants were surprised to find having little papers and candies among other things in their pockets they did not remember, some stating that they found something they thought they lost.

DATA EXPERIENCE USER STUDY

Setup

This user study was conducted to determine how users respond to different ways of feedback on their interaction with their pockets through data experience and to see the kind of feedback that was valued. As a probe, a belt with two pockets was made and used, see Appendix Figure D.1. Ten students participated in this study. A pilot study was conducted, see Appendix D for more information.

The user study consisted of two parts. The first part consisted of five rounds (see appendix D for table D) and after every round, the participant was asked to answer the same questions about how they felt during the experience by filling out a form with a Lickert scale for every question. The second part consisted of general open questions and a feedback part. See Appendix D for the Likert scale questions and open questions.

Every round the user was asked to stand up and interact with the pockets on the belt until they felt their experience was clear enough to answer the questions. The Wizard of Oz technique was used to operate the data experiences as explained in the HPB section. The first round was the control group where the user wore the belt and had the chance to familiarise with the belt and pockets. In the second round, a visualisation was depicted on a big screen that visualised the interaction with the pockets. This visualisation was created in Processing and was controlled manually on a laptop, see Appendix Figure B. for the code. In the third round, a sound of 440Hz (standard a-note) was played. The volume, that was manually controlled, represented the interaction with the pockets. In the fourth round, a marble was attached to a cord and added to the belt. One of the researchers stood behind the participant and pulled the cord to move the marble through the belt towards the pocket the participant touched to indicate their impact on the pockets. In the fifth round, all feedback from previous rounds was experienced simultaneously. Thereafter, the user was asked semi-structured questions about how they interact with their clothing, how they think about sustainability and the different data experiences. These questions can also be found in Appendix D. Figure 14 shows the setup of the user study. A pilot study was conducted, see Appendix D for more information.

Findings

Why (not) visual feedback?

Some participants preferred the visualisation of the pressure applied to the pockets. It was found to be intriguing, clear and personal. One of the participants said that they thought a visualisation has the most potential to clearly showcase differences in intensity of the pressure applied. As a disadvantage, one participant said that since the visual is projected far away from you, you can look away and therefore has a small impact. However, another participant said they liked the fact they can look away, since that offers more control of the situation. Multiple participants who preferred the visual indicated afterwards they are visually oriented in general.

Why (not) audio feedback?

One participant stated that the sound is clearer than the visual and haptic feedback since there was more variation of volume. Another participant mentioned that it did not feel personal since everyone could hear the sound and it therefore attracts the attention of others around you. Some participants found the specific sound used to be monotonous, uncomfortable and distracting. Moreover, it was said that the sound felt distant from the interaction with the pockets and therefore less impactful than the haptic feedback. One participant tried to figure out if there was a difference in sound between touching the left or right pocket and was disappointed when the participant found out there was no difference.

Why (not) haptic feedback?

Some participants preferred the marble. They found the marble to be intriguing and most communicative. They said the movement direction made sense. It was also mentioned that it felt most personal because no one else could see or hear what was going on. Some participants disliked the unexpected touch and movement of the marble. One of the participants who experienced the haptic feedback as uncomfortable also said that the feeling was distracting from the pockets.

Reflection on the experience

The majority of the participants mentioned that they did not think differently about how they handled their clothes after the experiences during this study. Participants mentioned that the experience was short and specific and they could often not see the relation with their own clothes, therefore they thought it would have no long-term effect. There were also participants who did not think about their own clothes, but after the questions, the link made more sense, or they expected to be more conscious after some time. However, they did become more aware of the pockets and where you place things during the experience. The placement of the pockets did not always correspond to the placement of the pockets in their own clothes, since the belt needed to be worn above the waistband of their trousers in order to feel the marble. This could have affected how they interacted with the pockets since they mentioned it was not the same as their own pockets. It might also have affected the connection they felt with their own clothes. Moreover, it was observed and pointed out by some participants that the curiosity of the participants became less after every round because they already knew what they could expect and therefore the feedback became more predictable.

Insights

It became clear that in order to make an impact with a data experience, the experience should be personalised. For all types of feedback there were advantages and disadvantages. The preference for visual, audio or haptic feedback differs largely. It is important to note that some people are very sensitive to touch and dislike unexpected touch and movement. In this case, haptic feedback is not suitable. There are also people who are sensitive to sound and dislike certain specific or loud sounds. In this case, audio feedback is not suitable. When someone is visually oriented, a visual is most suitable and impactful.

Considering all advantages and disadvantages of the experience of all types of feedback, the experience was found to be rather short. To make a stronger impact, it would be advisable to create a longer experience.

Figure 14: The setup during the Data Experience User Study.

FINAL DEMO DAY

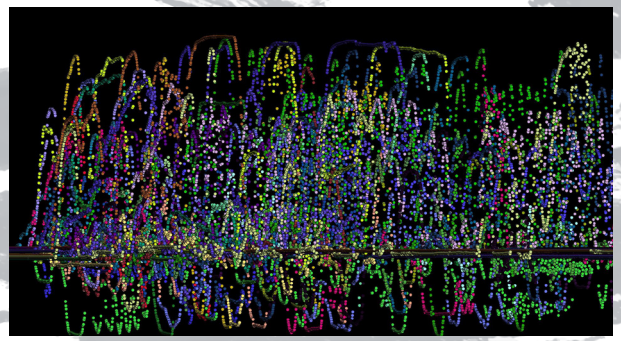
Set up

During the final Demo Day, the three designs mentioned in the design section were demonstrated, see Figures 15 and 16. There was also a poster with the abstract and research question to inform the visitors of the stand about the research. Moreover, there was a Sefar fabric sample which visitors could touch. After introducing our project in a pitch, they had the opportunity to try out the three experiences.

Findings

After the Final Demo Day the visual from the PGI showed an artwork with different trials with different colours indicating all the visitors that interacted with the data experience, see Figure 17.

The Final Demo Day provided feedback from different people. An important notion was made by a visitor that valuing a garment does not mean that you will be more careful with it. A decent pair of pants for example can be valued more because you can use them freely without worrying about how you handle them. H.K.G. (Kristina) Andersen made another important notion which was about the fact that pockets automatically add value to a garment and can increase the emotional connection with the wearer. Pockets make the garment more expensive since it adds additional steps in the manufacturing process with an increased risk of mistakes. Some people also mentioned that the impact of the experience depends on how long they interact with it. They would need to use it longer for a long-term effect. They also mentioned a real-time experience would have more impact with the haptic feedback and the feedback needed to be local, so in the pocket. Another person mentioned they forget things in their pockets and with these data visualisations they can become aware of what is in their pockets. Another visitor mentioned that they have an emotional connection with a garment since it represents an important milestone in their life. Moreover, some garments are for use like sportswear and therefore they feel no emotion with it, it is just for use.



They are used and this means they break after some time, which is inescapable. Additionally, a visitor mentioned that repairing/tailoring clothes is also culture-dependent, for example in India it is common and cheap.

Multiple people were positive about the HPB, words like surprising, comfortable, personal and massage were mentioned. However, some other people were less positive and mentioned that the feedback was too present and distracting. Some people preferred the PTL since it gives direct and clear feedback. However other people mentioned it was not detailed enough, it only gives feedback in three intensities: no light, little light or much light. Multiple people were positive about the PGI. Someone mentioned that a visual over time could be used to see how and when something broke, like a backpack, and also to reflect on when you are stressed for example. Other people mentioned that the PGI could show how people use garments and to identify weak points that have more to endure and could be used to work together with companies that make clothing. One person who was less positive about the PGI, mentioned that it was too much information to process. They preferred a visual which is clear and easy to react to, so one linear line. They preferred simple communication over abstract art.

Insights

The most important insight is that again the preferences for the data experiences were personal. The PGI is compatible with people who want to experience detailed data and use it for reflection. The PTL is compatible with people who want direct feedback and the HPB is compatible with people who want a personal experience that is not visible to others. Moreover, the experiences could be longer and in real-time to investigate a lasting impact. Lastly, the emotional connection to a garment has to do with its meaning and importance to its owner. So, when the clothing item represents an important event or milestone the user can have an emotional connection with it.

As feedback on the PTL, PGI and HPB displayed on the Final Demo Day, it was mentioned by Rong-Hao, that combining the three different interactions into one would extend the awareness and reflection aspects of the design into the action phase, as explained in r A Stage-Based Model of Personal Informatics Systems [13]. In this stage people can connect the feedback from the data experience to their own practices with garments. For this he suggested creating a wearable in which visual and haptic feedback is combined.

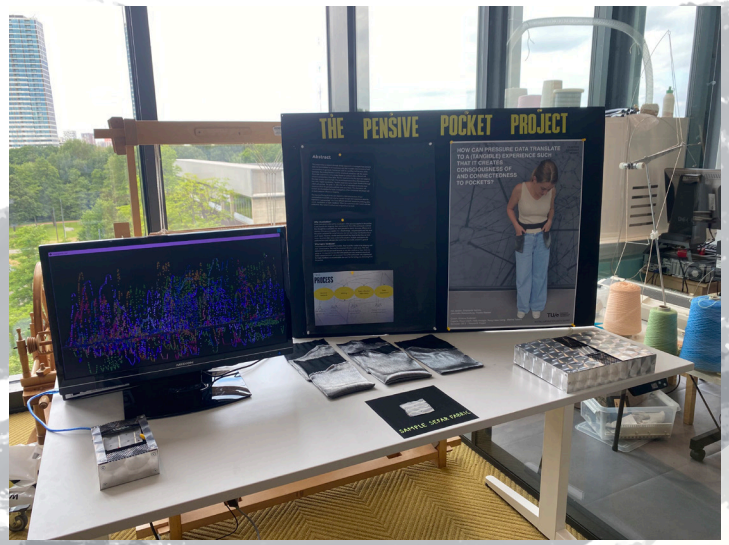


Figure 15: Setup Final Demo Day with PTL, PGI and the poster.

Figure 16: HPB on the wall for Final Demo Day.

Figure 17: The visual from the PGI after the Final Demo Day showing all the visitors that interacted with the prototype.

DESIGN

HAPTIC POCKET BELT (HPB)

The Wizard of Oz technique was used to create a haptic feedback experience. The Haptic Pocket Belt (HBP) design consists of a belt, two pockets and a marble for haptic feedback, see Figures 2 and 3. The belt is an adjusted luggage belt. From fabric, a sleeve was made and placed over the belt. A string with the marble attached to it ran through the sleeve. The pockets are made out of the same fabric as the sleeve.

The design is based on the concept that when the wearer of the belt touches one of the pockets, the marble moves towards it. The string is manually pulled to move the marble inside the belt. This movement is created to draw the wearers attention to that place and is intended to make them more conscious of their interaction with the pocket.

PRESSURE TRIGGERED LIGHT (PTL)

During the Final Demo Day a Pressure Triggered Light (PLT), depicted in Figure 4, was demonstrated. This type of feedback was designed to make people aware of the practices they had with the Sefar fabric. Therefore, the input (pressure on the Sefar fabric) and the output (lights) are at the same location in the design. If the user presses on the Sefar fabric, light will shine through the fabric. If more pressure is applied, a brighter LED will be lit. The aesthetics of the PLT was determined to be futuristic in coherence with the Sefar fabric, which led to using aluminium plates for the outer layer, together with strokes of black mesh as decoration. In order to let the light shine through the fabric, perspex is used. The case of the Pressure Generated Illustration (PGI) is constructed in a similar way, see Figure 5. An exploded-view illustration can be found in Figure 6. Besides that, the code used to let the LEDs shine can be found in Figure A.4, A.5 and A.6.

PRESSURE GENERATED ILLUSTRATION (PGI)

The Pressure-Generated Illustration (PGI) visualises pressure data over time with a digital visualisation, see Figure 7. The experience shows a moving ellipse that leaves a trail. The height of the ellipse is based on the pressure, when the pressure is high, the ellipse moves up. The ellipse gets a new colour for every new trail and in the end, an artwork is created with different tracks for every user. The visualisation is made with the programs Processing and Arduino and the pressure sensing fabric from Sefar is connected to an Arduino with alligator clips. The pressure values are sent from Arduino to Processing via the serial connection, see Figure A.3 for the code. In Processing the Y position of the moving ellipse is based on these pressure values. When the ellipse moves out of the window the program stops. When the spacebar is pressed, a new user can start with a different randomly generated coloured ellipse, see Figure A.1 and A.2 for the code.

Figure 3: Front and back of the Haptic Pocket Belt

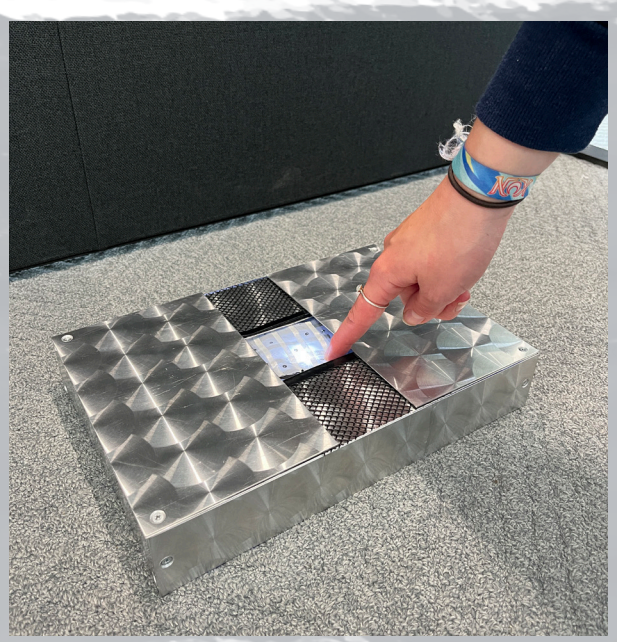


Figure 4: Pressure Triggered Light

Figure 5: Pressure Generated Illustration box

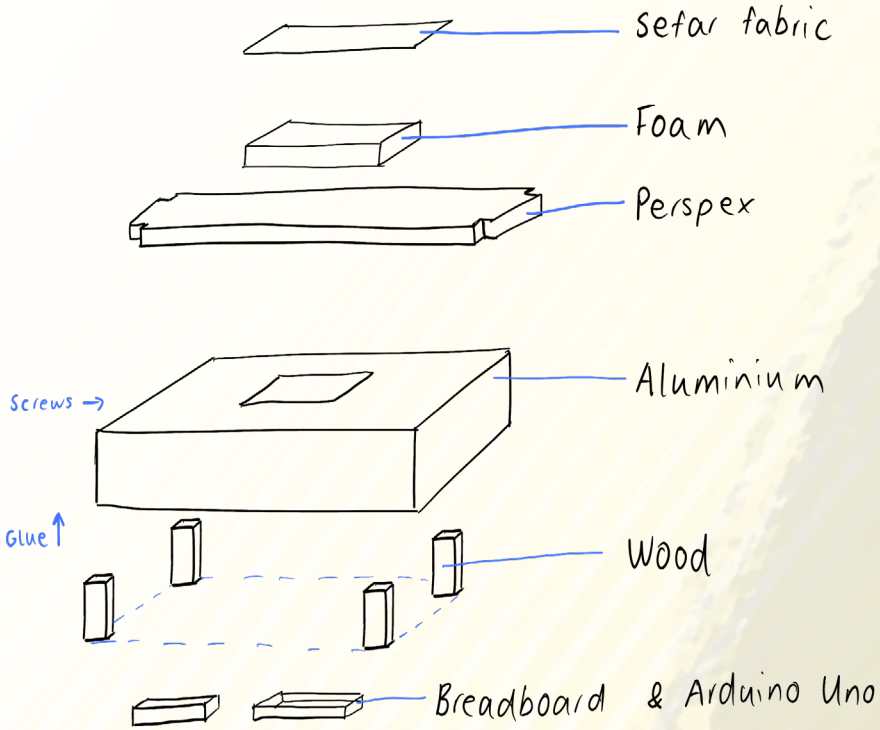


Figure 6: Exploded view of the Pressure Triggered Light and Pressure Generated Illustration.

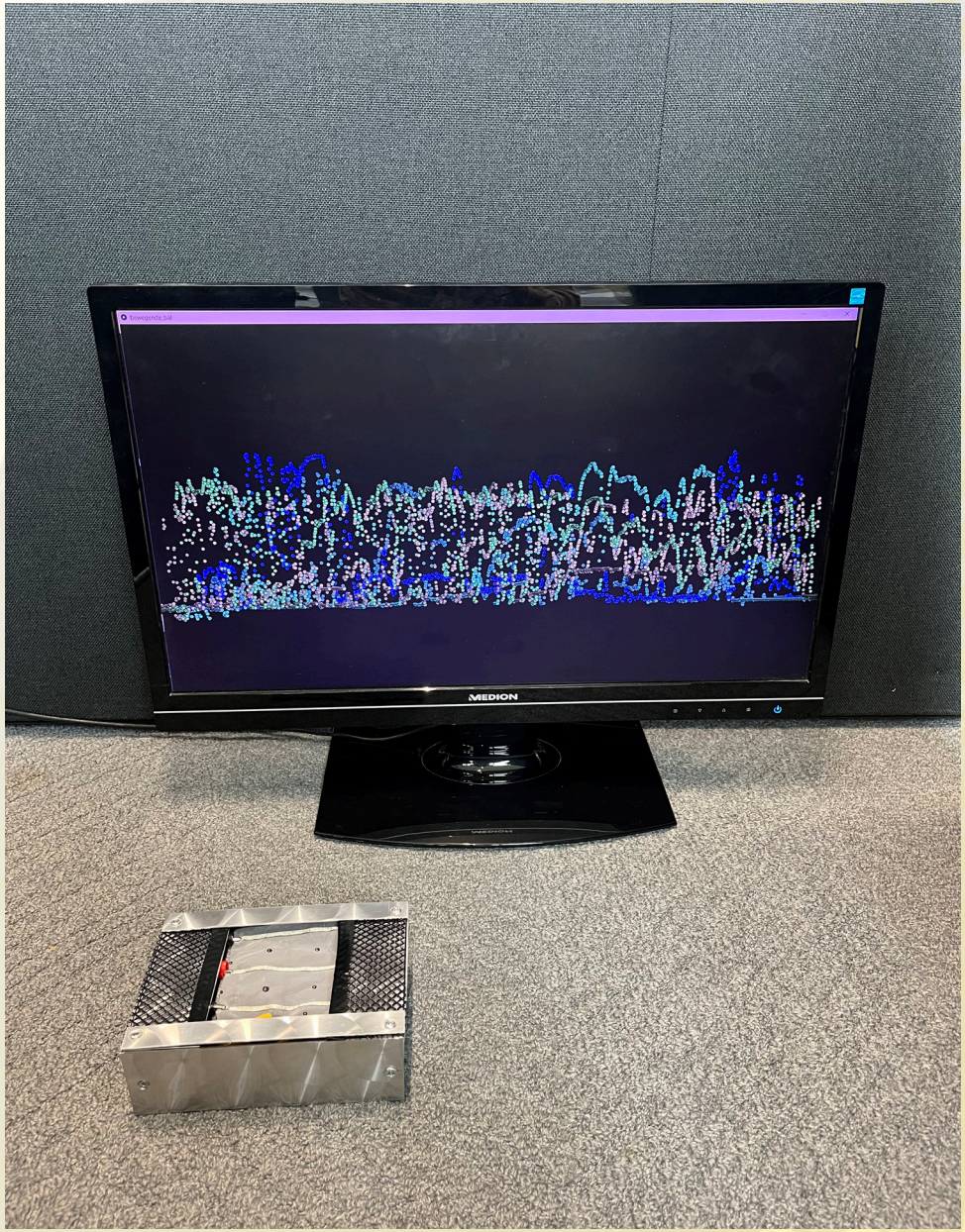


Figure 7: Pressure Generated Illustration.

DISCUSSION

The relevance of this study is mainly in the area of wearables. This study creates a guideline for future designers on how they can collect and visualise data. It shows the effects on users that designers need to take into account when designing a data experience with either audio, visual or haptic feedback. The results showed that data experiences are very personal and in order to have an impact the experience needs to match the user. These results were unexpected since the researchers expected to find one data experience that was preferred by the majority of the users. Moreover, it was found that an emotional connection with a garment is dependent on the meaning the garment holds for the user, so if it has a story behind it. Therefore, this connection is also personal. This result was expected by the researchers since it is explainable and also matches their personal experiences. The results show that a personal on-body data experience based on pressure data has the potential to create an emotional connection between the garment and the user. However, further research into emotional connection and data experiences needs to be performed to answer the research question.

During both user studies, students that are familiar to the investigators participated. Therefore the majority of the participants were students of Industrial Design as well. This could lead to bias since they want to help the researchers which might lead to different responses. Furthermore, these students already know how user tests work and what the role of these tests are in a project. Therefore they might answer differently because they know what kind of answers are usable. Similarly, the First-person perspective study provided the perspective of four female Industrial Design students, which can also result in a bias. Moreover, the pocket reflection study was stopped after 10 participants since no new relevant information emerged. Additionally, the data experience study was stopped after 10 participants, because enough information was gathered for the next iteration. The goal was not to draw strong conclusions from these user studies. It mainly functioned as building blocks for the direction of the research and to use for the next iterations. During the Midterm and Final Demo Day more than 20 people provided feedback, but further research is needed to validate the findings.

The Data Experience User Study used Wizard of Oz techniques causing a delay and inaccuracy since it is controlled manually. Therefore, users might catch on to these imperfections which might affect the study as they could perceive it does not actually work. Additionally, after the first round, it was observed that the participants were most likely having a better idea of what they can expect according to the questions after the experiment which can influence the results. Especially, during the last round where the participants experienced all different kinds of feedback simultaneously, habituation could occur, with the chance of leading to affected results. Besides that, the users mentioned that they were more careful with the belt since they knew it was designed especially for this research. They handled the belt differently because they wanted to be careful of other people’s properties. This might influence the results. The belt accidentally broke, see Appendix Figure D.9., when two participants were interacting with it and they both indicated feeling bad about it and were more careful in their practices afterwards. This led to different results for these users. Since the user studies were performed in the context of clothing and therefore the results cannot be generalised out of the wearable scope. Lastly, the PGI and PTL were not connected to pockets or clothing as the decision was made to keep this separate for technological feasibility. For this reason, the users did not feel a connection with their own clothes which might impact the results.

Figure 18: Different pockets

ACKNOWLEDGEMENTS

Initially a special thanks to our coach, Kristina Anderson, for supervising this project and giving insightful feedback and sources. We also want to thank the other teachers and TAs from the Crafting Wearable Senses squad; Loe Feijs, Bruna Goveia da Rocha, Holly Krueger, Rong-Hao Liang, Marina Toeters, Oscar Tomico Plasencia and Elvia Vasconcelos de Gouveia for providing insightful lectures. Moreover, we want to thank Marina Toeters, Holly Krueger, Oscar Tomico Plasencia and Rong-Hao Liang for giving valuable feedback on our project. Additionally, we appreciate the involvement of the other students from the squad as well for their valuable feedback during the midterm and final Demo Day. Lastly, we want to emphasise our appreciation for the collaboration with Sefar and thank our contact person, Roua Cheffi, in particular for providing us with the pressure sensing fabric that we implemented in the designs for this research.

FUTURE WORKS

As this research provides a guideline for designers to create a data experience that provokes emotional connection between users and their garments, a new study is proposed within this direction. This can also be applied more broadly in the sense of generic data experiences that use visual, haptic and audio feedback. As is seen in this investigation, indications are found of a correlation between a personalised data experience and a feeling of consciousness and connectedness with the user. It is suggested to create a data experience consisting of all wearables to emphasise the connection of the participant and garments, even more, thus this entails combining technology and garments. For this, the pressure-sensing fabric of Sefar could be used by making pockets out of it for instance. By using this fabric, data from the user can be collected and imported in Arduino which then can be converted into a data experience. Another interesting research direction could be to look into the emotional connection one has with soft materials in general rather than wearables. This generalisation could even be extended to hard materials. Advisably the red thread through these new research directions is personalisation of a data experience and the influence it can have on people's awareness, reflection and practices with materials.

CONCLUSION

This research investigates how a (tangible) data experience can be designed such that consciousness of and connectedness to pockets is created in order to change one's practices with garments. A small first-person perspective study was conducted alongside user tests and feedback sessions to investigate the emotional connection between garments and users. With data collected from these approaches, three separate parts of a data experience were designed including haptic and visual feedback. Based on this research study it was found that personalisation could function as a fundament for creating awareness, stimulating reflection and changing practices related to pockets. Also an approach was created on how data can be collected and turned into two different visuals (PTL and PGI) which creates a foundation for designing a data experience. However, more research is needed into the relationship between emotional connection and data experiences. This research is relevant in the world of wearables for reconstructing the appreciation of on-body materials. This paper provides a guideline on how to design for connection with garments which is valuable in future work that focuses on stimulating the appreciation of clothing and creating a different perspective on current consumeristic practices.

REFERENCES

[1] Nachtigall, T. R., & Andersen, K. (2018). Making Secret Pockets. Making Secret Pockets. https://doi.org/10.1145/3170427.3188611

[2] Bianchi, C. & Birtwistle, G. (2011). Consumer clothing disposal behaviour: a comparative study. https://doi.org/10.1111/j.1470-6431.2011.01011.x

[3] Wu, T., Xu, Z., Yang, X., Hodges, S., & Seyed, T. (2021). Project tasca: Enabling touch and contextual interactions with a pocket-based textile sensor: Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems. https://dl.acm.org/doi/10.1145/3411764.3445712

[4] Devendorf, L., Lo, J., Howell, N., Lee, J.L., Gong, N., Karagozler, M.E., Fukuhara, S., Poupyrev, I., Paulos, E., & Ryokai, K. (2016). "I don't want to wear a screen": Probing Perceptions of and Possibilities for Dynamic Displays on Clothing. https://doi.org/10.1145/2858036.2858192

[5] Sefar AG 9410. Sensing with fabrics. Retrieved June 10, 2022 from https://www.sefar.com/en/609/Smart%20Fabrics/Sensing/Sensing.htm?Folder=6924615

[6] Collins, R. (2019). New-Old Jeans or Old-New Jeans? Contradictory aesthetics and sustainability paradoxes in young people's clothing consumption. https://chesterrep.openrepository.com/bitstream/handle/10034/622779/Collins%202019%20New-Old%20Old-New%20Jeans%20-%20for%20PLATE%202019%20conference%20proceedings.pdf

[7] Boykoff, M., Chandle, P., Church, P., & Osnes, B. (2021). Examining climate change and sustainable/fast fashion in the 21st century: 'Trash the Runway'. https://doi.org/10.1093/oxfclm/kgab003

[8] Teli, M.D., Valia, S.P., Maurya, S., & Shitole, P. (2014). Sustainability Based Upcycling and Value Addition of Textile Apparels. https://www.globalilluminators.org/wp-content/uploads/2014/09/MISG-14-144.pdf

[9] Mugge, R., Schoormans, J.P.L., & Schifferstein, H.N.J. (2009). Incorporating consumers in the design of their own products. The dimensions of product personalisation. https://doi.org/10.1080/15710880802666416

[10] Kollenburg, J. van, & Bogers, S.J.A. (2019). Data-enabled design : A situated design approach that uses data as creative material when designing for intelligent ecosystems. https://research.tue.nl/en/publications/data-enabled-design-a-situated-design-approach-that-uses-data-as-

[11] Sengers, P., & Gaver, B. (2006). Staying open for user's interpretation in HCI. https://doi.org/10.1145/1142405.1142422

[12] Bogers, S.J.A., Kollenburg, J. van, Rutjes, H., Deckers, E., Frens, J., & Hummels, C. (2018). A Showcase of Data-enabled Design Explorations. https://doi.org/10.1145/3170427.3186543

[13] Li, I., Dey, A., Forlizzi, J. (2010). A Stage-Based Model of Personal Informatics Systems. https://doi.org/10.1145/1753326.1753409

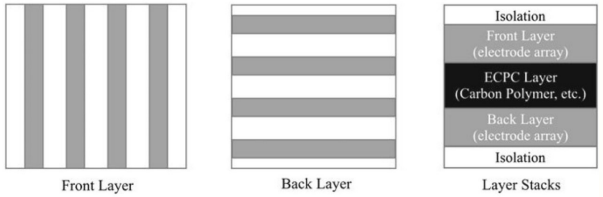
[14] Bekker, T and Barendregt, W (2021) Introduction to Research through Design, syllabus for Design < >. Research course. 2-3.

APPENDIX A: SEFAR FABRIC

Pressure force mapping on Sefar samples

Measurement based on the theory provided as described in Smart Textiles by Sefar. Experimentation of the fabric in preparation of data mapping.

The samples are piezoresistive matrix sensors, see fig below.



The electrodes and layer arrangement of a simple resistive pressure mapping sensor

First, a short summary of the content.

The sensor consists of a piezoresistive sheet (ECPC Layer) with on both sides a number of electrical conductors in an arrangement as shown in the figure above. Each crossing of the electrodes forms a piezoresistive element with a resistance value that is dependent upon the local pressure. It will become smaller as the local pressure is higher. In such a configuration the piezoresistive elements have shared electrodes. In this paper, we discuss why this invokes the difficulty that during measuring was faced: the reason data mapping was unfortunately dropped from this project because the examples could not be accurately addressed independently. In the configuration it introduces, as experienced and described later on, a strong interaction from the pressure on other locations.

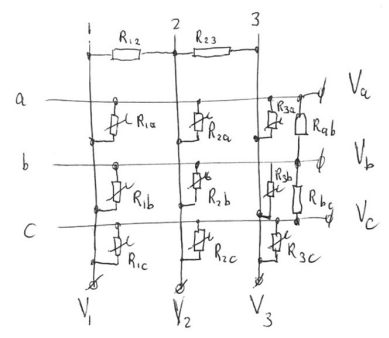
For underlining the findings, we want to refer back to the research already done on this subject by Sefar, after which personal experimentation was done. Here the description and the measurement method are followed as described in Smart Textiles Chapter 3 Textile Pressure Force Mapping *).

To walk you through this process, we first want to start with the measurements done on the 3x3 sample.

The measurement method as a basis to generate pressure mapping

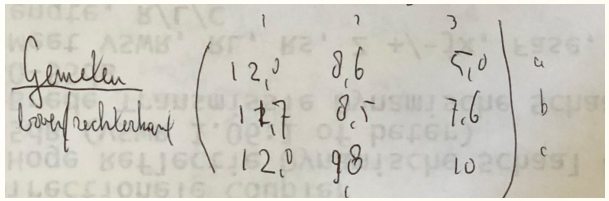
We have applied the measurement method as advised in Chapter 3.3.1 of *).

In our case the circuit network of a 3-by-3 resistor array was used (see below fig.).

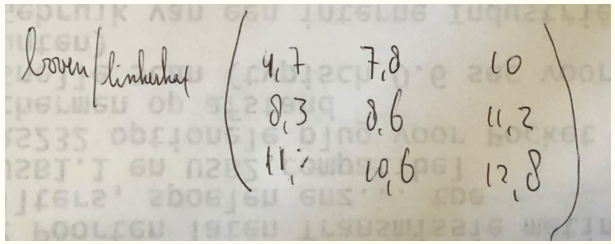


We define in our measurements the columns 1,2 and 3 and the rows a, b and c, as shown in the figure above. It is noted that in our test setup we neglected the very low leakage between a row-electrode and ground. In matrix form, the resistive results are given in [KΩ].

To start of, we have measured the resistance value in rest (with no external pressure) of every crossing R1a till R3c. Connecting the rows on the right side, as shown in this picture, we found:



Connecting the rows on the left side we measured:



Pressing any crossing of the electrodes resulted in a lower relevant resistance, depending upon the applied pressure. Everywhere values as low as about 120 Ω can be reached.

The immediate notable observation was that in most cases the resistance value in rest is varying after applying the pressure.

Based on the symmetry one would expect the same values for all elements in both measurements.

The resistance values R1a…R3c are the resistors between the crossing of two electrodes of the 3x3 array as shown above.

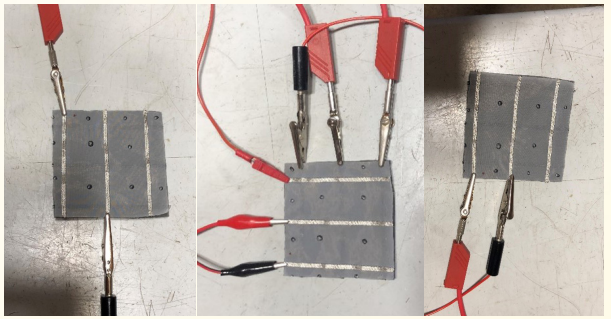
The resistors R12, R23, Rab and Rbc are the relevant resistor values of 2 adjacent parallel electrodes on the same side on the piezoresistive sheet.

The measured values with the connections on the same side are [KΩ]:

R12=7,8 ; R23=7,6 ; Rab=8,2 ; Rbc=7,8

The measured values with the connections on the opposite side are [KΩ]:

R12=9,4 ; R23=8,3 ; Rab=10,9 ; Rbc=10,9



In order to judge the importance of the differences in the observed values we first carried out practical measurements, measured by a mapping matrix:

For the mapping of column1 we apply V1=5V while V2=V3=0V, afterwards measuring Va, Vb and Vc.

For mapping colomn2 we apply V2=5V while V1=V3=0V, afterwards, again, measuring Va, Vb and Vc

For column 3 we apply V3=5V while V1=V2=0V.

This way we obtain a Mapping Voltage Matrix, which can be found in the figure below.

With no external pressure (in rest) we obtain:

$$\begin{pmatrix} 3,6 & 0,9 & 0,5 \\ 1 & 1,6 & 2,5 \\ 1,2 & 1,7 & 2,2 \end{pmatrix}$$

When pressing the fabric at any crossing of the electrodes, the relevant voltage is changing to 4,8-5V, concluding that the mapping of a single pressure point can be done.

After such an experiment, the mapping matrix in rest is changing to values between 0,2 v and 3,7V.

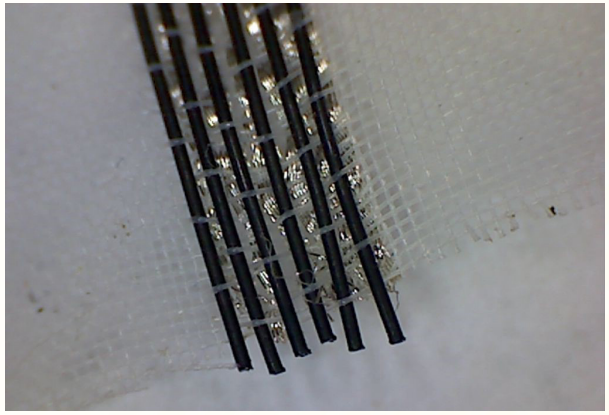
In this case we exercise a pressure simultaneously on 2 different crossings of the electrodes, obtaining on the relevant places a voltage of about 1,6V until 3V.

This means that, when pushing on 2 different places, a place in rest can be interpretated as being pressed. Pressing on 3 different places gives, in some cases, even lower values which causes even more misinterpretation of detecting the point of pressure.

Because of the inaccuracy of the samples we deemed it not possible to use these for mapping. Although, while the detection of a single pressure point was something we could work with, we wanted to continue to look into different possibilities or methods.

Discussion about the fabric

We have tried to investigate the unexpected conclusion further and wanted to share our findings for possible future purposes. Since the resistance will be determined by a proper contact between an electrode and the resistive foil, we tried to examinate the electrodes closer.



The picture above has been taken with a microscope, where it shows that an electrode consists of 2 parts: one on the inside and one on the outside of the fabric. A conductive strip seems to be part of the outside of the fabric. On the inside 6 conductive wires have been woven in the fabric. Looking carefully, we want to point out that it seems that these wires are not contacting by design the conductor on the other side. Added to that, careful measurement of the resistance between a single wire and the conductive strip shows that sometimes the value is infinite, implying that indeed no contact is made.

To work around this, taking care of a proper connection with the measuring equipment of both parts of the electrode was tried, yet this still did not solve the mentioned problem.

The most probable cause of the poor repeatability of the measurement results is a not well-defined contact between an electrode and the resistive foil.

The proof of this can logically be found in the results of the resistance between 2 adjacent electrodes, which was tried as well.

Different values of R12, R23, Rab and Rbc of more than a factor of 2 have been measured (see above).

Since the value is determined by the contact-surfaces we have mildly pressed the sample in order to observe possible improvement.

Changes in the measured value of R12, R23, etc. have been noticed with, in all cases, a minimum value of about 5 KΩ.

Besides using the 3x3 example fabric, we also done some measurements on the 5x5 sample, which we observed was slightly different from the 3x3. This sample has an electrode strip, woven on the inside of the fabric, which theoretically could mean that the contact with the piezoresistive foil had more potential to be conductive.

The measuring results however, as shown below, confirm our earlier conclusion.

We have obtained measurements (in[KΩ]) without external pressure as well as with a mild external pressure.

Without external pressure: R01=14, R12=∞, R23=∞, R34=∞, Rab=150, Rbc=87, Rcd=22.

With mild external pressure: R01=4,7, R12=13, R23=39, R34=98, Rab=32, Rbc=22, Rcd=11.

All values are not, as expected, around 5 KΩ and pressure- independent, which again makes us conclude that in order to apply these samples for contact mapping applications, which is most likely due to the contact-in-rest between the electrodes and the piezoelectric foil in the provided samples being insufficient.

APPENDIX B.1: PROCESSING CODE

Connected with arduino, for PGI prototype:

bewegende_bal

```
// This code draws an ellipse with the Y-position based on the pressure values from Arduino.
// The ellipse leaves a trial and stops when it moves out of the window.
// When spacebar is pressed the ellipse starts over with a new colour.

int Xpos=0;
int x = 0;

import processing.serial.* ; // serial libary

Serial myPort; // create object from serial class

int rawData = 0;
int dataIndex = 0;

void setup() {
  size(1920, 1080);
  background(0);
  String portName = Serial.list()[4];
  myPort = new Serial(this, portName, 9600);
  myPort.bufferUntil('\n');                                    // Arduino ends each data packet with a carriage return
  myPort.clear();                                              // Flush the Serial buffer
}

void draw() {

  // Draw an ellipse with yposition based on force
  Xpos = Xpos + x;
  ellipse(Xpos, height - rawData, 10, 10);
  }

void serialEvent(Serial port){
  String inData = port.readStringUntil('\n');
  dataIndex = -1;
  if(inData.charAt(0) == 'A'){
    dataIndex = 0;
```

bewegende_bal

```
void draw() {

  // Draw an ellipse with yposition based on force
  Xpos = Xpos + x;
  ellipse(Xpos, height - rawData, 10, 10);
  }

void serialEvent(Serial port){
  String inData = port.readStringUntil('\n');
  dataIndex = -1;
  if(inData.charAt(0) == 'A'){
    dataIndex = 0;
  }
  if(dataIndex >= 0) {
    rawData = int(trim(inData.substring(1)));
    println(rawData);
    return;
  }
}

// start moving again when spacebar is pressed and give a new random color
void keyPressed() {
  if (key == ' ') {
 x = 1;
     Xpos=0;
         fill(random(0, 255), random(0, 255), random(0, 255));
}
}

// if ellipse moves out of window start over and stop moving
void outofscreen() {
  if (Xpos>width-5) {
    x = 0;
}
}
```

APPENDIX B.1: PROCESSING CODE

The Human Shape prototype for the data experience user test:

Human_Shape | Links | Rechts

```
/**
 * Load and Display a Shape.
 * Illustration by George Brower.
 *
 * The loadShape() command is used to read simple SVG (Scalable Vector Graphics)
 * files and OBJ (Object) files into a Processing sketch. This example loads an
 * SVG file of a monster robot face and displays it to the screen.
 */

PShape bot;
int kleur = color (255, 104, 0);
  boolean rPressed;
  boolean tPressed;
  boolean yPressed;
  boolean jPressed;
  boolean kPressed;
  boolean lPressed;
void setup() {
  size(1920, 1080);

  // The file "bot1.svg" must be in the data folder
  // of the current sketch to load successfully
  bot = loadShape("Human_outline.svg");
}

void draw(){

  background(240);
  translate(400, 100);
  shape(bot, 200, 50, 700, 700);  // Draw at coordinate (110, 90) at size 100 x 100
  keyPressed();
  links();
  rechts();

```

Human_Shape | Links | Rechts

```
  links();
  rechts();



}
void keyPressed(){
  if(key == 'r'){
    rPressed = true;
    tPressed = false;
    yPressed = false;
  }
  if(key == 't'){
    tPressed = true;
    yPressed = false;
  }
  if(key == 'y'){
    yPressed = true;
  }
  if(key == 'j'){
    jPressed = true;
    kPressed = false;
    lPressed = false;
  }
  if(key == 'k'){
    kPressed = true;
    lPressed = false;
  }
  if(key == 'l'){
    lPressed = true;
  }

}
```

Human_Shape | Links | Rechts

```
void links(){


 if(rPressed == true){
  fill(kleur, 255);
      noStroke();
      rect(590, 400, 40, 40, 20, 0, 20, 0);
 }
 if(tPressed== true){
  fill(kleur, 255);
       noStroke();
       rect(590, 400, 40, 40, 20, 0, 20, 0);
       stroke(kleur);
       strokeWeight(4);
       noFill();
       rect(580, 390, 60, 60, 20, 0, 20, 0);
 }
 if(yPressed == true){
  fill(kleur, 255);
       noStroke();
       rect(590, 400, 40, 40, 20, 0, 20, 0);
       stroke(kleur);
       strokeWeight(4);
       noFill();
       rect(580, 390, 60, 60, 20, 0, 20, 0);
       rect(570, 380, 80, 80, 20, 0, 20, 0);
 }

else{
  fill(kleur,0);
}

//if (keyPressed){
```

Human_Shape | Links | Rechts

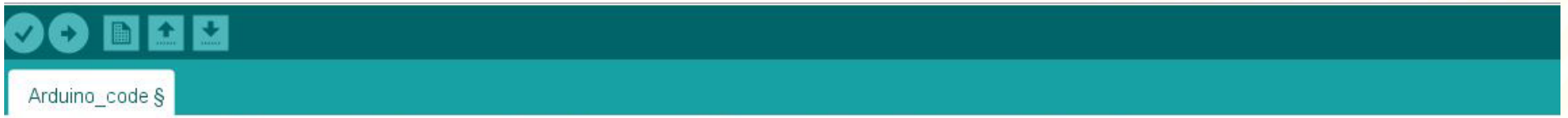
```
void rechts(){


 if(jPressed == true){
  fill(kleur, 255);
      noStroke();
      rect(470, 400, 40, 40, 0, 20, 0, 20);
 }
 if(kPressed== true){
  fill(kleur, 255);
       noStroke();
       rect(470, 400, 40, 40, 0, 20, 0, 20);
       stroke(kleur);
       strokeWeight(4);
       noFill();
       rect(460, 390, 60, 60, 0, 20, 0, 20);
 }
 if(lPressed == true){
  fill(kleur, 255);
       noStroke();
       rect(470, 400, 40, 40, 0, 20, 0, 20);
       stroke(kleur);
       strokeWeight(4);
       noFill();
       rect(460, 390, 60, 60, 0, 20, 0, 20);
       rect(450, 380, 80, 80, 0, 20, 0, 20);
 }

else{
  fill(kleur,0);
}
}
  //if (keyPressed){
```

APPENDIX B.2: ADRUINO CODE

Code for PGI prototype:



Arduino_code §

```
// Code collects the pressure values from the Sefar fabric which is connected to A0.
// It uses a timer to send the values with a delay.
// The code sends the values to Processing with a symbol prefix, A, to indicate where the data comes from.


int sampleRate = 100;                           //samples per second
int sampleInterval = 1000000/sampleRate;        //Inverse of SampleRate
long timer = micros(); //timer
float data = 0;

void setup(){
   Serial.begin(9600);
}

void loop() {
  if (micros() - timer >= sampleInterval) {    //Timer: send sensor data in every 10ms
    timer = micros();
    data = analogRead(A0);                     //get the analog reading
    sendDataToProcessing('A', data);           //Put the data into buffer to sent it out later.
  }
}

void sendDataToProcessing(char symbol, float data) {
  Serial.print(symbol);                        // symbol prefix of data type
  Serial.println(data);                        // the integer data with a carriage return
}
```

APPENDIX B.2: ADRUINO CODE

Code for led and PTL:

Verifiëer

pressure_test

```
const int FSR_PIN = A0; // Pin connected to FSR/resistor divider
const int LED_PIN1 = 7;
const int LED_PIN2 = 6;
const int LED_PIN3 = 4;
const float VCC = 4.98; // Measured voltage of Ardunio 5V line
const float R_DIV = 3230.0; // Measured resistance of 3.3k resistor
int ledOn = 0; //to control the LED.
float val;

void setup()
{
  Serial.begin(9600); // open serial port
  pinMode(FSR_PIN, INPUT);
  pinMode(LED_PIN1, OUTPUT);
  pinMode(LED_PIN2, OUTPUT);
  pinMode(LED_PIN3, OUTPUT);
}

void loop()
{
  int fsrADC = analogRead(FSR_PIN);
  // If the FSR has no pressure, the resistance will be
  // near infinite. So the voltage should be near 0.
  if (fsrADC != 0) // If the analog reading is non-zero
  {
    // Use ADC reading to calculate voltage:
    float fsrV = fsrADC * VCC / 1023.0;
    // Use voltage and static resistor value to
    // calculate FSR resistance:
    float fsrR = R_DIV * (VCC / fsrV - 1.0);
   Serial.println("Resistance: " + String(fsrR) + " ohms");
    // Guesstimate force based on slopes in figure 3 of
    // FSR datasheet:
```

Verifiëer

pressure_test

```
float force;
float fsrG = 1.0 / fsrR; // Calculate conductance
// Break parabolic curve down into two linear slopes:
if (fsrR <= 600)
  force = (fsrG - 0.00075) / 0.00000032639;
else
  force =  fsrG / 0.000000642857;
Serial.println("Force: " + String(force) + " g");
Serial.println();
if(force<10)
{
   digitalWrite(LED_PIN1,LOW);
  digitalWrite(LED_PIN2,LOW);
  digitalWrite(LED_PIN3,LOW);}
if(force>20)
{
  digitalWrite(LED_PIN1,HIGH);
  digitalWrite(LED_PIN2,LOW);
  digitalWrite(LED_PIN3,LOW);

}
if(force>60)
{
  digitalWrite(LED_PIN2,HIGH);
  digitalWrite(LED_PIN1,LOW);
  digitalWrite(LED_PIN3,LOW);
}
if(force>100)
{
   digitalWrite(LED_PIN3,HIGH);
  digitalWrite(LED_PIN2,LOW);
  digitalWrite(LED_PIN1,LOW);
}
```

APPENDIX C: POCKET REFLECTION USER STUDY

Questions:

- Without feeling (hands on the table), do you have pockets?
- Do you know what is in them and can you share that with us? Without feeling your pockets.
- Could you empty your pockets and share with us what is in them?
- Could you tell us why you carry each item?
- How does each item make you feel?
- Reflect, how come you do/do not know what is in your pockets?
- What if you did not have pockets right now, would you still carry all your things with you, and how?
- Do you take pockets into account when choosing an outfit and why?

APPENDIX D: POCKET REFLECTION

FIGURE D: The belt, almost falling apart, after the user study.

APPENDIX D: DATA EXPERIENCE USER TEST

Before conducting the actual user study, a pilot study was performed to practise the role division and tasks to make the set-up of the user study structured, see Figure D.2.. Here too, the Wizard of Oz technique was used to operate the data experiences. There was one interviewer, who explained the study, provided the forms that needed to be filled in, asked the questions and provided sound feedback. There was one observer who took notes during the experiences and wrote the answers of the participants down. There was one person providing the visual feedback and one person providing haptic feedback, see picture D.1 for the belt.

Round	Type of feedback
1	No feedback, belt only (control group)
2	Visual
3	Sound
4	Haptic
5	Visual, sound and haptic

Table D: The rounds and their description

QUESTIONS

Likert scale questions after every round, see figure D.3.

Questions after the experience:

- How do you handle your clothes
- How important are your clothes for you
- Do you think about the durability of your clothes
- Do you think differently about how you handle your clothes after this experience?
- Do you have feedback about the different aspects of the data experience; the visualisation, sound and the ball

Figure D.1: The belt with two pockets on a participant during pilot study

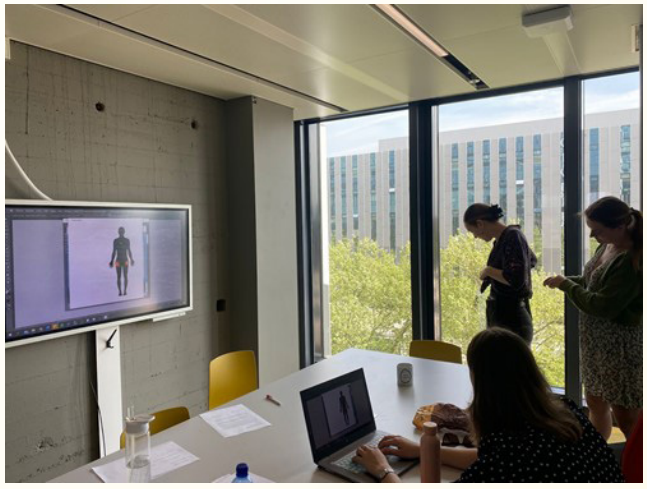


Figure D.2: the participant experiencing the combined round during the pilot study

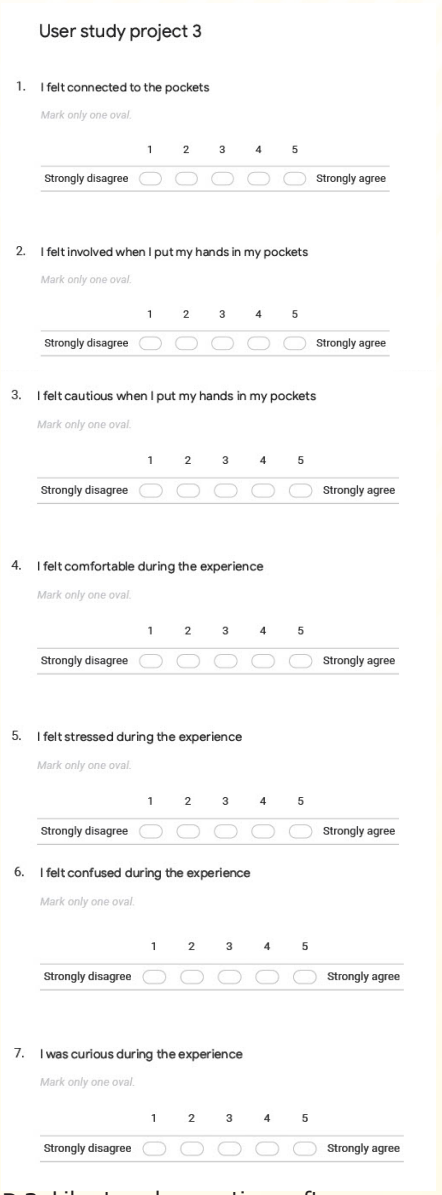


Figure D.3: Likert scale questions after every round

APPENDIX D: POCKET REFLECTION RESULTS

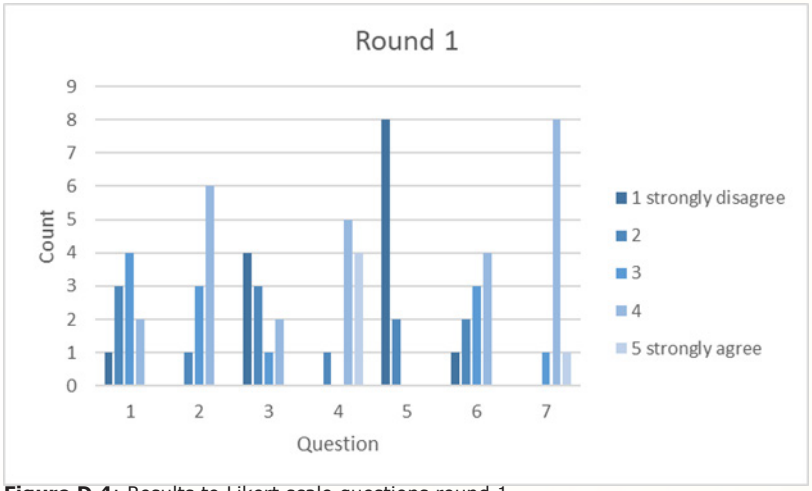


Figure D.4: Results to Likert scale questions round 1.

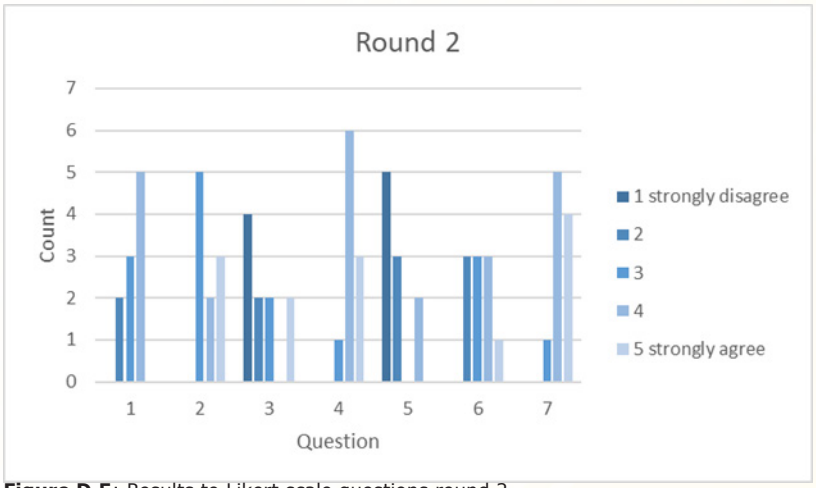


Figure D.5: Results to Likert scale questions round 2.

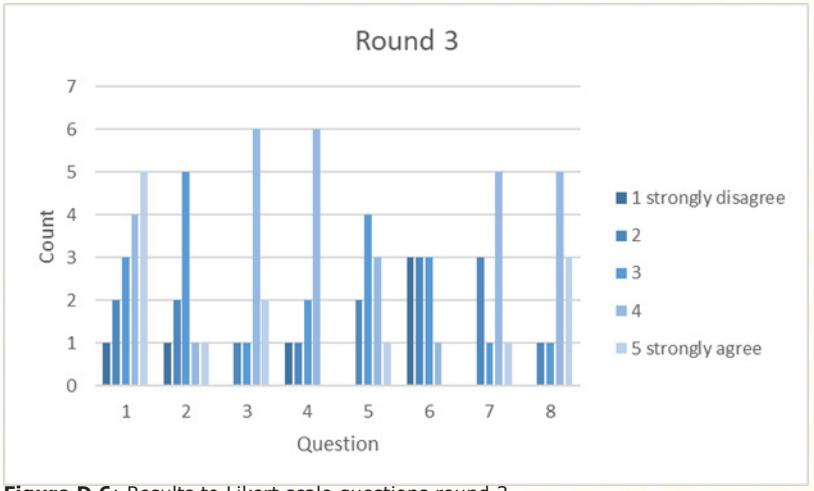


Figure D.6: Results to Likert scale questions round 3.

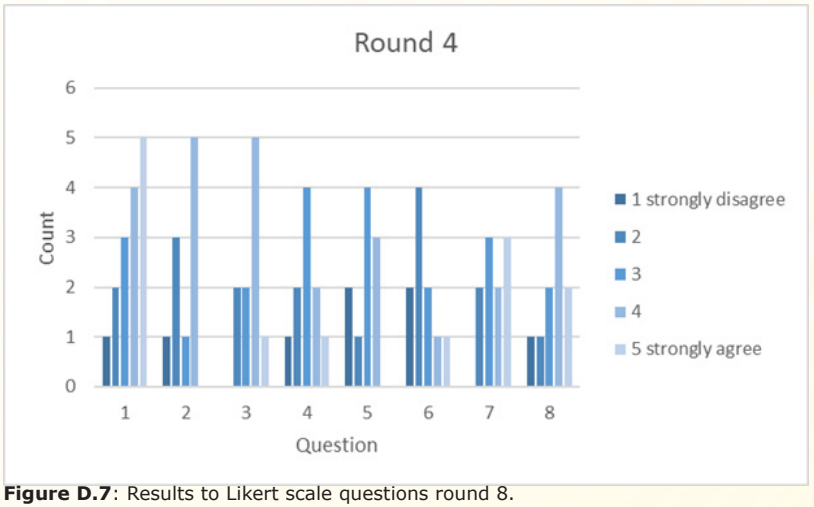


Figure D.7: Results to Likert scale questions round 8.

APPENDIX E: VIDEO

https://demoday-mediaconvert-outputmedia.s3.eu-west-1.amazonaws.com/id85f0fdd13ed1cfbf2c414c648b79ab94/Default/MP4/id85f0fdd13ed1cfbf2c-414c648b79ab94.mp4?X-Amz-Content-Sha256=UNSIGNED-PAYLOAD&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIA5EHC6XOTREYTVAXD%2F20220615%2Feu-west-1%2Fs3%2Faws4_request&X-Amz-Date=20220615T231616Z&X-Amz-SignedHeaders=host&X-Amz-Expires=1200&X-Amz-Signature=825c6500d60ede04d01a8bab4e94b775352791abc7027c762fc27a91fb475f5f

APPENDIX F: ETHICAL REVIEW BOARD FORM

HTTPS://DOCS.GOOGLE.COM/DOCUMENT/D/1UI7O60Y0K-EG4Y0I-YE8JEMLY3LVSVZJ/EDIT?USP=SHARING&OUID=116651017850820147310&RTPOF=TRUE&SD=TRUE