



Flipping Pages: Exploring Physical Workbooks as Reflective Method for Documentation

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ABSTRACT

As first-person perspective methods gain popularity in the field of HCI, discussion about methodologies regarding their documentation has arisen due to the rich, context-dependent data that emerges from these methods. Reflective, multimedia documentation, along with annotation have been widely proposed in design research to address the qualitative and rich properties generated by a design process. In this pictorial, we analyze a workbook employing these practices as design case. It was used to document the design process of Undertone, a device designed for bodily awareness from a first-person perspective. Through identifying a page taxonomy, we reflect on how the practice of annotating supported the design process through continuous reflection practice and emphasizing relations between activities & decisions. We propose layered annotations as an approach to documenting first-person perspective design work that supports traceability of decisions, iterative working, collaboration and documenting the building of a practice.

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CSS Concepts

•Human-centered computing~Human computer interaction

**The first three authors have all equally contributed to this pictorial*

INTRODUCTION

Throughout HCI and design research, designers have developed different methods of understanding the complexity of their projects' design contexts. A particular challenge that emerges in these processes is the issue of documentation [6,27]. In the traditional design practice, detailed documenting, often in design workbooks, allows for storing information for future reference but also supports designers to re-evaluate such information, and the design decisions informed by it when new data comes to light [22]. Effective documentation is also pivotal for collaborative design processes to make sure all designers are up-to-date and on the same page. As such, design documentation embodies a reflective, as well as communicative role [7,23].

The issue of documentation has been a point of ongoing discussion within the design research community [6,27]. The complex and unpredictable nature of design

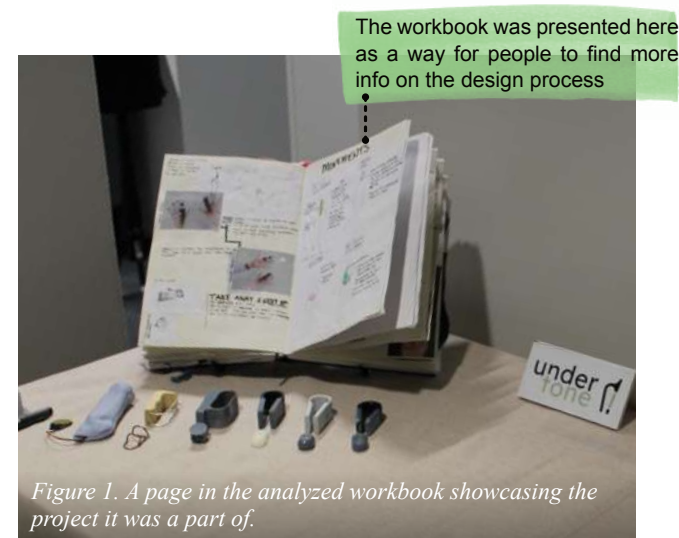


Figure 1. A page in the analyzed workbook showcasing the project it was a part of.

processes means that consistent documentation is often difficult and time-consuming [3], while existing practices in the scientific community also do not necessarily fit the more qualitative and context-dependent practices employed during a design (research) process [6]. This especially holds true for first-person perspective processes, which concern “qualitative research approaches that turn to the researcher as the subject of inquiry” [5]. Although the deep knowledge provided by the first-person perspective is valuable, associated design and research methods (e.g., autobiographical and autoethnographic

design) are often tedious in their data collection and documentation due to their richness. Yet, these practices form the basis for the credibility of first-person research [15]. The nature of the knowledge generated by the first-person perspective causes problems as the data is often multi-layered and interconnected, which can be challenging to document with existing practices and particularly in longer processes [15].

Design process documentation in general has been explored before (e.g. [3,6,22,23]). Some methods emphasize reflective, next to descriptive writing practices throughout a design (research) process [3,16,22], which inherently suits the experience-driven nature of first-person design processes (as illustrated by [1,11,16]). Others focus on enabling ways of multimedia documentation to capture the richness of a design (context) [2,4,6,13]. A common strategy in the documentation of design work is the use of annotations.

Perhaps most notably Annotated Portfolios [6] seek to embrace the interconnectedness of different designs through annotating and collaging pictures and text. Such an approach is based on the existing practice of keeping workbooks in design. According to Gaver and Bowers, when adopting this way of working for documenting design research, the visual nature of an annotated portfolio keeps the documentation closer to the design artifact itself [6]. To convey information accurately, a vital part of any first-person design (research) process is to provide exhaustive data about a design in multiple formats [5,15]. Similar sentiments can be found in [8], which advocates being systematic in these annotations to enable reflective practice while keeping a certain sense of ‘material drift’ in the process, shown through an open-ended exploration of embroidery.

This pictorial describes and reflects on the usage of an annotated workbook similar to annotated portfolios [6]. Rather than using annotations to situate a portfolio of different finished designs, the workbook we analyze in this pictorial was used generatively as a form of supporting consistency, multimodality, and reflective



Figure 2. The design project's result, Undertone, in use; this is one of the aesthetics focused prototypes.

practice. This workbook was created by three designers, the first three authors of this paper, during their development of Undertone, a tool for meditative purposes that supports bodily awareness through amplification of the sound of touching or stroking the body. This design was the outcome of an open-ended design process conducted mainly from a first-person perspective, which aimed for the exploration of personal experiences and closeness to the body. The material-driven [24,25] design process resulted in a meditation tool which supports bodily awareness through amplification of the sound of touching or stroking.

The documentation challenges presented by designing from the first-person perspective prompted this process to call for a creative method of documentation. The designers chose to deal with these challenges by using a physical workbook. This medium was chosen since it fitted the designer's interest in embodied design processes and physical ideation. The workbook does not only narrate the design process but also contains annotations of insights and reflections gained from the explorations; design explorations are represented by pictures, physical samples, and textual descriptions. Certain design decisions, such as (re)defining the project direction, resulted directly from revisiting previous pages and recontextualizing these through new annotations.

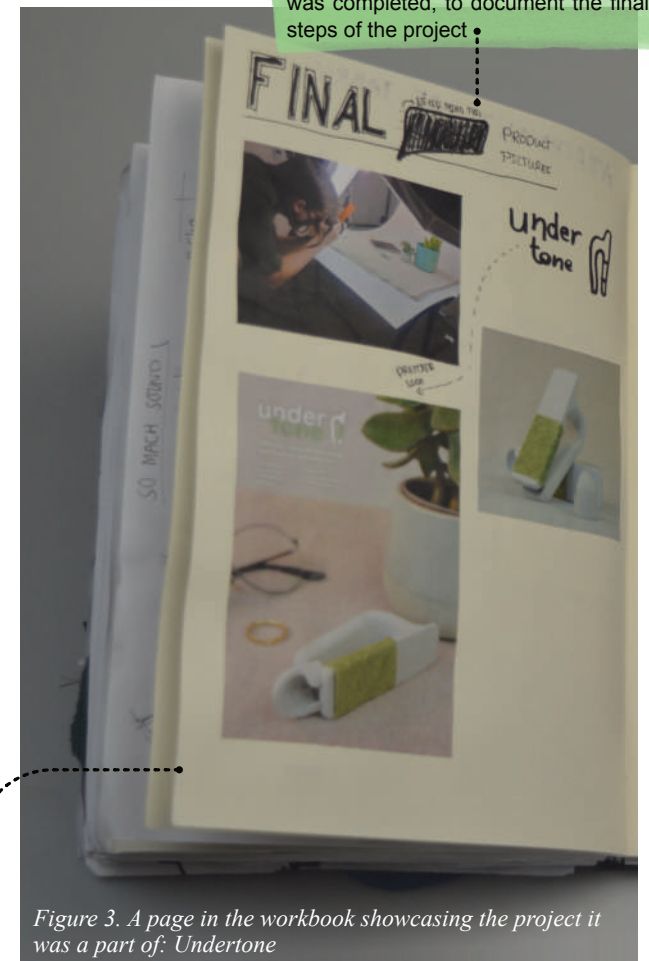


Figure 3. A page in the workbook showcasing the project it was a part of: Undertone

The aim of this paper is to analyze whether this method of documentation is appropriate to deal with the challenge of first-person perspective design documentation and determine in which ways the use of a workbook supported the design process. To determine how the workbook supported the design process, all pages were analyzed and classified into page types. The connections between pages in context of the process were also examined to investigate how revisiting older work influenced design decisions. Through this

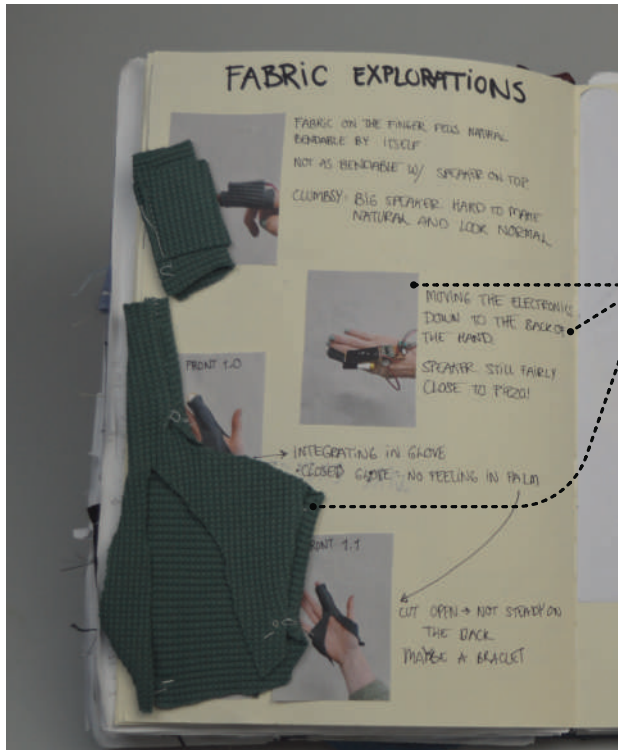


Figure 4. A page in the workbook showcasing multiple forms of media (glove sample, pictures) annotated.



Figure 5. Undertone, depicted in handheld usage.

analysis, four distinct ways in which the workbook supported the design process were identified. Firstly, there is traceability: since pages describing design decisions directly reference older work documented in the physical book, all design decisions can be traced back to where they originated and can be reconsidered without disregarding the original basis for the decision. Secondly, the rigorous annotations and revisiting of the workbook supported the design process by encouraging repetition. Looking at older work and recontextualizing it, using new information, allowed the designers to iterate on their ideas. Thirdly, the workbook allowed for effective collaboration since all designers had access to all information generated by the process and could thus all provide input on design decisions. And lastly the workbook supported building a practice, through motivating the designers to also document how design work was carried out and the effectiveness of those methods.

Through the analysis of the Undertone workbook, we discuss how this approach to documentation can aid first-person research or design methods through traceability, iteration, collaboration, and building a practice. In the next section, we present the analysis of the workbook, followed by reflections on how its use supported the design process. Lastly, we discuss how this use case relates to documentation in first-person perspective processes. As such, this pictorial aims to contribute to first-person design practices by reflecting on how annotated workbooks can be used within a design process that employs a first-person perspective as a generative tool.

THE WORKBOOK

The Undertone workbook is a result of the collaboration between the first three authors in the context of a design project that explored personal experiences and closeness to the body through a material-centered [24,25] and open-ended process [14]. Due to the project's focus on embodied experiences, many aspects of the process were rooted in somaesthetic practices [10,17,26]. The project was approached mainly from a first-person

perspective [5,20,21], exploring embodied experiences in the design process as both designers and users. This perspective gave the authors more concrete ways of designing for these types of experiences than by remaining abstracted from them. The workbook was adopted as a way of continuously documenting the design process to support collaboration and communication between designers. It consists of 120 pages, containing around 400 items. Types of items in the workbook include physical samples, pictures of explorations and prototypes and documentation of the methods used.

The design process, and consequently the usage of the workbook, spanned a period of four months. Weekly feedback sessions were held where the work of a week and possible future directions were evaluated using the workbook. There were no clear agreed upon guidelines for what to document or annotate, and who would do this; generally, the designer that worked the most on an exploration would automatically be assigned to document & annotate. Timing, however, was consistent: items were annotated as they were put into the workbook shortly after each exploration happened, situating the knowledge from each activity inside the workbook. Throughout activities, designers would refer to, reflect on, take inspiration from, point others to, or discuss subjects using the content that was present in the workbook. Several moments in the design process were also organized to collectively look at the past work in the workbook and make sense of it within the project's context at that time, to make sure all designers were on the same line and to discuss future directions.

This process of situating knowledge in a common place and continually reflecting on that helped the design team to get to important tipping points in the design process. Documenting the process through the annotated workbook gave voice to smaller explorations that at the time did not seem important. The documentation ensured that these explorations were not forgotten, and that these could be revisited in the synthesizing phases of the project, directly influencing the direction of new

work. Being new to open-ended processes, it supported the design team in trusting the process when looking back at the work done, realizing that the team did move forward, as each step was documented.

To analyze how exactly the workbook contributed to and supported the design process, each page was examined in-depth, documenting the primary information that is conveyed on each page, how the information is conveyed and how it informed future perspectives. That is, first identifying whether the activities on the page are primarily explorative, inspirational, reflective, or otherwise. Secondly looking into how the activities are documented in the workbook, seeing what the primary medium is in which documentations occur, whether it being pictures, samples, annotations or otherwise. For pictures, these are further categorized into the information and/or exploration displayed. Lastly it was noted down how a particular page informed future perspectives. Both when the page was created looking at the direct influence it has on the next page, but also looking at the page in retrospective and identifying what that specific page meant for the process and project as a whole.

After identifying the primary information that is conveyed on each page, the pages were clustered to identify a page taxonomy. The pages were clustered into four categories: Exploration, Inspiration, Storage and Synthesis. With explorations making up the vast majority of the pages, a further subdivision of different exploration types was identified, defining four types of exploration: Form, Technique, Context and Material. The page types and subtypes are described in the next section.

To understand the relation between the pages, a timeline was created as seen in figure 8. This visualizes the spreads in the book in relation to each other. Under the spread number weeks are separated, making it possible to identify which week specific explorations are from. Below the timeline important tipping points are identified. Spreads referencing back to other spreads are

showed with a solid black line on top of the numbering, and a more detailed annotations of some pages are provided on the top of the overview.

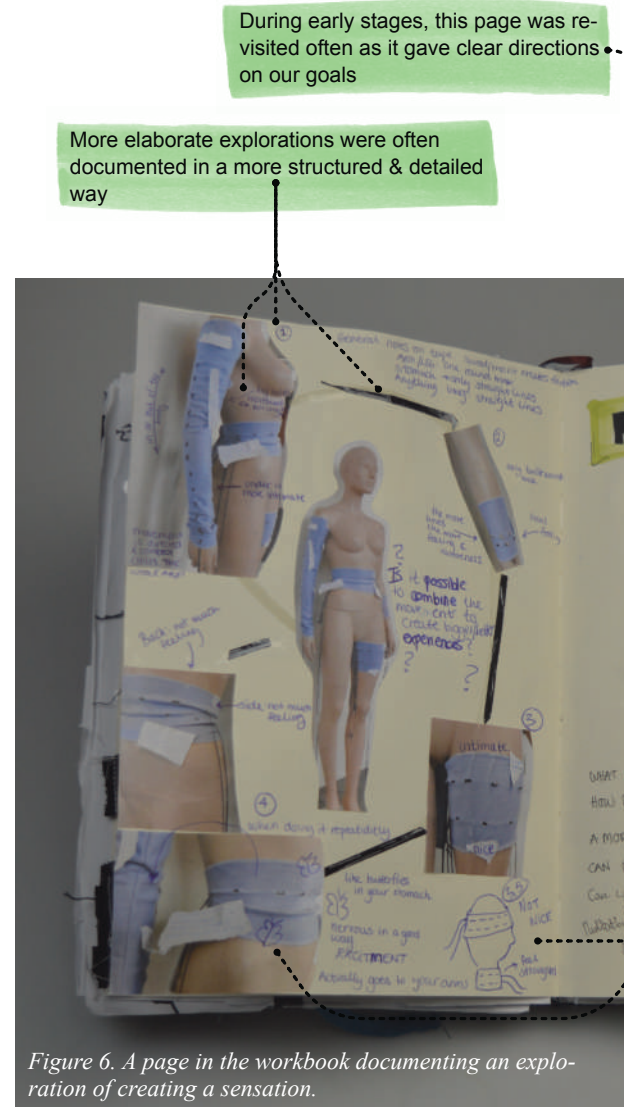


Figure 6. A page in the workbook documenting an exploration of creating a sensation.

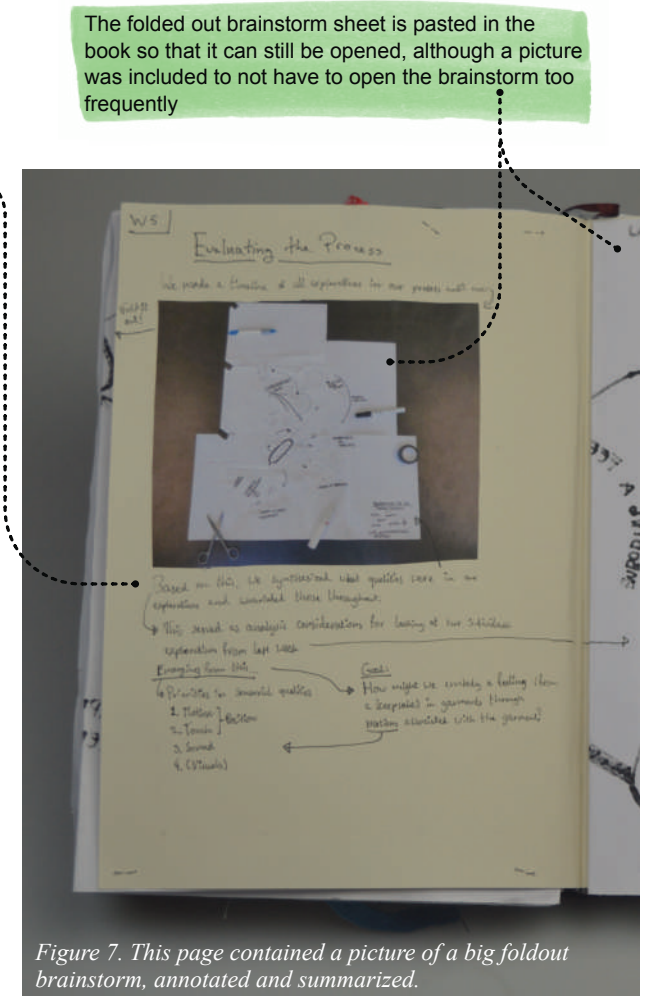


Figure 7. This page contained a picture of a big foldout brainstorm, annotated and summarized.

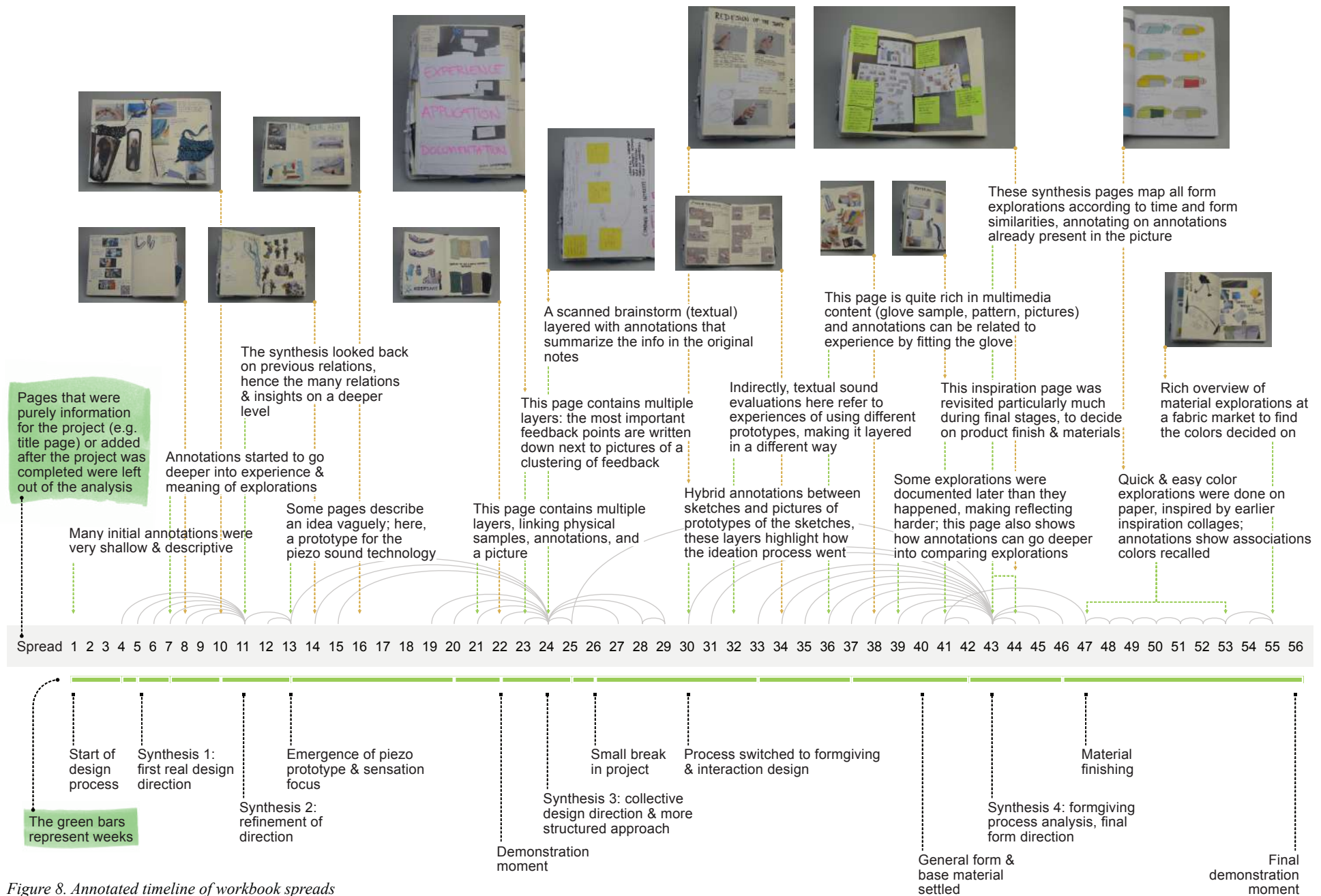


Figure 8. Annotated timeline of workbook spreads

RESULTS

Initial analysis results yielded a page taxonomy for this specific workbook. Determining the different ways in which certain activities were documented allows us to examine how exactly the workbook supported the design process.

Taxonomy

The encountered page types are listed and described below, they consist of the following types: Exploration, Inspiration, Storage and Synthesis. Since exploration pages document such a variety of activities, they are subdivided into four types of explorations: Form, Technique, Context and Material.

Explorations

The workbook documents an open ended, material focused and explorative process, which explains why the workbook inevitably contains primarily exploration pages: 80 pages of the total 120 are exploration pages. Exploration pages document work that was carried out with the goal of exploring a certain form, material, context, technique, sensation, or direction. In Figure 9, one can see a variety of explorations. A context exploration is visible, in which a designer dressed to match the lyrics of a certain song to explore how certain emotions are captured in music and annotated the experience. A material exploration is also visible where audio tape was explored as a material to have recorded audio be part of garments. Tying into this, a material as well as a technique exploration can be seen on the right page where audio tape was combined with a thick yarn using different knitting techniques such as a stockinette stitch and ribbing. Lastly, a form exploration can be seen where a designer annotated their experience of integrating paper into their trouser pocket to make them aware when they had their hands in their pockets.

As the workbook documents different types of explorations, the following section will describe four common types of explorations revolving around either form, technique, context, or material. It is important to note that most exploration pages do not fit into only one of these categories; rather they contain combinations of sections individually focused on one of these four categories, which can be seen in Figure 9.

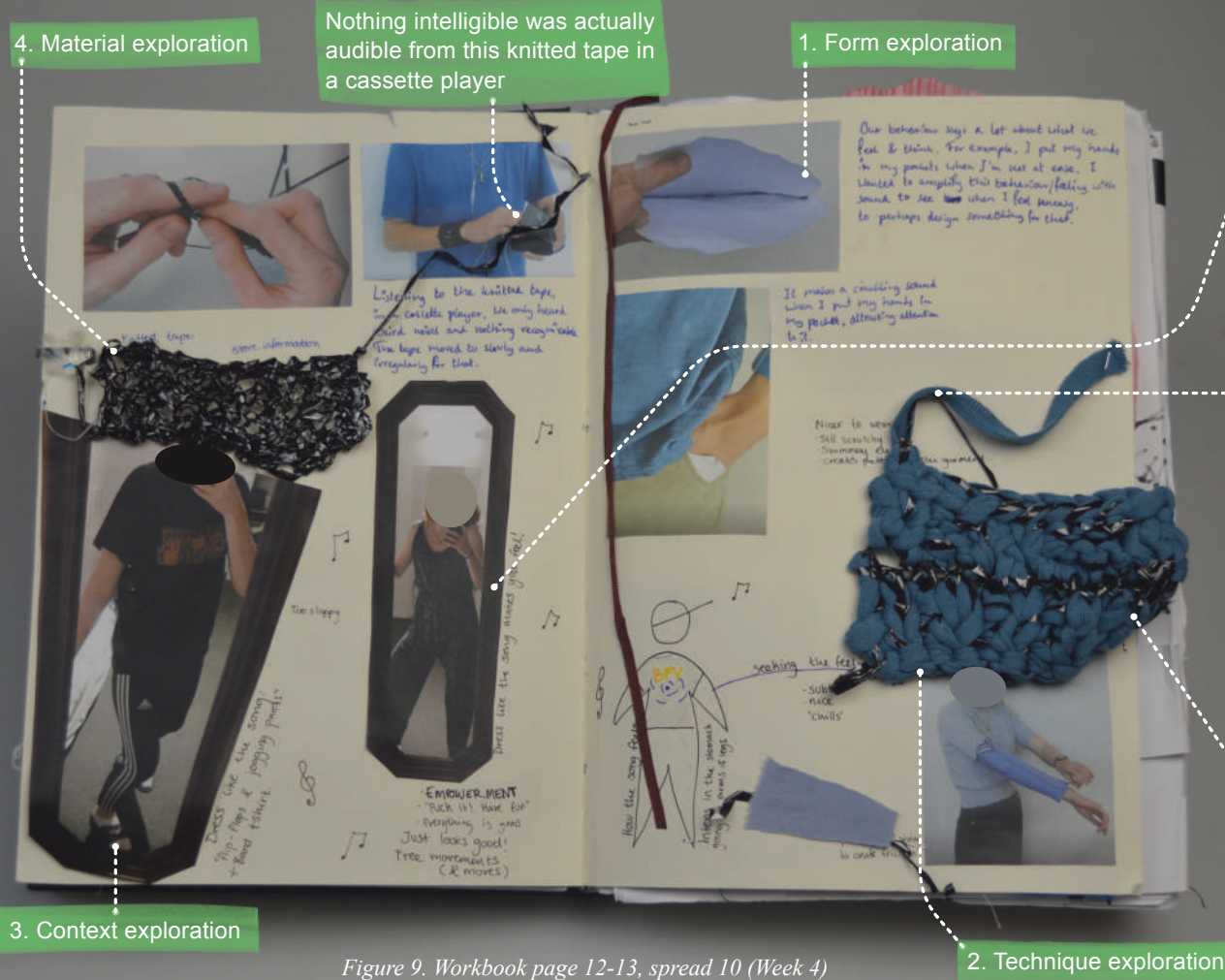


Figure 9. Workbook page 12-13, spread 10 (Week 4)

1. Form explorations

These revolve around the form factor of the device and are often documented using annotated, printed pictures of physical explorations. An example of this can be seen in Figure 10. Here, a designer annotated the feel of different configurations of electronics on the hand which were explored through clay. Another way in which the form was explored, is through sketching. Form exploration pages contain explorations of the physical, multimodal attributes of the design such as sound, placement on the body, texture, and appearance (color, finish, etc.).

Markings for explorations with potential

Exploring placement on the finger to keep speaker close touch point of finger

Foamboard cutout in the dimensions of the speaker, used for quick prototyping

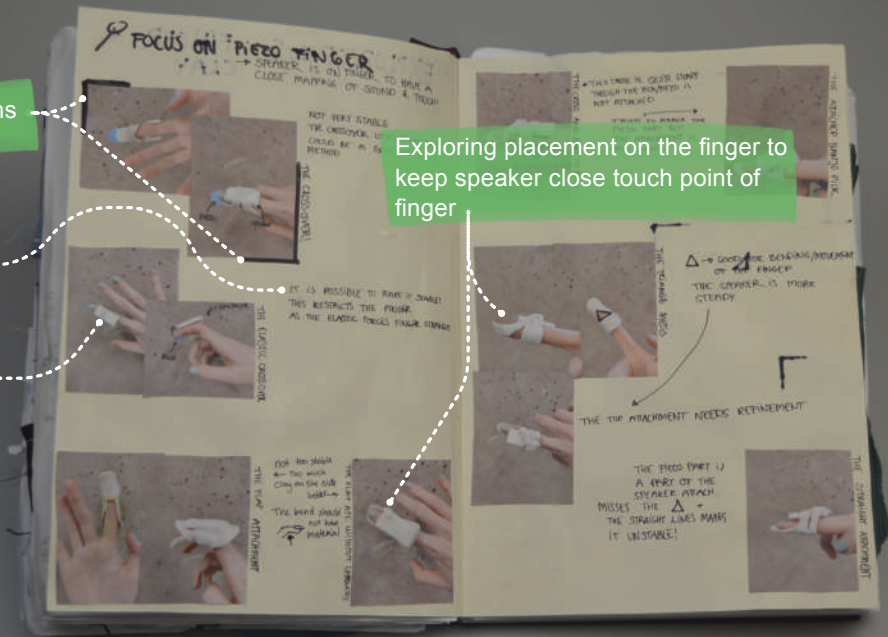
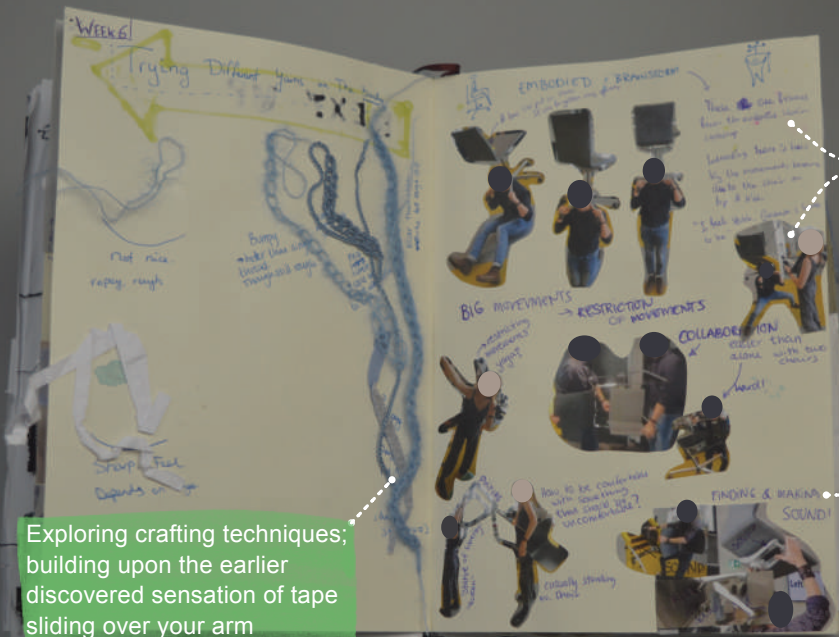


Figure 10. Workbook page 64-65, spread 34 (Week 11)



Exploring ideation techniques; the design team was new to embodied ideation

Since we decided to focus our project partially on sound, we tried to explore this (it was not very successful)

Exploring crafting techniques; building upon the earlier discovered sensation of tape sliding over your arm

Figure 11. Workbook page 24-25, spread 14 (Week 6)

2. Technique explorations

Such pages document different crafting and manufacturing techniques, as well as new design methods. That includes everything from forming clay, knitting, and casting silicone to 3D modeling and 3D printing. This also includes trying different ideation or design methods. In Figure 11, the left page contains a crafting technique where different yarns are crocheted and their difference in tactility was annotated. The right page contains an exploration of an ideation method and is a results of an embodied design workshop. Pictures of the designer interacting with each other through only carrying chairs are annotated with how this affected their social experience.

3. Context Explorations

These are explorations of the context in which the design could be applied. In Figure 12 annotated screenshots from a video can be seen. At this point in the process the design team focused on keepsakes and wanted to explore some of the reasons we keep certain things with us. The video documents the designers explaining their keepsakes to each other and a follow up material ideation that attempted to create garments based on those descriptions. Screenshots of the video are used to show the keepsakes and the resulting ideation and are annotated for clarification. Common elements on context exploration pages include descriptions of experiences and pictures of design context elements.

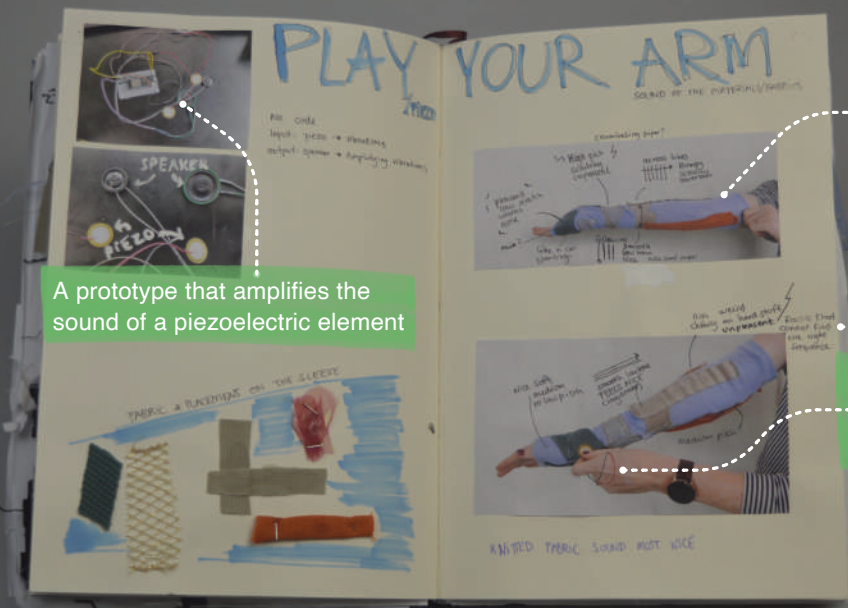
Videos of sessions where the design team explored embodying feelings or sensations into clothing artefacts

The story of a ring which was lost and found multiple times, it reminded of the feeling of family

This was early in the process, where the Undertone concept did not exist yet; clearly visible by the focus on garment like explorations

A QR code was included for others to watch the videos

Figure 12. Workbook page 8-9, spread 8 (Week 3)



A prototype that amplifies the sound of a piezoelectric element

Exploring textures sonically through making a multi textured sleeve

Example of using the prototype to explore the sound of materials

4. Material explorations

These pages investigate the (interactive) opportunities of different materials. These materials can be annotated fabric samples but also annotated notes of electronics and their effect (since electronic components are also considered a material). Common elements include physical materials and pictures of samples. In Figure 13 one can see how the designers annotate not only pictures, but also physical materials and how they sound using certain electronics. The fabrics which were tested upon are also visible on the right page, along with annotations about how they sounded through the electronics, using descriptors such as 'harsh' or 'fluffy'. Crafting technique explorations are closely connected to Material explorations, although for the former explorations the focus lies on how a sample was created rather than the resulting samples properties.

Figure 13. Workbook page 28-29, spread 16 (Week 6)

Inspiration

Inspiration in this design process meant 'all conscious uses of previous designs and other objects and images in a design process' [19:1]. The 10 pages marked as inspiration pages have the purpose of documenting work that was not done particularly as part of this design process but which serves as external input. This work served as direct inspiration for the project. The inspirational pages are used to communicate a certain look, feel or direction the design team strives towards and functions as an either style or mood board. The inspirational pages mostly make use of printed pictures and annotations to convey their message. In Figure 14 & 15, two pages are depicted which contain inspirational material. The left page contains inspiration for different materials and finishes that were considered for the final demonstrator of the project. The right page contains Inspiration for the form of the device, showing images that contain for example thimbles or gloves which were both considered as a possible form.

We preferred a calm, somewhat unassuming look & feel for the device to fit its function

Formgiving inspiration, several kinds of forms due to modularity of device

Using two material finishes for achieving 'home like' friendly aesthetic

Figure 14. Workbook page 80, part of spread 41 (Week 12)

Figure 15. Workbook page 75, part of spread 38 (Week 12)

Inspiration from banjo picks & thimbles, as we wanted the piezo to be usable on the finger

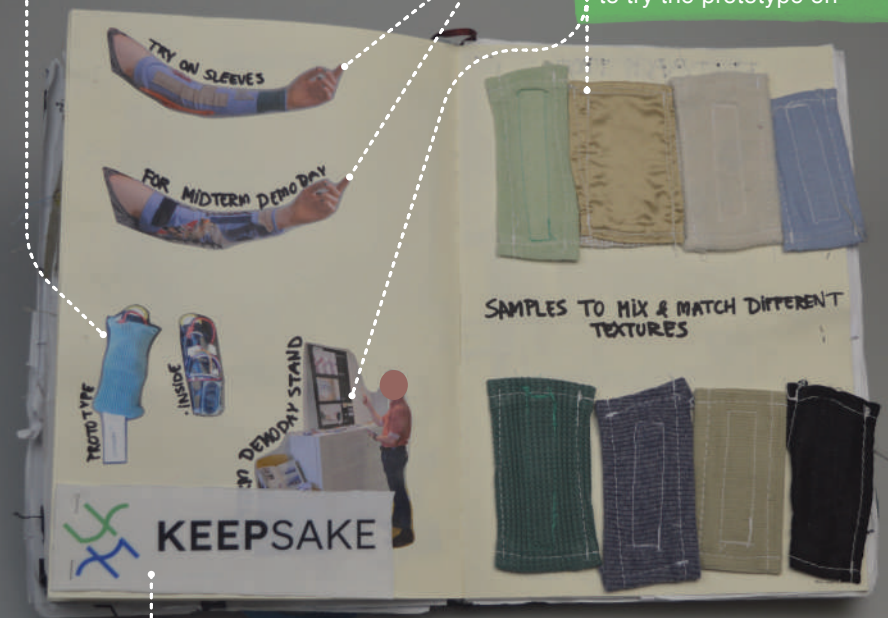
Storage

A total of 5 pages in the workbook are marked as storage pages. This type of page adapts a very narrow definition for the term documentation. Namely, 'capturing and documenting the data generated by the research' [3:428] or in this case design process instead of research. Thus storage pages document work and the process without reflecting on it or creating new insights. These pages are used to ensure all work is stored, even if they provided no additional insights (yet), and for reference for future work. In Figure 16 one can see a documented logo, as well as materials that were used for testing during a demonstration.

For testing and demonstrating the prototype, we made sleeves with differently textured materials sewn onto them to illustrate the way each texture sounds different.

Working prototype, produces sound when piezo is moved over a texture

Several textures for visitors to try the prototype on



Initial name and logo of the product, inspired by the starting point of the project

Figure 16. Workbook page 40-41, spread 22 (Week 8)

Synthesis

Synthesis pages revisit and review work done over a longer period and combines it to make certain decisions about the design and the process. An example of this is the synthesis page in Figure 17. Here all prior prototypes, made by different designers, both pictures and physical prototypes are mapped out to support decisions for the coming prototype. This page was used by the designers to present their insights about their own prototypes to their teammates and come to a joint decision about the form of the device. These decisions and insights were annotated on the page. The annotations are layered, meaning they build on previous annotations, since annotated pieces are re annotated and placed in context of work done before and after. The 14 synthesis pages in the workbook mark important tipping points in the design process. This can also be seen in the timeline (see Figure 8: some pages can be seen that have connections to a lot of other pages). These pages are almost exclusively synthesis pages.

GENERATIVE DOCUMENTATION THROUGH LAYERED ANNOTATIONS

Studying the workbook's taxonomy allows us to explore the way in which pages are connected and how the workbook supported the design process. Particularly the Synthesis pages are notable; as the storage, exploration, and inspiration pages are summarized in and design decisions are noted down on them. Synthesis pages 'revisit' and review work to motivate decisions about the design or the process. They provide a snapshot of the design team's current understanding of the design and the process. After defining these page types, four distinct aspects which this method supported, were identified: Traceability, Collaboration, Iteration and Building a Practice.

Traceability

Documenting all work and revisiting (and referencing) the work used to make certain decisions supports traceability within the design process. Since all design material is gathered in one place and design decisions are documented consistently, this information is directly referenced and accessible. It is always possible to go back to certain decisions and re-evaluate them. Every decision in the design process can be traced back to the exploration which triggered it and old decisions may be re-evaluated using new information, while still properly considering the reasons the decisions were made in the first place. Traceability can be a challenge within first person perspective design work since the designer uses their own knowledge, they are prone to make decisions in their head without being mindful about the decisions or noting it down. This form of workbook counteracts that tendency by motivating designers to document everything. An example of traceability can be found in Figure 17 where decisions about the form of the device are traceable back to the form explorations documented on another page (see figure 10). The first-person perspective insights noted down on these pages were used to come to a joint decision about the form of the device.

Especially relevant in early stages of a project

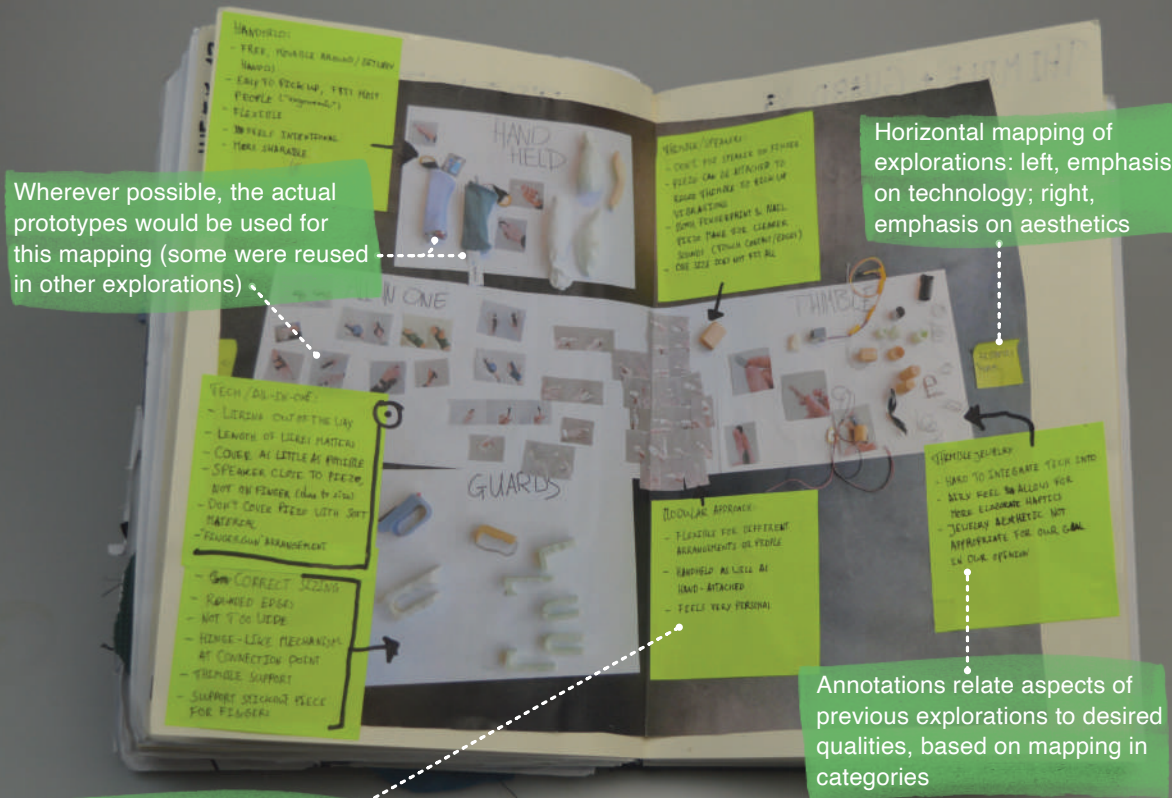


Figure 17. Workbook page 90-91, spread 44 (Week 13)

Iteration

Revisiting work using synthesis pages supports an iterative design process by summarizing the current state of the design to identify what is still lacking and what a subsequent iteration should focus on. An example of iteration motivated by a synthesis page can be found in Figure 17, where all form explorations are summarized and reannotated to determine what the next iteration of the form should look like and what still needs to be worked on. The workbook also motivates designers to iterate on their fellow designers' work, as they read other people's annotations, they might see unexplored areas or identify untapped potential. Synthesis pages are a way for the designers to record and evaluate how they are currently viewing the design and how they must move forward in a certain way.

Collaboration

During first-person design work carried out in teams, bridging the gap between personal experience and a collective design is challenging. The workbook supported collaboration in and transitioning towards working from second-person perspective by allowing the designers to experience their team's perspective. A physical workbook allowed for physical samples to be pasted in the book and exist next to annotations detailing insights that were gained from it. An example of this can be seen in Figure 9, where samples as well as personal experiences are pasted in the workbook and annotated. Reading other designer's annotations on explorations and experiencing those explorations through a variety of media sparked conversations about where potential new designs and made it evident when not all designers were on the same page. Additionally, the synthesis pages also served for a way for designers to discuss and agree upon the direction of the project: first on where they find themselves in the design process currently, and secondly where they are headed, making sure everyone is on the same page, both metaphorically and literally. In a different sense, it made collaboration quite explicit, as differences in handwriting and the situated explorations were a visible mark of having worked on something.

If we didn't document it, only the person who did it knew what happened and what we gained from it

The process of documenting did form an extra task to divide within the team, which needed guidelines for when, how, and by whom documentation, annotation, and reflection would be performed. These mostly emerged during practice: the person who worked most on an exploration would document it immediately after finishing it; others would often add to it during this process, giving feedback when asked by the documenter, or afterwards, by annotating themselves. Occasionally, knowledge would be lost if a designer did not document an activity, as this process was mostly based on individual responsibility in teamwork context.

Building a practice

Everything from the design process is documented in the workbook. This includes the way in which the process itself was carried out and reflections on the design methods that were applied. This information might have been omitted in more traditional report structures. Documenting and reflecting on the process in real time and in very close proximity to information about the design itself allowed for the designers to be more conscious about the effects of certain design practices on the design and the process. Particularly in Figure 11 (right), an ideation method is explored and the annotations document not only the contributions to the project but also the strengths of the method. Due to this fact, especially in educational contexts a workbook may allow designers to view which type of design process fits their vision and professional identity more clearly. Moreover, in design work carried out from the first-person perspective it is important to realize and document how the process influenced the results to communicate findings effectively, especially in collaborative contexts. The consistent practice of annotation and reflection that emerged because of documenting in the workbook gave structure to an otherwise more loosely organized first-person perspective project, as well as more experiential understanding as experiences were documented over a longer period of time; two aspects mentioned as crucial for first-person methods in design research [15].

Specifically important to our process, as we were dealing with bodily experiences

DISCUSSION

The workbook is a result of a four-month long, open-ended design project, mostly carried out through a first-person perspective by the authors. The workbook is an extension of the concept of Annotated Portfolios [6], and was used to document and express feelings, thoughts and experiences through annotated pictures, material samples, sketches, and videos. The workbook turned feelings and thoughts not only into words, but more importantly into visuals and tactile experiences. Documenting physical elements as they are felt or shortly after, made the design team reflect, elaborate on, and clarify their own understanding of the design. This confirms prior assertion about multimodal documentation of design processes [2,4,6,13]. As the visual and physical elements are the primary drivers behind the documentation, supported by annotations, it is easier for the design team to get back into the thoughts and mindset of the time the pages were created. The workbook's purpose is manifold in this regard. Firstly it has personal value to the designers to structure their thoughts and insights, similar to how reflective journaling might function [3,16,22]. Secondly it is a collaborative mediator within the design team to share insights and together reflect on where to go next. Third it is used to share the process to get feedback and show specific explorations leading to specific decisions

Traditional design projects tend to be planned, executed, and later reflected upon [9], but the workbook motivated the designers to reflect continuously and to regularly take a step back and evaluate the process as a whole, tying into movements motivating designers to reflect more regularly [12] and enabling the documentation itself to become generative. The workbook was updated continuously and documents every step and every exploration. Through consistent and continuous documentation, a workbook allows designers to revisit explorations and reflect on work, making informed decisions on how to proceed. This makes the documentation generative, as annotation and revisiting are directly influencing the process.

We set ourselves the unofficial mission to fill as many pages in the workbook as possible

As every member of the design team wrote their own annotations, everyone was invested in the workbook. In between updating the workbook, explorations were carried out which were annotated later. Most often, the explorations were not annotated as they were performed, though there were always an inner dialogue and sometime outer dialogue guiding the explorations. These dialogues are revisited as the explorations are annotated in the workbook. This also means that the annotations are not necessarily an exact summary of the dialogue, but that they are a summary of explorations, ensuring reflection on the process.

It was never predefined when and how the designer should annotate their explorations, though there was a consensus that explorations should be documented and annotated to make them meaningful. This also means that the workbook itself is just as explorative as its content. Just as explorations happened iteratively, building on the explorations done before, the way these explorations were documented also adapted and grew over time. In different stages of the project the workbook fulfilled different purposes and the annotations within the book adapted to this.

Physical workbooks make sense

The workbook is a tangible object, which is why it has other properties, possibilities, and limitation than a digital tool for documenting the same work. One such aspect is the natural chronological order of the documentations. The physical format is limited, meaning that the order elements are placed in is fixed by using glue and annotating using pens & markers. Changing the order of the pages or documenting a-chronologically are cumbersome, making it a driving factor to incorporate updates on a daily or weekly basis.

It is also important to note that the workbook is a result of good teamwork. The whole design team was engaged in the project and everyone found the workbook an important medium for documenting the process. If team members would not be equally invested in using the workbook and did not motivate each other to document

their work, the resulting workbook would be different and perhaps less effective. The growing size was also a motivational factor for the design team to use and keep using a physical workbook. There was no reason, or easy way, to throw out earlier pages. All the work documented was remembered & valued later on.

The physical workbook is always a work in progress and the pages are a snapshot of the thoughts and explorations created that day. This makes the workbook messy, as new explorations might be results of explorations done several pages back. As everything is documented, it is possible to trace everything back to its origin. However, the messy process and the messiness of the workbook makes it harder to find the direct references to earlier pages, especially when there are many pages between reference and origin. Dynamic hyperlinks in a digital documentation format could be considered more 'traceable' in this regard; nevertheless digital documentation methods are more likely to lack the visceral nature of physical annotations. Traceability in a digital format might mean a link to a picture of an exploration and a description of the decision process, traceability in the workbook means being able to go through the designer's experiences, from beginning to end, which lead to the decision. It could be argued that this is also possible using digital version control. However in digital programs older versions are often purposefully hidden behind a menu and thus will be easily overlooked. In a physical workbook older work is always present, almost forcing itself to be considered during decisions. The physical nature of the book also makes it possible to see how much time different explorations have taken. Some explorations are fast and small, and the annotations are just that. Other explorations have more depth, which can be seen in quality of both the pictures, sketches, and annotations. The physical nature of the workbook conveys a plethora of metadata about the explorations documented within.

The workbook was also used to store and annotate samples, especially garments and fabrics. This gave meaning to the material-centered process, as the

materials also were the main focus of the documentation. Most material explorations and samples are found in the in the beginning of the workbook. As the product became a solid handheld device, it was harder to store the larger prototypes. These were instead stored next to the workbook and photos of the prototypes were taken. Because the design team focused so much on materials in the beginning of the project, this was also a focus when annotating the pictures of the prototypes maintaining the material-centered nature of the project. However, due the lack of material samples, the tactile properties of the prototypes are harder for outsiders to understand when only seeing the workbook.

The same goes for a video created to document stories at the beginning of the process. Documenting and annotating this work in the workbook were limited to a few snapshots of the video, where the main insights were annotated. No sound or movement was converted to the workbook, though the pictures and annotations should bring some of the atmosphere and mood of the video into the physical pages. Later in the project the design team also found it hard to document sounds. This was a limitation the design team did not immediately find a fitting solution to. Trying to draw wave-graphs or describe sounds using adjectives such as fluffy, warm, piercing, or cold were methods that were tried out but did not convey the richness of information. A way around this, could be to put the electronics (a piezo, amplifier, speaker, and battery) in the book, making it possible to listen to the materials when re-visiting the pages or to provide links (e.g. in the form of QR codes) to relevant media as was done for the video in the workbook. Although multi-media experiences can be challenging to document in a physical workbook there are ways to deal with those challenges, as exemplified by the solutions presented, whereas moving to a digital solution undermines some of the key strengths of this documentation method argued for earlier in this section.

As shown here, the workbook is a physical medium for sketches, samples, and pictures. Where digital methods of documentation allow for elaborate, dynamic and

complex documentation [18], the workbook invites smaller annotations. This type of annotation motivates immediate and localized documentation of insights. Experiences are documented in the moment and can be reannotated for deeper insights later. In this regard the physical nature of the workbook enables the support of repetition mentioned in the results section. Moreover, physical annotations force a certain amount of repetition since content cannot be digitally copied. Physical elements need be physically copied over, annotations and all. This was done for example through taking and printing a picture of older work and reannotating it. In a digital environment one might simply copy over the original content and leave annotation behind, or, even worse, edit the original content with new insights, effectively destroying old work. Using a digital tool with version control, this could be accommodated for, though the designer should make sure to always revisit the older version in order to identify when information is added. In a physical workbook it is much more effortful to edit previous work, so work is much more likely to be copied rather than edited, and annotations are more likely to be layered rather than replaced, supporting not only repetition but also traceability.

The moment-to-moment nature of the workbook also makes it hard to read it from one end to the other – but this is not the purpose. The purpose of the workbook is simply to document daily exploration and knowledge, making it possible to reflect on the work during the process to help progress and improve understanding of the work done. Short, layered annotation also means the workbook is most easily read and understood by members of the design team and cannot by itself tell other people the level of detail needed to understand the entire process or final design. This is not the intention of using a workbook. Current literature such as annotated portfolios [6] or examples on documentation methods for first person perspective HCI research [5,15] focus on documentation for presentation or data analysis purposes. This pictorial focuses first and foremost on documentation as a tool to support designers and the

design process and illustrates an example of how such a method might look.

This workbook is a result of a project mostly done from a first-person perspective, meant for the design team to describe their understanding and thoughts on design activities & explorations, and is not meant for others to understand or care for. As the project behind the workbook was explorative, most pages reflect this. If others are to take from our experience and make a workbook themselves, they might find other types of pages and ways of utilizing them differently. However, we believe that working closely with a workbook through continuous & consistent documenting and revisiting for reflection supported this design process will elucidate new meaning.

CONCLUSION

This paper has illustrated the use of a workbook during a material-centered and open-ended design process. After analyzing the pages of the workbook in terms of how and what they documented and identifying the relations between the pages, four distinct aspects in which this workbook supported the design process were identified. Namely the workbook supported traceability through continuous documentation, iterative design work through synthesis pages, collaboration through evocative, multi-modal documentation and the building of a practice through documented reflection on design methods. The workbook's strengths are exemplified by its physical nature and many of its unique advantages would be negated when replaced by a digital tool. This calls for those designing digital design documentation tools to play into the strengths of the digital and leave continuous, experience focused documentation to pen, paper and everything that fits between the two pages of a workbook. Although page typology may vary depending on the type of design process, we believe keeping a workbook in which the process is consistently documented and in which older work is revisited, is uniquely suited to document a design process due to its continuous and reflective nature.

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