Hans Jørgen Steinkellner Engstad

Web Application for Generating Customized Knitted Clothing Items

Exploring Interactions and Visualizations in Configurators for Customized Knitted Clothing Items

Master's thesis in Computer Science
Supervisor: George Adrian Stoica
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Abstract

Customization of products has become increasingly more popular through on-line e-commerce shopping. Orders ranging from shoes, clothing, electronics, and even cars can be customized using online product configurators. Dreamknit is a business that offers an online configurator for customizing knitted sweaters. Un-like regular e-commerce sites, Dreamknit only sells a recipe for a sweater design, where knitters will have to knit the sweater themselves.

This thesis investigates visualizations and interactions in Dreamknit's online configurator. The design and creation strategy was used to develop a functional prototype, and two usability tests with eye-tracking and one design review were conducted. Dreamknit's existing website was used as a basis, where functionality for adding structures, like braids and twists, to sweaters were implemented.

Different types of interactions for modifying structures were tested, and direct manipulation was preferable among users. Using drag for adding new structures but also modifying existing structures was desirable. However, one feature with a low degree of freedom, resizing structures, did not show a clear preference to-wards direct manipulation, suggesting that direct manipulation becomes more favorable as the degree of freedom increases.

Two primary visualizations were tested, one splitting the sweater into several primitive shapes and one using more realistic sketched images. Surprisingly, the level of realism in the primitive visualization did not receive much criticism from users, and supporting the proper placement of elements was more important than a high level of realism. Furthermore, users would immediately gaze towards the visualization after changing an option, making the visualization a powerful feed-back mechanism.

Sammendrag

Tilpasning av produkter har blitt stadig mer populært gjennom netthandel. Alt fra sko, klær, elektronikk og til og med biler kan tilpasses ved å bruke online produktkonfiguratorer. Dreamknit er en bedrift som tilbyr en online konfigurator for å tilpasse strikkede gensere. I motsetning til vanlige e-handelssider, selger Dreamknit kun en oppskrift på genserdesign, der strikkere må lage genseren selv.

Denne oppgaven undersøker visualiseringer og interaksjoner i Dreamknit sin online konfigurator. En funksjonell prototype ble utviklet, og to brukertester med eye-tracking og ett design review ble utført. Dreamknits eksisterende nettside ble brukt som utgangspunkt, hvor funksjonalitet for å legge til strukturer, som fletter og tvister, til gensere ble implementert.

Ulike typer interaksjoner for å modifisere strukturer ble testet, og direkte manipulasjon var å foretrekke blant brukere. Det var ønskelig å dra for å legge til nye strukturer, men også for å modifisere eksisterende strukturer. En funksjon med få alternativer, endring av bredde på strukturer, viste imidlertid ikke en klar preferanse for direkte manipulasjon, noe som tyder på at direkte manipulasjon blir mer fordelaktig ettersom antall alternativer øker.

To primære visualiseringer ble testet, den ene delte genseren i flere primitive former og den andre brukte mer realistiske skisserte bilder. Overraskende nok fikk ikke den primitive visualiseringen mye kritikk i forhold til realisme fra brukerne, og å støtte riktig plassering av elementer var viktigere enn et høyt nivå av realisme. Videre ville brukere umiddelbart se mot visualiseringen etter å ha endret et alternativ, noe som gjorde visualiseringen til en gunstig tilbakemeldingsmekanisme.

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Chapter 1

Introduction

The thesis begins with an introduction to the motivation for doing the research, followed by the project scope, where the research questions are presented.

1.1 Motivation

This section presents the motivation behind this project. First, the concept of mass customization and product configurators are discussed. After that, an explanation for why Dreamknit's website is a good candidate for studying online product configurators is given.

1.1.1 Mass Customization

Davis proposed the concept of Mass Customization (MC) in 1987, which is the idea of tailoring a product to an individual but still having the benefits of mass production [1]. Producing highly customized products at the same speed and cost as standard mass-produced ones seems like a paradox but is enabled by technological advances. Even when Davis wrote Future Perfect in 1987 [1], mass customization had started to enter the apparel industry. For example, one could order tailored t-shirts at the same price as standardized ones but with a longer wait time, as the manufacturer had to ship the t-shirts from Hong Kong. Because more technologically advanced factory machines could stitch together t-shirts of different lengths and sizes without downtime between different specifications, it was possible to offer highly customized t-shirts at no extra cost. Davis predicted this trend would continue to grow across various products and services, like house construction, furniture, and automobiles.

However, to satisfy customers' needs, customization does not need to be at the factory level. It is also possible to mass-produce standardized components that are combined into one customized product. The automobile industry is an excellent example of this, where one can customize different aspects, like color and extra equipment, which are then combined into a bespoke car. One way of explaining this approach is, "Every buy is customized, every sale is standardized." [1] This

way, customers buy the product with customization freedom, but the production is relatively standardized, as different standard components are assembled to form the final customized product.

The adoption of MC in practice has not reached the potential that Davis envisioned yet [2]. Zhao *et al.* found that website design plays an essential role in customers purchasing decisions, and poor usability experiences could be one reason for the lack of adoption [2]. A product with many options would therefore require a more capable interface to handle the added complexity. Piller *et al.* coined the term "Mass Confusion" in 2005 [3], which happens when the user is presented with so many options that they do not know what to choose. Improving user experience can make it easier for users to deal with the added complexity of customization and, therefore, possibly boost the adoption of MC.

1.1.2   Product Configurators

Developing product configurators with high usability would remove at least one obstacle for MC adoption, and guidelines for creating such configurators could be useful. Streichsbier *et al.* examined 126 web-based product configurators across the apparel, automotive, and electronics industries [4]. Unfortunately, these configurators had few similarities, and only general design elements, like the logo, had a standard placement on the page. Even configurators within the same industry could have substantial differences. Streichsbier *et al.* did provide some guidelines but also suggests involving users, for example, through user-testing to refine their recommendations [4]. For a new product type, it is likely that involving users can significantly improve the design's usability, as simply copying other configurators can be challenging.

Yavari *et al.* also attempted to find guidelines for MC toolkits and focused mainly on positioning and layout of User Interface (UI) elements [5]. The study gathered self-reported data among 30 Masters and Ph.D. students at Loughborough University. As a result, several features related to product configurators were gathered and ranked. However, this approach has limitations, and they suggested further research based on observation and user testing on various products.

Abbasi *et al.* performed a case study with 111 participants and found, among other things, that standard widgets should be used in configurators whenever possible [6]. They provided high-level guidelines, but more specific guidelines for custom widgets were not presented.

Rogoll and Piller performed a study of 12 product configurators and found visualization in configurators to be an essential part of usability [7]. Furthermore, in a virtual environment, the customer will rely heavily on visualization to get a feeling of the product. However, they do not propose specific guidelines for designing such visualizations.

1.1.3 Customized Knitting

Dreamknit is a business that provides a product configurator for customized knitted sweaters. They started their business because they could not find similar products on the market at the time. Customers of Dreamknit purchase a knitting recipe for a custom-made knitting design. A sweater is designed on their website before a recipe is generated, providing higher customization freedom than traditional knitting recipes. Studying the usability of Dreamknit's configurator, especially regarding visualizations, could provide valuable results for the knitting domain and potentially for other domains.

1.2 Project Scope

This project began in August 2021 and ended in June 2022. It was a collaboration with a startup company called Dreamknit and between two students that produced two separate Masters Theses. More details about this collaboration is found in Section 4.3. Dreamknit already had an existing website implementation, which put some limitations upon the project. The technology stack was already determined, as any prototype would have to be integrated into Dreamknit's React application.

Making the functional prototype compatible with Dreamknit's existing application was desirable but not a top priority. Dreamknit would continue developing its website in parallel to this project. Therefore, keeping up with any changes alongside the project would bring extra overhead to the project and was not prioritized. The development of the functional prototype was primarily kept inside an isolated module, thereby allowing for easier integration by Dreamknit in the future. This way, the prototype would not depend upon changes to their existing code, which would likely change. The prototype implementation is discussed further in Section 5.5.

Dreamknit's website was expanded by adding functionality for adding structures to the sweater design. The collection of structures was kept to two: braids and twists. Adding more types of structures were considered out of scope for this project. Furthermore, the placement of braids and twists was constrained to be vertically at full height. One could imagine having a braid that does not go from the top to the bottom of the sweater, but this was not prioritized. Additionally, horizontal structures were not supported by the prototype. Using the same principles for braids and twists at full height, one could expand to support different types of structures in the future.

1.2.1 Research Questions

Toolkits for creating custom widgets for product configurators are challenging to create since the custom nature of the widget will determine how the design of the widget should take shape. This thesis aims to investigate product configurators in

one specific domain, namely the customization of knitted sweaters. RQ1 focuses on interactions, while RQ2 focuses more on visualizations in product configurators for customized knitted clothing items.

RQ1: What types of interactions are suitable in configurators for customized knitted clothing items?

RQ2: How can visualizations improve user experience in configurators for customized knitted clothing items?

Chapter 2

Theory

This chapter presents the theory used in the thesis. First, usability is defined and includes user-centered design, expert evaluation, paper prototyping, usability testing, and usability guidelines. After that, theory related to eye-tracking and interviews is given.

2.1 Usability

ISO 9241-210 defines *usability* as the *extent to which a system, product, or service can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use* [8]. Ruben provides a similar but more informal definition, and defines a product or service as *usable* when *the user can do what he or she wants to do the way he or she expects to be able to do it, without hindrance, hesitation, or questions* [9].

Ruben presents six dimensions that must be fulfilled to make something usable: usefulness, efficiency, effectiveness, learnability, satisfaction, and accessibility [9].

In order for a product to be *useful*, the end-user must be motivated to use the product [9]. It does not matter if the product is easy to use if it does not help the user achieve their goal. In other words, the user must have a reason for using the product.

Efficiency concerns the speed at which the user can achieve their goals [9]. The less time it takes to carry out a task, the higher the efficiency. ISO 9241-11 defines efficiency as *resources expended in relation to the accuracy and completeness with which users achieve goals* [10]. The *resources expended* can, for example, be measured by the time it takes a user to complete a task.

A product has high *effectiveness* when it behaves the way the user expects it to, and it is easy for the user to carry out their tasks [9]. ISO 9241-11 defines effectiveness as *accuracy and completeness with which users achieve specified goals*. While efficiency is concerned with how much effort the user puts into executing tasks, effectiveness is concerned with how well the user can fulfill their desired goals.

Learnability involves how easy it is for the user to complete their goals after a predetermined amount of training [9]. It is related to effectiveness and can be thought of as how high the effectiveness is after a training period. This way, the less training needed, the better the learnability.

Every user of a system will produce their subjective feelings and opinions of a product, which will determine the degree of *satisfaction* the user is feeling. When a user is satisfied with a product, they are more likely to use it successfully [9]. ISO 9241-11 defines satisfaction as *freedom from discomfort, and positive attitudes towards the use of the product* [10]. Therefore, the users will have a more pleasant experience if they are satisfied.

Accessibility is the degree to which a person with a disability can use a product. Improving accessibility can also benefit people without disabilities when for example, a product is used under poor lighting conditions [9]. According to ISO 9241-210, accessibility for interactive systems is defined as the usability of a product, service, environment or facility by people with the widest range of capabilities [8]. Improving accessibility makes the product available to more people in a wider range of circumstances.

The six dimensions previously presented can often be measured quantitatively. The *efficiency* can, for example, be measured by timing several users while they perform a specific task to see how much time they are using, and *satisfaction* can be measured by asking the users to rank different products that they try. While numbers are useful for finding usability problems, they do not offer a way to fix them. In order to fix usability problems, one must understand *why* the problem occurs. This is not always easy to represent with numbers and therefore requires a qualitative approach. A doctor can easily measure different things on a patient, like blood pressure and temperature. Interpreting these measurements and providing treatment for the patient's problems ultimately determines the doctor's success. Understanding how to fix a usability problem is like understanding how to design effective treatment for a patient [9].

In the same way a patient will only see a doctor if they are sick, a product will only be concerned with usability when it becomes a problem. In other words, it is impossible to measure how usable a product is, only how *unusable* it is [9].

2.1.1 Human-Centered Design

Human-centered design (HCD) involves techniques, processes, methods, and procedures for designing usable products that place the user in the center. The terms *human factors engineering*, *ergonomics*, user-centered design, and *usability engineering* are also commonly used terms for describing this process [9, p. 36]. ISO 9241-210 uses the term *human-centered design* to emphasize that the standard includes not only end-users but also other stakeholders. The standard defines *human-centered design* as an *approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques* [8].

Ruben highlights three factors of HCD as especially important [9, p. 37]:

- The process of designing a product should involve contact with users from the very beginning
- Early prototypes should be tested with real users and evaluated based on measurements
- HCD is an iterative process where prototypes are designed and tested iteratively

2.1.2 Expert Evaluation

Having an expert review a piece of work can be helpful in any field, and HCI is no different. For example, a usability specialist can leverage previous experience, well-known heuristic principles, and human factors literature to evaluate the design of a product [9, p. 44]. This way, potential usability problems can be discovered early, saving time and resources.

A product is always associated with some domain, be it automobile production, chemical engineering, or legal services. When the user expects specific domain knowledge of the product, it can be helpful if the expert also possesses knowledge of the given domain [9, p. 44]. It is, however, more important that the expert has knowledge in the usability field [11].

2.1.3 Paper prototyping

Showing users a very early product version can provide helpful feedback about fundamental parts of the design. The version does not have to be advanced in order to receive feedback. It can even be made with pen and paper, which is exactly what a paper prototype aims to do. A user is shown a primitive paper version of the product and asked to give feedback or try to use the prototype. This can bring valuable insights which can help the design team make informed decisions quickly and inexpensively [9, p. 43].

The lucrative aspect of paper prototyping is the inexpensive nature of making paper prototypes. As a result, intuitive elements can be discovered quickly and survive to the next iteration, while problematic elements can be removed. In this way, informed design decisions can be made without writing a single line of code [9, p. 44].

2.1.4 Usability Testing

Asking users to test a product can be an effective tool in the iterative HCD process. Ruben defines *usability testing* as *a process that employs people as testing participants who are representative of the target audience to evaluate the degree to which a product meets specific usability criteria* [9, p. 46]. The involvement of potential product users is a crucial part of usability testing and distinguishes the technique from other tools like expert evaluation (Section 2.1.2).

Usability testing comes in several different forms but can broadly be placed on a spectrum ranging from formal to informal tests. Formal tests are used to gather *quantitative* data and resemble classical experiments. Hypotheses are formed and either validated or discarded. However, this type of experiment often requires a substantial number of participants to prove or disprove the hypothesis statistically. More informal tests can therefore be more resource-efficient and focus on gathering *qualitative* data instead. This type of testing can be performed with considerably fewer participants. Even tests with just one participant can provide useful qualitative information [9, p. 48].

The two different approaches to testing are relevant in different circumstances and will depend on the goal of running the tests and available resources. An informal usability test can obtain more profound knowledge on how to fix usability problems rather than just testing a specific hypothesis. In this sense, the informal variant is more broad and flexible than the more rigid and focused formal approach. The formal quantitative vs. informal qualitative aspects of usability tests can be compared to structured and unstructured interviews (respectively), which is described further in Section 2.3. Recruiting users can also be more challenging with the formal approach since they must be systematically chosen and use a control group. This requires a larger user population than the informal approach, which does not have such stringent requirements [9, p. 48].

2.1.4.1 Types of Usability Testing

Ruben and Chisnell presents four different types of usability tests that have different goals [9]:

1. Exploratory
2. Assessment
3. Validation
4. Comparison

Exploratory testing, also called formative, happens early in the design process. This type of testing aims to establish high-level design factors and thereby *exploring* users' preferences. One should figure out the fundamental design decisions as early as possible since moving forward with an incorrect fundament would produce a poor design. It is not necessary to develop a fully functional prototype to conduct exploratory testing but to implement just enough to reach the goal for the test. A prototype implementation can be either vertical, horizontal, or a combination. A vertical prototype goes deep into one feature but leaves surrounding features incomplete. The benefit of the vertical approach is that one can test that specific feature before implementing other features, getting feedback earlier and at a lower cost. On the other hand, a horizontal prototype will broadly implement functionality without going too deep into any specific feature. In this way, a horizontal implementation can give a higher-level view of the overall process but will not extend very far into one particular feature. It is also possible to combine these approaches by, for example, supporting the overall design process by implement-

ing a horizontal prototype and creating a couple of vertical areas where the user can interact more deeply. Exploratory tests can be performed as comparison tests, where various prototypes are compared to one another [9].

Assessment testing, also called summative, goes more into detail than exploratory testing. If exploratory testing is the skeleton, assessment testing is the meat and flesh [9]. The goal is to evaluate the implementation of the concept, and the degree of realism is, therefore, higher than in exploratory tests. Because the prototype will be more realistic, users can perform tasks without too much help from the test conductor. In this way, one should be more distant when performing assessment testing and let users use the product and observe their behavior. Unlike exploratory tests, quantitative measurements are normally collected.

Validation testing, also called verification testing, is the most formal type and is usually conducted at the end of the design cycle. The goal is to validate the product against a predefined standard before release. The product can be compared to a project-related performance standard, internal company standard, historical standard, or a competitor's performance standard. A validation test's horizontal and vertical aspects are essential, but it is often challenging to ensure it is horizontal enough. It must be integrated into other processes because only then does it represent how the users will use the product in real life. It must also be vertical to validate specific features' details, where the primary focus is collecting quantitative data that measures the product's performance.

Lastly, comparison testing is not performed at any particular part of the development cycle but can be used at any stage. Two or more designs are tested and compared against each other to figure out which design is better. A comparison test is a technique that can be combined with the three other types of testing. For example, in an exploratory test, one can compare completely different designs because the goal is to look at the high-level picture. During an assessment test, however, one often makes more minor changes to the design details, for example, by having a button on the left or right side of the screen and comparing the differences. Finally, validation testing can compare the product to a competitor to measure how well the design stacks up against the competition. In this way, comparison testing can be at all steps in the development cycle.

2.1.4.2   Preparation

Before conducting a usability test, a test plan should be created. The test plan should include the purpose and goal of running the test, and tasks should help reach the goal. The tasks should be realistic and mimic how a user would use the product in real life [12]. Different roles are assigned when performing a usability test. A test moderator will be the primary contact point for the participant during the session. He/she will give instructions, explain what will happen, and ask questions after the test. Observers will stick to the background and take notes of any problem during the test. If it is a paper prototype, someone might need to move paper pieces around during the test in a *Wizard of Oz* type fashion. Seland

presents 10 steps for how to conduct a usability test [12]:

1. Introduce yourself
2. Describe the purpose of the test
3. Tell participants they can abort at any time
4. Describe equipment in the room and limitations of the prototype
5. Explain think-aloud protocol
6. Explain that you can not help during the test
7. Present task and introduce product
8. Ask for questions and run test
9. Close the test by allowing the participant to talk, collect loose threads
10. Use the results to improve the design

The think-aloud protocol is not strictly required for a usability test but can be very useful for understanding the reason for a particular behavior. This can be used to analyze the situation qualitatively. One should, however, be careful with timing tasks when users are asked to think aloud because it can drastically influence the time spent on a particular task. Therefore, it does not necessarily give an accurate picture of how long a user would typically spend on the given task [9].

The test moderator has the most crucial role on the test team and is the one member that is necessary when conducting a usability test [9]. Ruben and Chisnell presents 12 key characteristics that a good test moderator should have.

(1) Knowledge of HCD can help the moderator distinguish between trivial problems and problems that can be generalized to the entire population. The general problems are more interesting and can therefore be probed further during the discussion after the test.

(2) The moderator should be a quick learner. A fundamental understanding of concepts and vocabulary related to the domain in question is necessary to quickly understand the comments and actions of the participant, which again is necessary to decide where to probe further.

(3) A moderator should be able to put the participant at ease by establishing a harmonious relationship with the user. A participant should be treated as a guest because a comfortable user will act more naturally and produce more accurate results.

(4) Good memory helps remember situations that happened during the test. A test session can often take a long time, and important situations have to be remembered in order to be discussed further during discussion. Therefore, even after the test is complete, relying on memory and notes is often used instead of going through entire recordings to save time.

(5) Good listening skills are beneficial for a moderator. Opinions and biases should be left at the door because the participant's opinions are what matters. Understanding subtle nuances of comments made by participants is crucial because their comments are often indirect and can conceal information. Misunderstanding users can lead to poor design decisions, so the moderator must understand what

the user is saying.

(6) Moderators should be comfortable with ambiguity since usability is often an imprecise and ambiguous venture, consisting of conflicting observations and opinions. Without patience and negotiation skills, a moderator tends to blame participants for acting in unexpected ways.

(7) Flexibility is another critical characteristic of a good test moderator. When things do not go according to plan, one must be able to adapt.

(8) A moderator should be patient and have a long attention span. User testing can be a long and tiresome process. Interesting findings can happen at any time. Being alert and ready for when that happens is required to discover them.

(9) Being empathic is especially important during the discussion part of a usability test. Getting users to open up their innermost thoughts about what happened during the test can be difficult if the participant does not feel like the moderator can relate to their situation.

(10) Considering the big-picture will help avoid being buried in data. A usability test often produces a vast amount of data, and extracting the essential bits is crucial.

(11) Communication skills are necessary to communicate with participants and other team members effectively. In addition, a written report is often how test results are communicated to people who did not attend the session, and writing skills are therefore also necessary.

(12) Organization and coordination skills are required to perform a successful usability test. Making sure all equipment is working, coordinating with participants, and ensuring that the product is ready for testing are all responsibilities that the test moderator must fulfill.

2.1.4.3 Remote Usability Testing

Remote usability testing is when the participant is not in the same physical location as the rest of the test team and can either be moderated or unmoderated [13]. A moderated test is more like an in-person test, where a test moderator facilitates the test. On the other hand, participants perform the test alone during an unmoderated test. A moderated test will use a remote communication tool, like Zoom or Teams, for communicating during the session and requires thorough preparation in advance [14]. After choosing a communication tool, one must prepare how the tasks will be presented. Handing the tasks on a piece of paper is not an option during a remote session, and a strategy for presenting tasks must therefore be planned. Presenting questions one at a time and asking them to read the question out loud will work as a confirmation that the participant understands the task. Mastalerz shares her experience with remote usability testing, and also reiterates the importance of being well prepared [15]. In addition, she shares a quote from Krug during a talk he held:

> *One thing that is true about remote testing is you have to pay really close attention, because you may not know whether they fell silent because*

*they're thinking about something, or they fell silent because their dog
just came into the room. - Steve Krug [16]*

In this way, moderating a remote usability test requires more careful consideration, especially since the user's physical environment cannot be controlled during the test.

2.1.4.4 Participants

A usability test can, in principle, be performed on only a single user. However, aggregating results among several users is considered best practice [17]. Still, one can not test on an infinite amount of users, which begs the question: How many users should be tested? Nielsen suggests that conducting a usability test with only 5 participants is the optimal size [18]. Nielsen and Landauer investigated 11 studies with a total of 359 participants, where both usability testing and heuristic evaluation was used, and found that the number of usability problems found followed a Poisson process as the number of participants increased [17]. Figure 2.1 presents a graph showing this relationship modelled as a Poisson process. As more users test the product, discoveries become less frequent because users will face problems that previous users have already discovered. Nielsen therefore recommends running several smaller test sessions instead of one big test at the end of the project to improve the cost-benefit relationship [18].
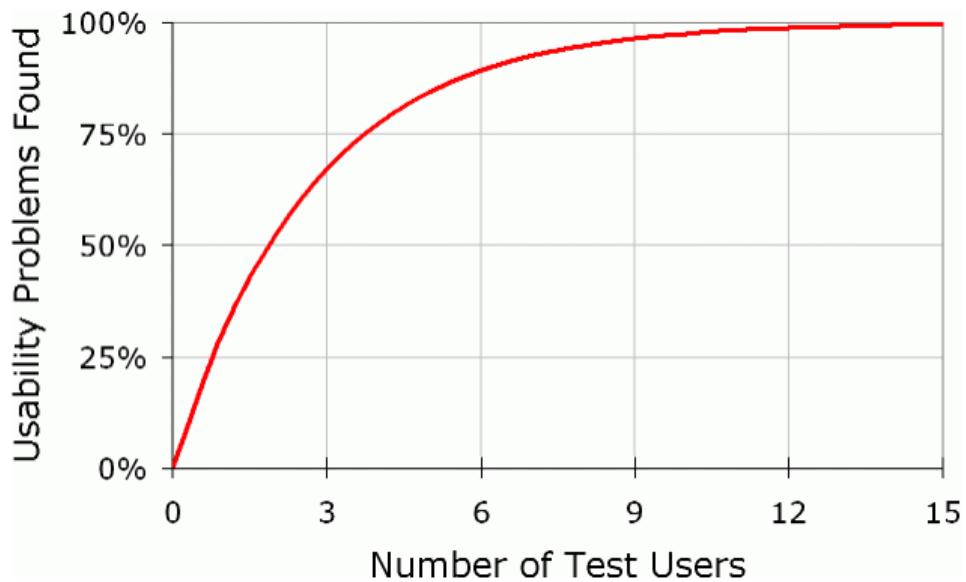
Figure 2.1: Graph showing relationship between number of test users and usability problems found [18].

2.1.5 Usability Guidelines

One approach for constructing general-purpose guidelines for creating a usable design would be to extract standard practices across different products and, after that, construct usability guidelines that can be applied across various products. Some principles are, however, so general that they are rooted in human psychology, and Norman presents the concept of *discoverability* as the degree to which a user will discover how a product works, what operations are possible and how to use it [19]. Discoverability can be obtained by following six fundamental psychological principles:

1. Affordances
2. Signifiers
3. Constraints
4. Mappings
5. Feedback
6. Conceptual model

The term *affordance* is a noun created by Gibson, and comes from the verb *to afford* [20]. Affordance can be defined as *a relationship between the properties of an object and the capabilities of the agent that determine just how the object could possibly be used* [19]. It is the potential actions someone can conceive themselves to perform on an object by looking at its properties. A book can, for example, afford reading, but only for people that know how to read. In this way, an object's affordances depend on both the agent and the object's properties. Affordance is, therefore, not a property that an object has but rather the relationship between an object's properties and a person's abilities.

Affordances depend upon an agent's capability to use an object, but the agent does not necessarily have to know about these potential operations. In other words, an affordance can be hidden. Therefore, an agent must be able to discover affordances to make use of them. Objects can broadcast what affordances are available. This is what *signifiers* are meant to accomplish. Signifiers are *perceivable indicators that communicates appropriate behaviour to a person* [19]. A door can, for example, signify that it should be pushed by putting up a sign that says *Push*. However, signifiers do not have to be deliberately created to exist. A pathway in the woods created by several people walking the same way would signify the best possible path to walk through the terrain. One can perceive that the path is different from the rest of the terrain. It sticks out visibly, and the path reveals the affordance of walking. It does not matter whether the path was created by accident or not.

Constraints are factors that limit the number of possible actions. Therefore, people can determine the appropriate actions to take due to the restricted set of possibilities. [19] presents four different types of constraints. (1) Physical constraints limit possible operations in the physical world. A large package will not fit into a mailbox slit meant for letters. The mailbox's physical shape prevents incorrect items from being put into the mailbox. (2) Cultural constraints are lim-

itations due to cultural rules and norms. Different cultures will follow different rules in social situations, and humans, therefore, make these types of constraints. For example, the standard convention is to have red brake lights on a vehicle. A yellow brake light would not be allowed by conventional standards, and therefore vehicles, for the most part, follows the cultural rule by having red brake lights. (3) Semantic constraints are concerned with using the meaning of a situation to reduce possible actions. People can use their knowledge of the world to infer helpful clues about how to act. Placing break lights on the bottom of a car does not make any sense because nobody would see them. The knowledge that brake lights should be visible from the rear constrains the placement to the vehicle's backside. Both cultural and semantic constraints can change over time. (4) Logical constraints are actions that can be figured out using a logical mindset. When for example, assembling a piece of furniture from IKEA, it is easy to logically infer where the last screw will have to go because there will, hopefully, be only one hole left.

Mapping represents a relationship between two sets and is a term from mathematics. For example, the mapping of switches to lights defines what switch controls which light. If the switches are placed such that they spatially correspond to the placement of the lights, the mapping is natural. The benefit of natural mappings is that they are immediately understood. Understanding the relationship between controls and their actions describes the essence of the mapping principle.

Feedback is used to communicate the results of an action. Suppose a system does not convey that an action has been received and is being worked on. In that case, users will become uncertain if the action was performed correctly, and lack of feedback can be a significant contributor to frustration. The feedback should happen immediately because people often give up if there is a considerable delay. On the other hand, too much feedback can also irritate and disturb an otherwise peaceful environment. Furthermore, if several elements indicate a crisis, for example, flashing with red lights and alarms going off, ignoring all alarms is often what ends up happening. Thus, feedback is a fundamental principle integral to a good design, but it must be done correctly.

A conceptual model is *an explanation, usually highly simplified, of how something works* [19]. Using concepts that are easy to understand, one can use a product even if the concepts are not technically correct. That is, the conceptual model does not have to be correct to be useful, as long as it can predict the results of actions. For example, folders are useful for organizing files on a computer. In reality, the computer does not have any folders inside of it, but thinking in terms of folders provides an understanding that is good enough for predicting what will happen. The designer of a product will have an ideal conception of how the model should be. However, it is not given that the actual users will share the same model. A user's actual conceptual model will be formed by communicating with the *system image*. The system image consists of the information available for the user, including the product itself, previous experience with similar products, information

from salespeople, advertisements, websites, and manuals. In other words, the designer's conceptual model is conveyed through the system image to the user. The goal is to provide a system image that accurately explains the designer's intent.

2.2 Eye Tracking

Eye-tracking is a process where participant's eye movements are recorded so that researchers can determine where a person is looking, and the sequence in which the eyes are moving from location to location [21]. Eye movements are helpful to analyze because the object users are looking at can be considered to be the thought at the "top of the stack" in terms of cognitive processing [22]. Different kinds of eye-tracking systems exist, but they can be divided into two primary categories; Head-mounted and table-mounted [23]. Head-mounted systems are devices that are directly mounted on the participant's head (Figure 2.2b). In contrast, table-mounted systems are freestanding equipment that does not have to be in direct contact with the participant (Figure 2.2a).

(a) Table-mounted eye tracker from Tobii connected to a desktop computer screen.

(b) Head-mounted eye tracking glasses from Tobii.

Figure 2.2: Eye tracking equipment.

Three types of positional eye movements help determine the location of visual attention: Fixations, saccades, and smooth pursuits [23]. Fixations are movements that stabilize the focus on a stationary object of interest. Tiny eye movements characterize this kind of movement, and these small movements can be categorized as noise when analyzing [23]. Saccades are rapid movements between objects of interest, and the gaze will quickly move to a new location. The movement is between 10-100 ms, making the environment imperceivable during a saccade [23]. Finally, smooth pursuits are used to follow a moving target. The eyes will match the target's velocity, keeping the focus on the object [23].

Gaze visualizations allow researchers to quickly interpret eye-tracking data [24]. Scanpaths, heatmaps, and Areas Of Interest (AOI) are commonly used methods for studying searching behavior for people on the web [25]. (1) Scanpaths help understands an individual's behavior and can be visualized with a *gaze plot* which displays an ordered set of fixations and saccades. A circle represents each

fixation, and saccades are shown by drawing lines between fixations (circles). In addition, a number is shown inside each fixation circle, presenting the order of the path. Combining scanpaths from several participants can introduce visual clutter, making it challenging to analyze aggregated scanpaths [24]. (2) Heatmaps are more commonly used to aggregate results among several participants. They display different colors on top of the webpage, where the color will depend on either the number or duration of fixations. Since heatmaps show an aggregation across time, they do not contain information on the ordering of the fixations. In this way, heatmaps sacrifices temporal order information to produce an aggregated display where fixations have occurred [23]. (3) A webpage can be divided into several AOIs, where fixations and saccades can be analyzed between different AOIs [25]. Participants seldom gaze at exactly the same point, even when looking at the same object. In order to determine where the user's attention is, it is sufficient to know the area in which the user is looking. This way, fixations inside the same AOI can be grouped, allowing for more straightforward analysis.

Eye-tracking data is useful for analyzing users' visual attention, but the method does, however, have some limitations. Performing eye-tracking sessions with representative users is crucial for the validity of the data [26]. Furthermore, a lack of realism in the tasks performed can produce unreliable results. A controlled test in a usability lab does not reflect how users will act in reality when browsing the web. For example, when users are asked to comment on a website, they also notice things they usually would not pay attention to. This can introduce an unnatural behavior and therefore impact the results of an eye-tracking study [26].

2.3 Interviews

Interviews are a standard method used to understand other human beings and can take a structured or unstructured form, or semi-structured which is somewhere in between [27]. Regular face-to-face conversations are the most common form of interviews. However, they can also take other forms, like face-to-face group conversations, online questionnaires, or telephone conversations [27]. This thesis will refer to a normal face-to-face conversation as an *interview* unless otherwise specified.

A structured interview has a clear set of predefined questions and limits the response categories. Open-ended questions are not commonly used, and the goal is to treat all participants in a standardized way [27]. Wright *et al.* found structured interviews to have a validity of 0.39 in a job hiring process, while only 0.14 when using unstructured interviews [28]. A job interview intends to assess the abilities of the participant, and Wright *et al.* mentions a hypothesis that a structured interview might work as an "orally administered intelligence test" [28]. Christina and Latham did however not find a significant correlation between situational interviews (a subset of structural interviews [28]) and cognitive ability [29]. One should not improvise when conducting a structured interview; there is generally little room for deviating from the plan [27].

Unstructured interviews include more open-ended questions than structured interviews and are qualitative in nature [27]. While structured interviews are suited to explain behavior within predetermined categories, the goal of unstructured interviews is to *understand* complex situations. In order to build an understanding, one must see the situation from the participant's viewpoint, but without compromising ones objective credibility [27]. In this way, the researcher must see the world from the participant's perspective, but at the same time keep their distance and remain unbiased when analyzing the results.

Semi-structured interviews combines elements of structured and unstructured interviews. Kallio *et al.* [30] presents five stages for preparing a semi-structured interview:

1. Evaluate relevance to research question(s)
2. Literature review
3. Create preliminary interview guide
4. Pilot test
5. Complete interview guide

One should begin by evaluating if a semi-structured interview is the best way of answering the research questions(s). If this is the case, one can proceed with reviewing relevant literature. After that, a preliminary interview guide can be created. The prepared questions should cover the main topics, and follow-up questions can also be prepared where needed. The ordering of questions should be logical and provide a natural flow to the conversation. The preliminary guide should be tested using a pilot test before the complete guide is finally created.

Chapter 3

Related Products

Examining existing products can offer beneficial insights and ideas when creating a product configurator. This chapter presents several different products that offer functionality relevant to an online product configurator for customized knitted clothing items. Features from Figma, Custom Ink, Microsoft Word, Google Docs, and Microsoft PowerPoint are investigated.

3.1 Figma

Figma provides two different products: Figma Design and FigJam [31]. Figma Design will sometimes be referred to as only *Figma*, because it originally consisted of only this tool. Both of them are collaborative tools that run in a web browser. The company was founded in 2012, and their website had 49.8 million visitors in April 2022 [32].

3.1.1 Figma Design

Figma originally consisted of only the Figma Design tool, and was released to the general public in September 2016 [33]. The tool can be described as a platform that enables designing and prototyping. The design is drawn in their editor and can be converted into a more interactive prototype. Figure 3.1 presents an overview of how the Figma Design tool looks like. Elements are drawn on a canvas and can be modified in different ways. The canvas can be panned and zoomed in order to view different elements. Direct manipulation of elements by dragging in the canvas is supported. It is also possible to adjust an element manually by entering values in the menu to the right.

When dragging an element, guidelines will help with alignment, as shown in Figure 3.2a. Visual feedback in the form of orange lines is displayed, but the positioning also snaps to these lines as an element is dragged close. In this way, the user does not have to be very precise to align elements using direct manipulation. Figure 3.2b shows how elements can be spaced at equal distances from each other. These guidelines appear when an element is dragged to approximately the same
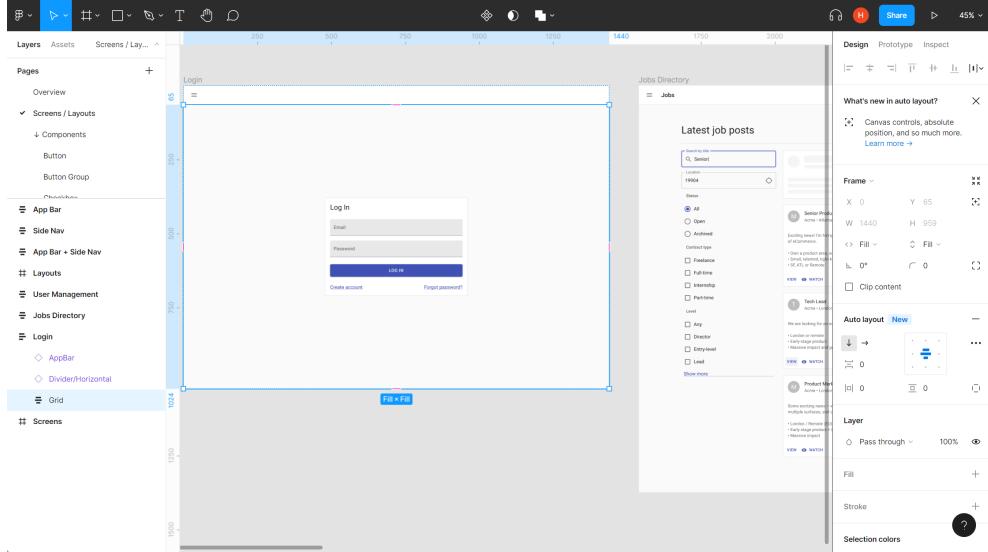
Figure 3.1: Overview of Figma Design.

distance to an element as the spacing between all the elements. Therefore, this requires at least three elements to work. In addition to a visual line showing, a number also displays the distance between the elements.

New elements are created using different tools from the toolbar at the top. Each tool must be selected before it can be used. For example, when the shape-tool is selected, geometric shapes like rectangles, triangles, and circles can be drawn by clicking anywhere on the canvas. The hand tool is used to pan around the canvas, while the text tool adds text. Functionality like copy, paste, cut, and delete are also available through keyboard shortcuts or by using the context menu when right-clicking an element.
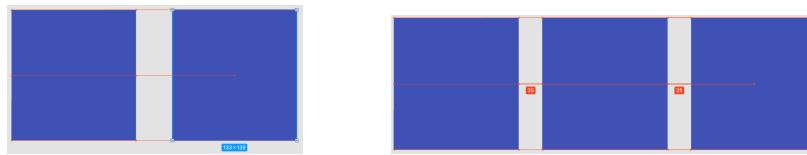
(a) Basic guidelines between two elements.

(b) Guidelines used for equal distribution between three elements.

Figure 3.2: Different guidelines in Figma.

When selecting three or more elements with equal spacing between them, it is possible to reorder them. By dragging from the small pink circle shown in the middle of each square in Figure 3.3, elements can be swapped. It is also possible to change the spacing between elements by dragging the pink line in the middle of each element.

Explicit alignment and distribution tools are also available in addition to di-

Figure 3.3: Changing distribution spacing of all elements in selection.

rectly manipulating elements, as shown in Figure 3.4. Using buttons, a selected element can be aligned to the left, right, top, bottom, horizontal center, and vertical center. A selection of multiple (at least 3) elements can also be distributed using buttons, both in the horizontal and vertical dimensions.
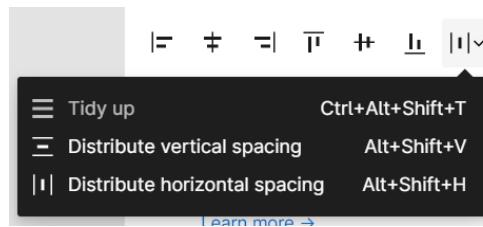
Figure 3.4: Align and distribute buttons in Figma

Elements can overlap in a layered manner, and a hierarchy decides the order of the layering. This hierarchy is displayed to the left in Figure 3.1. An element can also be locked, meaning it is impossible to select or modify the element directly. This is useful when having multiple layers, so the correct element will be selected when clicking on the canvas.

3.1.2 FigJam

FigJam is an online whiteboard used for brainstorming, and a beta version was released in April 2021 [34]. An overview of the interface can be seen in Figure 3.5. Figures can be dragged from the toolbar at the bottom onto the whiteboard. A figure can also be added using clicking. When a figure in the toolbar is clicked, it becomes active, and clicking on the canvas will then add the figure at the position that is clicked.

The board itself contains a grid, and placed items can be dragged along this grid. It is also possible to resize elements by dragging on the edge of the selection, and resizing will follow this same grid. However, a selection can be moved by only 1 pixel using the arrow keys, which makes the item misaligned with the grid. Shift+arrow keys will, however, move the item one notch along the grid. In this way, the grid is not enforced strictly but serves as a guide that the user can opt-out of by using the arrow keys.

As with Figma Design, FigJam also provides guidelines to help with alignment and distribution of elements. Figure 3.6 shows guidelines for alignment in blue, and distribution guidelines in purple. Distribution guidelines in FigJam does
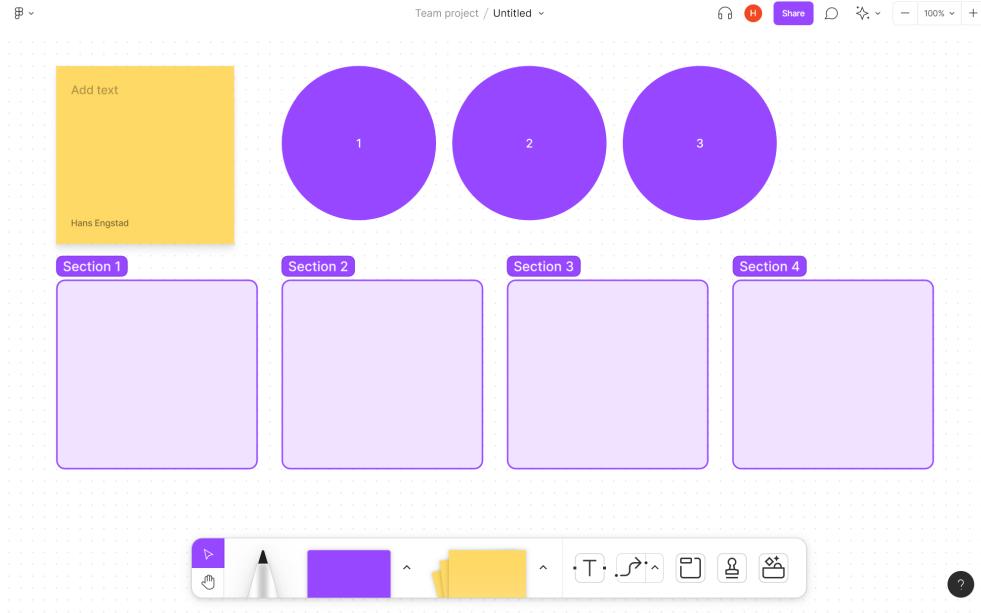
Figure 3.5: Overview of FigJam.

not include a number. FigJam offers the same type of reordering and distribution movement as Figma Design, as shown in Figure 3.3.
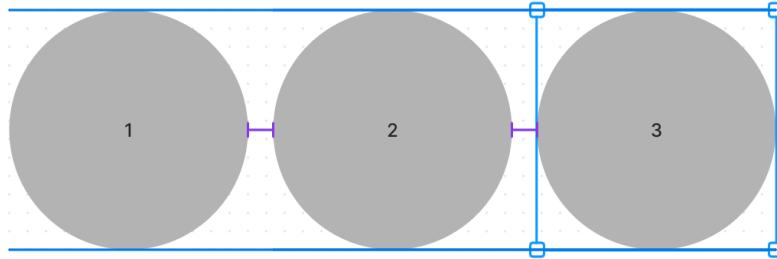
Figure 3.6: Alignment and distribution guidelines in FigJam.

A small toolbar will appear above a selected item. The tools available in this toolbar are used to modify the element and will differ based on the type of item. Operations like changing shape, color, text styling, and size can be found in this toolbar.

3.2   Custom Ink

Custom Ink offers customized clothing like t-shirts and therefore has a product configurator for adding custom designs to a t-shirt [35]. Figure 3.7a shows how an item can be added to a t-shirt, in this case, a smiley. Items are added from a vast library of images and are added to the t-shirt only by clicking.

The element can be dragged around to move it and resized using a resize button in the lower right corner of the smiley. It is removed by pressing the red X, as shown next to the smiley in Figure 3.7a. The delete and resize buttons are only shown when an item is selected. Operations like copy, paste, cut, delete, undo and redo are available through keyboard shortcuts. Undo and redo also have explicit buttons that can be used.

The visualization shows a realistic photograph of a person wearing the t-shirt. The front and back of the t-shirt can be edited, but only one is displayed at a time. There are buttons for switching sides that include a thumbnail of the visualization from each side. The sleeves have limited configurations and require a custom purchasing order, meaning they can not be edited using the online configurator. Photographs of different sleeve examples are displayed from the side, with a real person wearing the clothing.

(a) A smiley added to the t-shirt. **(b)** Guidelines.

Figure 3.7: T-shirt configurator in Custom Ink.

Figure 3.7b shows different guidelines in the t-shirt configurator. When dragging an item near the center of the t-shirt, a gray dotted line appears, and the item is snapped to the center. In addition, three boxes appear when dragging, labeled Adult, Youth, and Left Chest. There is, however, no snap-functionality when moving an item near the edges of any of these boxes. Items can be layered on top of each other, and overlapping items are therefore allowed.

3.3   Microsoft Word

Microsoft Word [36] is a text editing software released by Microsoft in 1983 [37]. The toolbar in Microsoft Word, shown in Figure 3.8 contains several tools, where

each tool has an icon and sometimes an explaining text label next to it. Tools are separated into different sections, each with a small text label at the bottom (clipboard, text, paragraphs). The layout of tools is primarily in two rows, except for the clipboard section. When hovering over a button, a tooltip with a header and text will be shown to explain how to use the tool. A keyboard shortcut for using the tool is also displayed in the heading, inside parentheses. The tooltip is displayed right below the hovered button but below the toolbar and therefore does not hide other tools.
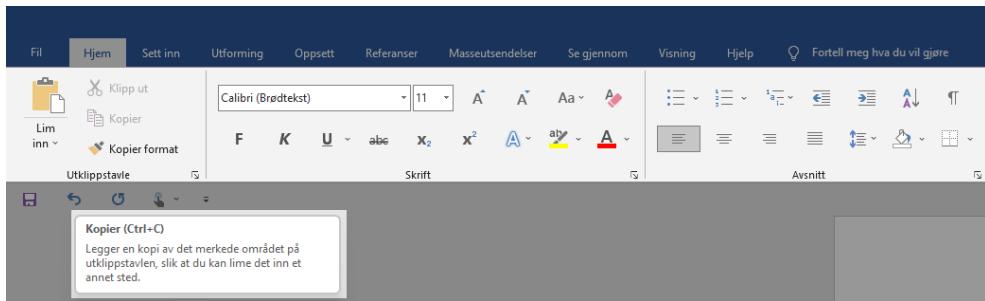
Figure 3.8: Toolbar with tooltip in Microsoft Word.

3.4 Google Docs

Google Docs is an online word editing program and was first released by Google in 2006 (out of beta in 2009) [38]. It provides many of the same functions as Microsoft Word, but was released 23 years later and made to work online from the beginning. Figure 3.9 shows the toolbar in Google Docs, where each tool is displayed as an icon. Unlike Microsoft Word, the tools do not include text labels. However, they show a tooltip upon hover, but it is far shorter than tooltips in Microsoft Word. The tools are laid out in a single row, and the toolbar is six times shorter in height compared to Microsoft Word (120 pixels vs. 20 pixels). The icons are also dark gray, whereas icons in Microsoft Word are colored. Tools are placed in sections and separated by a vertical divider, but the sections are not named.
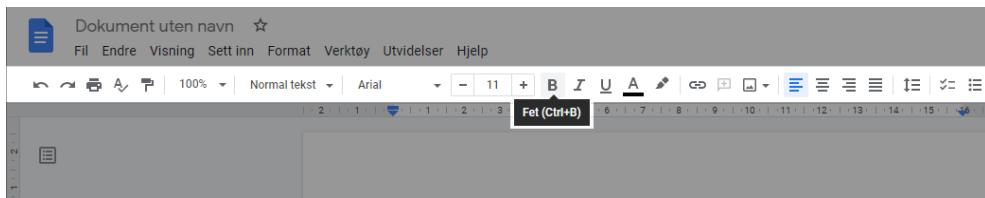
Figure 3.9: Toolbar with tooltip in Google Docs

3.5 Microsoft PowerPoint

Microsoft PowerPoint is a program for creating presentations and was released by Microsoft in 1990 [39]. The toolbar is very similar to that of Microsoft Word, but it offers a different set of tools. Direct manipulation of elements are also more prevalent in Microsoft PowerPoint than in Microsoft Word. Figure 3.10a shows how guidelines help align elements relative to the canvas, and Figure 3.10b shows how elements can be distributed with equal spacing between them. This behaviour is similar to the guidelines found in Figma Design and FigJam. Similarly, there are guidelines for placing two elements next to each other.

(a) Vertical and horizontal guidelines of element placed in the center of canvas.

(b) Guidelines for equally distributing three elements horizontally.
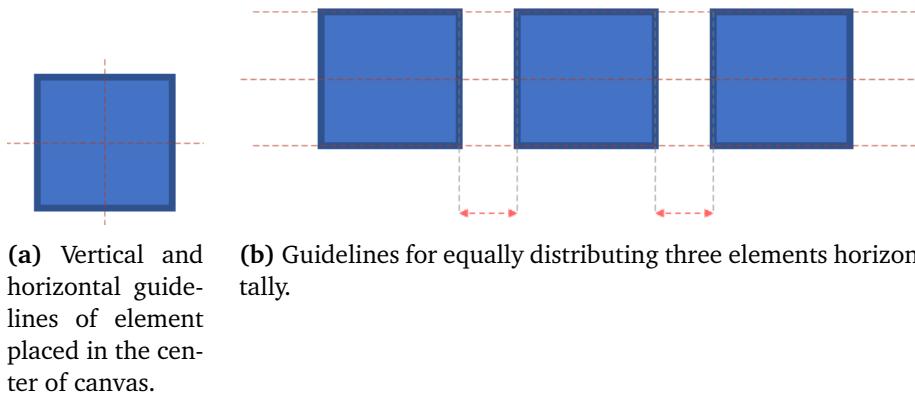
Figure 3.10: Guidelines in Microsoft PowerPoint.

There is, however, one more type of guideline in Microsoft PowerPoint used to place an element with equal distance to the center as another, as seen in Figure 3.11. Two arrows are displayed on either side of the center, indicating that the distance is equal. Note that the colors of the guidelines are different. For example, the guidelines for alignment are beige red (#D08A78), the arrows marking the distance toward the center are light red (#FF6565), and the lines marking the center of the canvas in Figure 3.11 are gray (#B2B2B2). These colors are likely meant to form a visual hierarchy, where more important lines receive a stronger color.
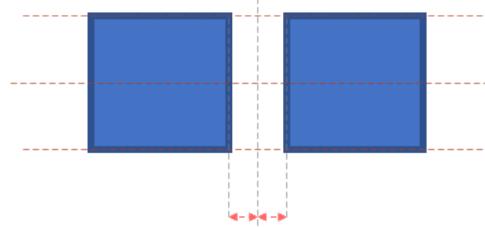
Figure 3.11: Guidelines for placing two elements with equal distance to the center of the canvas in Microsoft PowerPoint.

Chapter 4

Methodology

This chapter explains the methodology used during the research. Firstly, an overview of what contributions this work will add to the body of knowledge is given, followed by a thorough description of the research method. The work was a collaboration between several parties described in Section 4.3. Lastly, the research participants and the research paradigm used are presented.

4.1 Contributions

Research should contribute to the body of knowledge [40]. This thesis aims to produce an improved computer-based product in the form of a web application that demonstrates how creating a visualization in a product configurator for knitted sweaters can be created with good usability. Even though the knitting domain is quite specific, findings from this thesis could still be of use in other domains. Especially in product configurators with a high degree of freedom and where visualizing the product with photographs is not feasible.

Previous empirical studies have highlighted the importance of visualizations and feedback in product configurators [5, 7]. However, the studies focused on examining existing product configurators and failed to provide concrete design guidelines for visualizations. High-level toolkits have, however, been researched to some degree, but utilizing this knowledge in creating a visualization for a specific product configurator is only of limited usefulness. Furthermore, general guidelines can not take all details for each specific situation into account. Therefore, providing an example of which other configurators can take inspiration from can be helpful for situations similar to knitted sweaters.

4.2 Research Method

Informal usability testing is a cheap and effective method of shaping a design with high usability (Section 2.1.4). However, early in the design process, many design decisions will not have been made yet. By involving users early on, they can

participate in making these decisions. In such a scenario, informal usability testing is more suitable than formal ones for several reasons. Firstly, they require far fewer resources and effort, which are practical factors that must be considered. Secondly, informality allows for exploring ideas and thoughts of the users that designers might not know and can therefore not include in the testing procedure. In this way, users will reveal what is important to them. Finally, informal testing can provide information on fixing a usability problem by asking users how they would do it. The answers will produce qualitative data, which can take considerable time to analyze, reiterating the practical aspect of informal tests since they can be performed with relatively few participants.

Oates presents different strategies for conducting research [40], shown in Figure 4.1. The parts relevant to this thesis are highlighted in red. Experiences from Dreamknit and a review of the available literature shaped the research questions. The research project will follow a design and creation strategy to answer these questions, and IT artifacts will be produced as a web-based prototype.
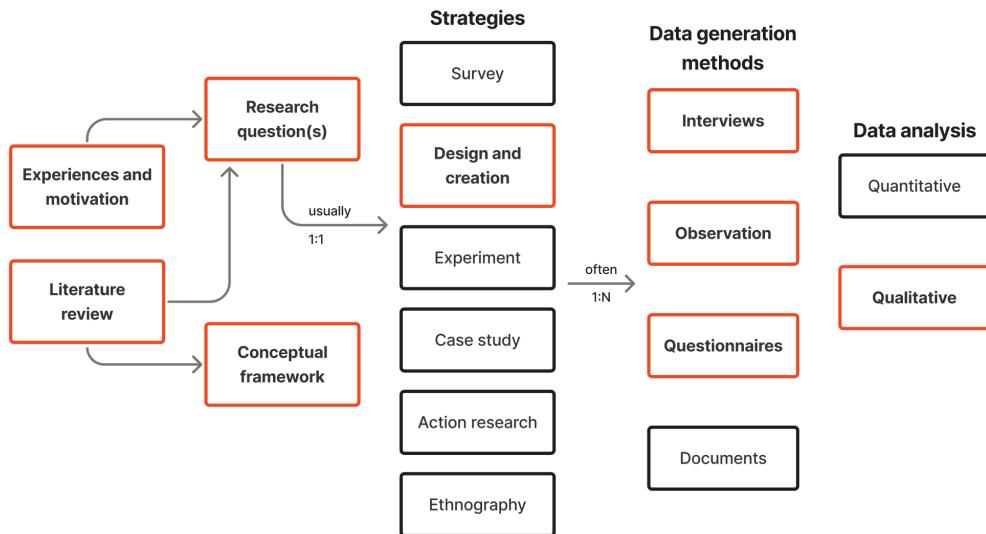
Figure 4.1: Overview of research process.

The prototype development will follow an iterative HCD process, and several different versions will be produced. Figure 4.2 shows the iterative process used during design and creation. Each version will be evaluated and improved upon in the next iteration. The level of detail will gradually increase and allows users to participate from the early stages of development. As the complexity of the visualization increases, so do the implementation difficulty and the required resources. An advanced visualization might not be necessary or desirable to users, and therefore it is reasonable to investigate the alternative which requires the least amount of effort first. For this reason, the prototype will begin with a less detailed visualization and gradually make it more advanced.

Several different data generation methods will be used in the project. In col-
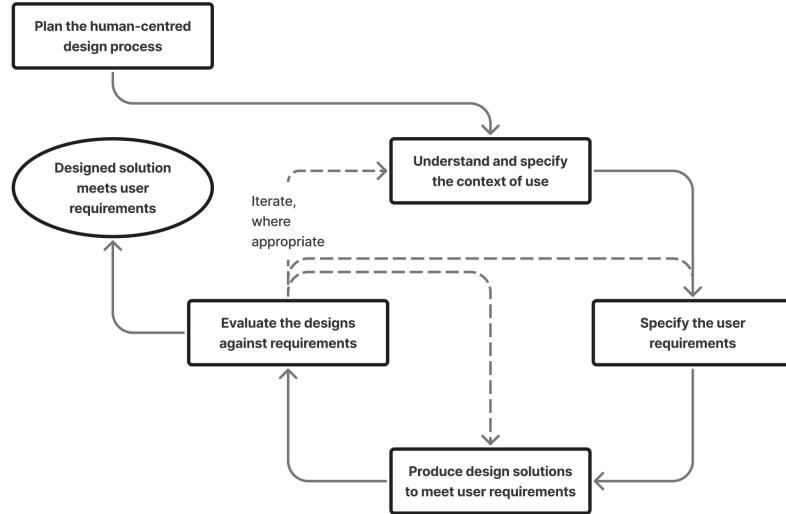
Figure 4.2: Iterative process of HCD [8].

laboration with Rosita, a questionnaire was created and distributed. The questionnaire, together with interviews held by Rosita [41], created the foundation upon which the prototype was based. Read more about the collaboration in Section 4.3, the results of the questionnaire in Section 6.1, and results from the interviews in Section 6.3. The data analysis of the questionnaire could be considered quantitative. However, since the majority of this thesis's analysis is done in a qualitative method, only the qualitative data analysis part is highlighted in Figure 4.1.

A low fidelity prototype based on data was constructed using the foundational knowledge from the questionnaire and interviews. However, what users say and what they do is not always consistent, and one can also not expect users to be aware of all available design possibilities unless they coincidentally are experts in user interface design, which is highly unlikely in this case. For these reasons, relying only on questionnaires and interviews is a poor research strategy for creating a user-friendly design. Observation would also be utilized in the form of usability testing. However, usability testing is problematic without a prototype with which users can interact. Although questionnaires and interviews can not provide all the answers, they generate data on which design decisions can be based. In this way, the first iteration of the prototype was based on user data, as opposed to assumptions.

Each usability test session consisted of two parts, task execution and discussion. Firstly, the user will execute several tasks using the prototype while being observed. Data from this stage was primarily qualitative in the form of video and audio recordings. Eye-tracking was also used to some extent, and although eye-tracking data is essentially quantitative, it was analyzed qualitatively. Enriching the video recording with eye-tracking data established a better understanding of what the user was doing. Heatmaps are also helpful but were not the primary method of analysis in this thesis. Answering the research questions of this the-

sis required a deeper understanding of user preferences than a heatmap could provide.

The second part of a usability test is the discussion, which can be described as a semi-structured interview. Some questions were prepared in advance, while others were spontaneously asked based on what the user encountered during the task execution. The opportunity to dive deeper into specific topics increases the exploratory element of the usability tests. This interview structure was reasonable because each user is different, and understanding the challenges and preferences of users is necessary to solve their problems. Furthermore, one can only predict what kind of problems users will encounter, and if a user does something unexpected, elaborating on that could provide valuable insights. In this way, the semi-structured nature of the discussion aimed not only to uncover usability problems but also to find solutions.

Evaluating the user interface through user-testing is the key to answering the research questions. Data from the testing will be analyzed to explore new design opportunities and validate what design decisions work. However, this approach is not perfect and has some limitations. Usability testing is time-consuming and requires successfully recruiting users in the target population. Therefore, the usability tests' results depend on the degree to which the selected participants represent the opinions and preferences of the larger population. The recruitment methods, primarily social media channels, can also introduce bias into the data since all knitters might not be active on social media. In this way, the participants might not reflect the whole range of users out there, which would produce inaccuracies in the results.

Dreamknit's product produces a knitting recipe instead of a finished product. This is not a very common characteristic in product configurators, where the product is assembled and shipped to the customer, which is the case when, for example, purchasing shoes, furniture, or a car. However, the fact that the consumer only purchases a recipe for the final product can influence users' expectations related to the visualization.

4.3   Collaboration

The project was a collaboration between NTNU and Dreamknit, but collaboration also happened within the research team, as Rosita and Hans would produce two different master theses. Figure 4.3 presents a timeline that highlights important events throughout the project and the primary areas of responsibility for Rosita and Hans. Even though the researchers had different responsibilities, they worked more or less like a team, where discussions were frequent.

The beginning of the project started with preliminary work. Meetings with Dreamknit and reviewing the literature and similar systems to that of Dreamknit made up the foundation upon which the research questions were based. Dreamknit suggested implementing structure functionality for their product, which was exactly what the research would revolve around.

As Dreamknit was already familiar with their domain, they did have several assumptions about their users but lacked a data set that could back up their claims. Therefore, a questionnaire was created and distributed to clarify assumptions and collect data about users' preferences, especially about knitting structured patterns. Both Rosita and Hans prepared this questionnaire in collaboration with Dreamknit, and Hans coordinated the questionnaire distribution on Facebook. Dreamknit also distributed the questionnaire on their Instagram account, which exposed it directly to Dreamknit's existing follower base. Rosita continued analyzing the results from the questionnaire while Hans began to familiarize himself with technical aspects related to Dreamknit's website implementation.

From November to December 2021, Rosita and Hans worked more or less separately. Rosita held interviews with users, while Hans implemented three Figma prototypes and tested them in User Test 1. Hans delivered his specialization project report on December 15 and began the Master's thesis in January. The specialization project is 15 study points, while the master thesis is 30. Since Rosita only wrote a Master's thesis, she took 30 study points throughout the project, while Hans took 45. This explains why Hans undertook somewhat more obligations than Rosita.

Both Rosita and Hans worked on implementing React Prototype 1. Rosita continued preparing, leading, and analyzing User Test 2 while Hans observed the usability test. After the test, Hans started working on the next iteration, React Prototype 2, while also preparing User Test 3. Rosita began to write her thesis at this time, and the collaboration was largely over. After User Test 3 was completed and the results analyzed, the work started on the final functional prototype, React Prototype 3. User Test 4 was the last usability test performed in May. The results from User Test 4 was then analyzed and Hans focused on writing his thesis.

4.4   Participants

Table 4.1 presents the participants of the project. Hans Jørgen Engstad and Rosita Høybakken played the role of researchers in the project. Section 4.3 described the collaboration further. George Adrian Stoica was the project's supervisor and contributed with experience as a researcher in the field of Software Engineering and HCI. Dreamknit participated with their knowledge in the knitting domain and provided a concept and existing web application upon which this project's prototype was built. Finally, end-users also participated in interviews, usability testing, and questionnaire.

Users were recruited in collaboration with Dreamknit and through social media channels like Facebook and Instagram. Furthermore, each participant received a gift card of 100 NOK, sponsored by the Information Systems and Software Engineering (ISSE) group at NTNU. This was a symbolic gesture meant to encourage users to participate. Nielsen found that a user test should include five users to optimize the cost-benefit ratio [18] (Section 2.1.4). Therefore, the goal of each usability test was to include at least five users, and the project aimed to perform

several smaller test sessions rather than a big one at the end.

User Test 1 and User Test 2 had to be performed remotely due to the ongoing COVID-19 pandemic, while the remaining User Test 3 and User Test 4 was performed physically at NTNU's UX lab. Recruitment was a challenge, especially for the physical test sessions, and was also a reason for not increasing the number of participants. For the same reason, several users participated in multiple sessions. Across all four usability tests, a total of 17 unique users participated.

A plan for managing data from a privacy perspective was also created and approved by the Norwegian Centre for Research Data (NSD). The plan is found in Appendix D and required that every user gave their consent to being recorded.

Table 4.1: Overview of key factors in User Test 3.

Participant	Role
Hans Jørgen Engstad	Researcher
Rosita Høybakken	Researcher
George Adrian Stoica	Supervisor
Dreamknit	Domain knowledge, concept, and existing web application.
Users	End-users participating in interviews, usability tests and questionnaire.

4.5   Research Paradigm

Oates presents three different paradigms used during research: positivism, interpretivism and critical research [40]. The paradigms consist of philosophies that take different approaches to conduct research. A positivist will strive to remain objective, and the *scientific method* has its roots in this paradigm. Natural science fields like chemistry and physics rely heavily on this type of research. The type of formal usability testing, described in Section 2.1.4, is similar to a classical experiment and would follow the positivist paradigm. One criticism of positivism is that reducing complex scenarios into simpler factors, like numbers, is not always possible without losing significant meaning [40, p. 288]. However, positivism is not the only paradigm available, and interpretivism is better suited to investigate the subjective world that people live in [40].

Interpretivism aims to *identify, explore and explain how all factors in a particular social setting are related and interdependent* [40, p .292]. This way, the paradigm is more interested in subjective opinions and perceptions. Informal usability testing, presented in Section 2.1.4, takes an interpretative approach to conducting research and is the primary method used in this thesis (Section 4.2). Understanding why users act as they do is required to design solutions to usability problems. Qualitatively analyzing the users can provide insights that are not easily reduced to numbers. For these reasons, an interpretive research paradigm was chosen to

conduct research in this thesis.

Lastly, critical research takes interpretivism to the next level. In this paradigm, it is not enough to understand how things are, but they will also challenge why a given reality has to be that way. For example, they are interested in the modern world's power relations, conflicts, and contradictions and aim to eliminate unfair alienation and domination [40, p .297]. Criticizing users is not a proper way of conducting usability research because usability depends on users' subjective reality. Adapting the interface design to this reality is a more realistic strategy than modifying the user's world into a more idealistic reality. The critical research paradigm was therefore not chosen in this thesis.
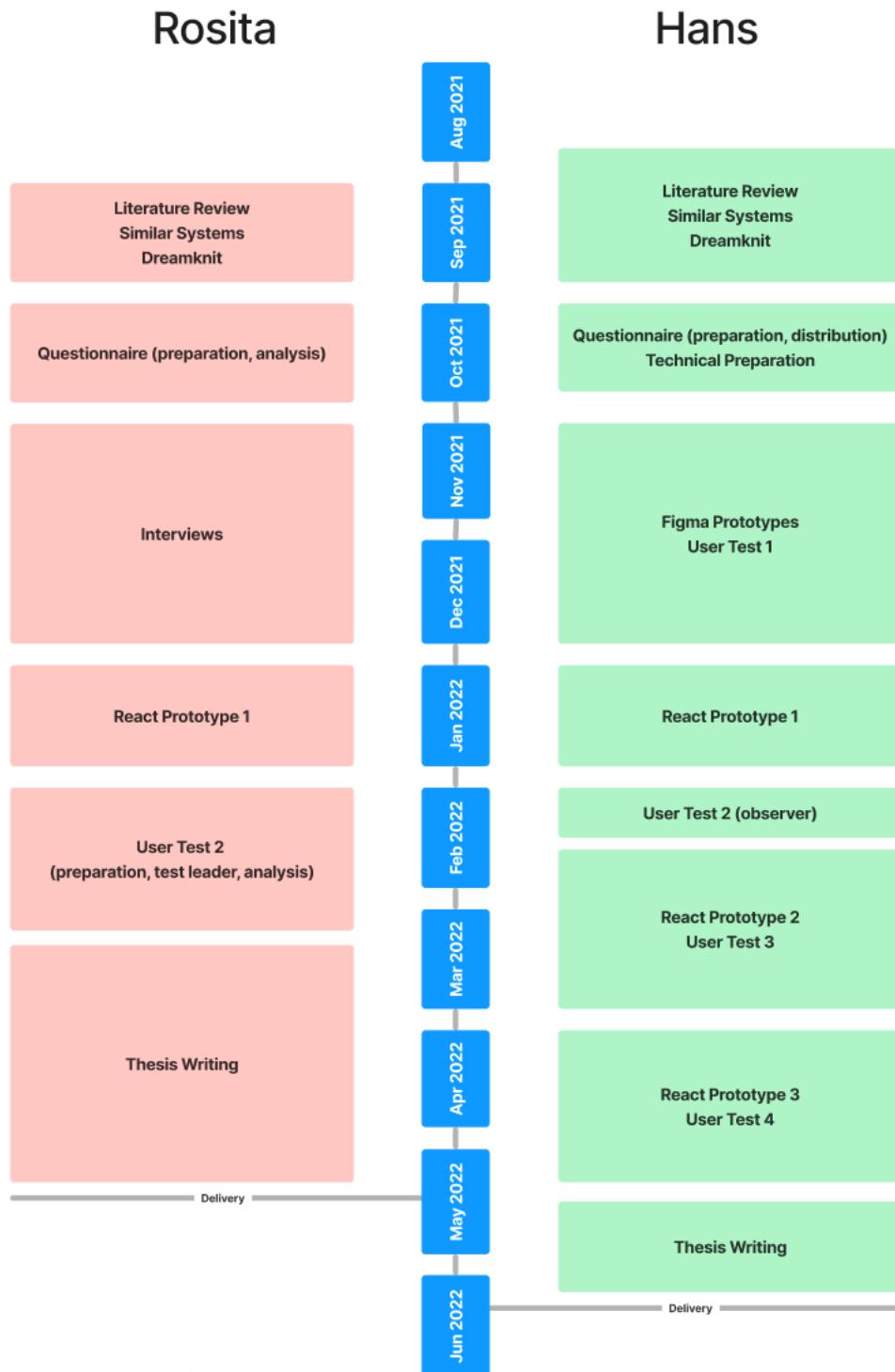
Figure 4.3: Timeline of important events during the project, starting from August 2021 to June 2022.

Chapter 5

Prototypes

The work included four different iterations of a prototype, where the first version was a low-fidelity Figma prototype. The three remaining versions were implemented using React, and the features of all versions are presented in this chapter. Lastly, a more detailed description of how the functional prototype was implemented is given in Section 5.5.

5.1 Figma Prototypes

During the specialization project in the fall of 2021, several low-fidelity prototypes were created in Figma [42]. These prototypes will be referred to as *Figma Prototypes*. They are presented in this section, but a more comprehensive description can be found in the specialization project's report [42].

Three prototypes were created in Figma, where each prototype provided a different degree of freedom. Alternative 1 (A1) provided the least customization, while Alternative 3 (A3) had the most. They are called *alternatives* to emphasize that they were developed simultaneously and are not consecutive iterations. A3 turned out to be the most liked alternative, and the first functional prototype (React Prototype 1) continued in the same direction. For this reason, only A3 is presented in this section, but A1 and A2 can be found in the full report [42].

5.1.1 Alternative 3 (A3)

A3 was the alternative with the most degree of freedom, meaning that users could customize their design to a high degree. Figure 5.1 presents an overview of the structure step in A3. This is where the user adds and modifies structures, which is done by direct manipulation on the visualization. The visualization consists of six pieces and splits the front and back of the sweater. Each side has three pieces, one for each arm and one for the body. The left and right sides are marked with a label above each arm. Note that the front right arm is on the screen's left side. When looking at the front side of a sweater, the right arm will be to the left from that perspective.
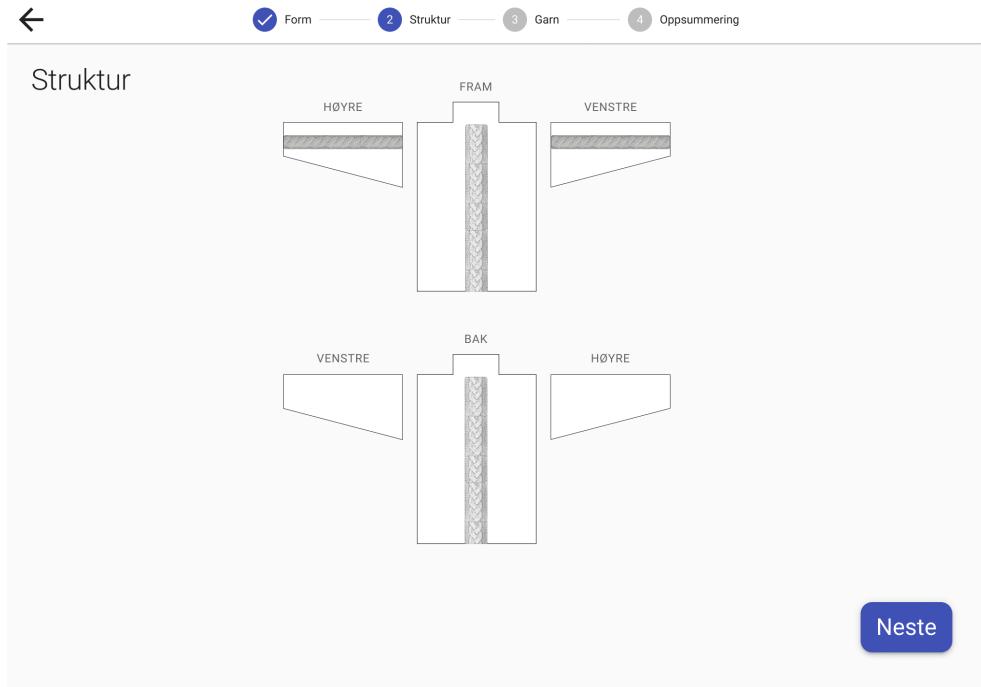
Figure 5.1: Overview of structure step in A3.

Structures are added to the sweater by clicking directly on the visualization. A menu will then appear, asking the user if they want to add a twist or a braid. When a structure has been added, it can be dragged to change the positioning.

A structure can be clicked to select it, as shown in Figure 5.2a. A colored border around the structure and squares on the corners are displayed. These squares can be dragged to modify the structure's width and height. The menu shown in Figure 5.2b is displayed right next to a selection. This allows the user to change the type of structure and delete it. The menu also contains a short description explaining that the structure's position is modified by dragging.

(a) A selected braid.

(b) Menu displayed next to selected structure.
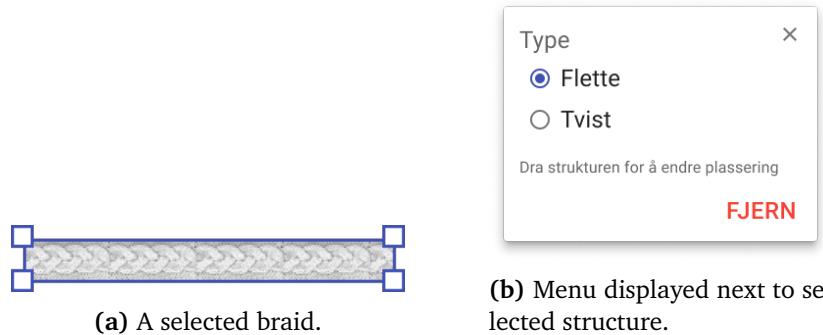
Figure 5.2: Structure selection in A3.

5.2 React Prototype 1

The first functional prototype was implemented in React, and will therefore have the name *React Prototype 1*. This iteration was developed in collaboration with Rosita, and more details regarding the collaboration are presented in Section 4.3. The prototype is presented in her master thesis [41], but this section also gives a description.

Figure 5.4 presents an overview of the prototype. Unlike the Figma Prototypes, the structure step is integrated into Dreamknit's existing website without significant changes to aspects beyond structures.
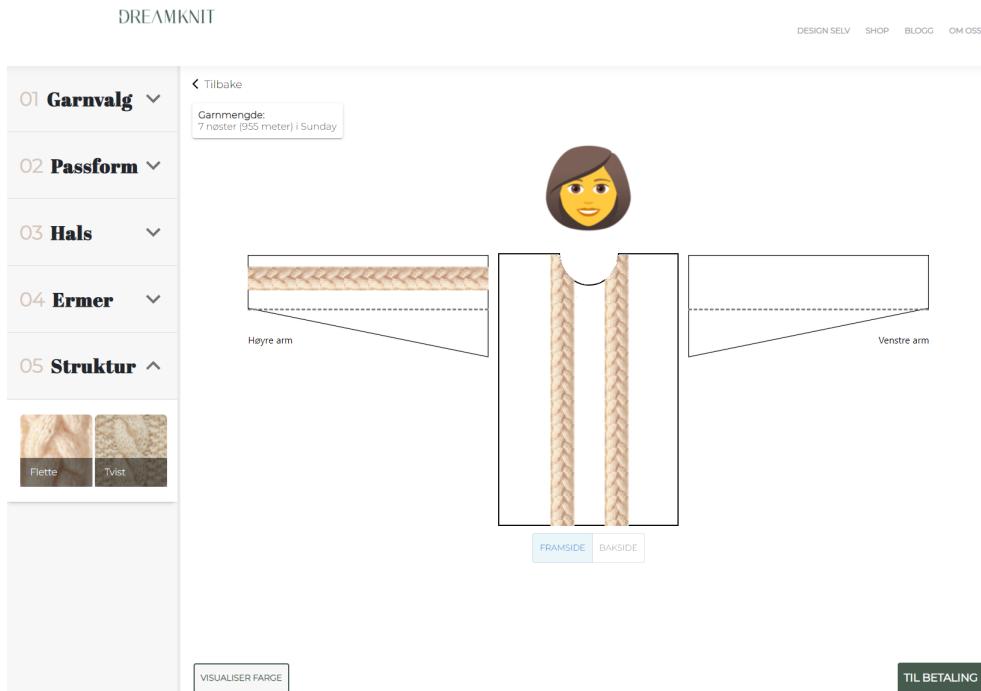
Figure 5.3: Overview of React Prototype 1 with structure step.

5.2.1 Accordion

Structures can be added to the sweater when step 5, the structure step, is opened in the accordion to the left in Figure 5.4. A custom visualization for the sweater is displayed when the structure step is opened, similar to the visualization used in the Figma Prototypes. The structure step title uses the same styling as the previous steps that Dreamknit has already implemented.

The accordion panel contains two buttons that add braids and twists to the sweater. A thumbnail is used as the background for the buttons, and a label with the structure's name is also provided. The structures are added to the sweater by dragging from these buttons and dropping them onto the visualization.

5.2.2 Visualization and Direct Structure Manipulation

The visualization splits the sweater into six parts, as described previously in Section 5.1. In addition, the parts are split into front and back, as shown in Figure 5.4, meaning that only three pieces are visible simultaneously. Buttons are provided below the visualization to switch between the sweater's front and back. These buttons will be referred to as *View buttons* because they change the viewing perspective of the visualization.

Above the visualization is a head, as shown in Figure 5.4, which changes direction based on the currently active view. When viewing the front of the sweater, the head is facing towards you, indicating that this is how the sweater will look from the front. When viewing the back, the face is turned away.

Figure 5.4: Front- and back-side of the head above visualization in React Prototype 1.

In the bottom left in Figure 5.4 there is a button used to change the sweater's color. Figure 5.5 shows how the visualization looks with color. This functionality was already implemented on Dreamknit's website and is not a result of this project. Coloring the visualization used to display structures is not supported in this iteration; therefore, only steps 1-4 offer a colored visualization.

Figure 5.5: Visualization with color in React Prototype 1. The color is only visible in the visualization used in steps 1-4.

After a structure is placed on the sweater, it can be dragged to change the positioning. Note that both braids and twists always stretch from top to bottom on the body or from the arm to the shoulder on the arms. It is, therefore, only possible to move a structure left/right on the body and up/down on the arms, and the movement is in this way only occurring in one dimension for each piece of the sweater.

Figure 5.6a shows how guidelines are provided when dragging a structure near the center of the body. The braid's position snaps to align with the center of the sweater. A blue dotted line indicates that the structure has been aligned. It is also possible to align the edge of the structure to the center, as seen in Figure 5.6b.

The arms contain a dotted line as seen in Figure 5.4. Structures can only be placed above this line. The blue guidelines on the body work the same way on the arms but are horizontally instead of vertically. Aligning a structure to the center of the arm is therefore supported with guidelines when directly dragging the structure.

The mouse cursor does not change when manipulating structures and has the default value during all structure interactions in React Prototype 1.

(a) Center of structure aligned to center of sweater.

(b) Left side of structure aligned to center of sweater.
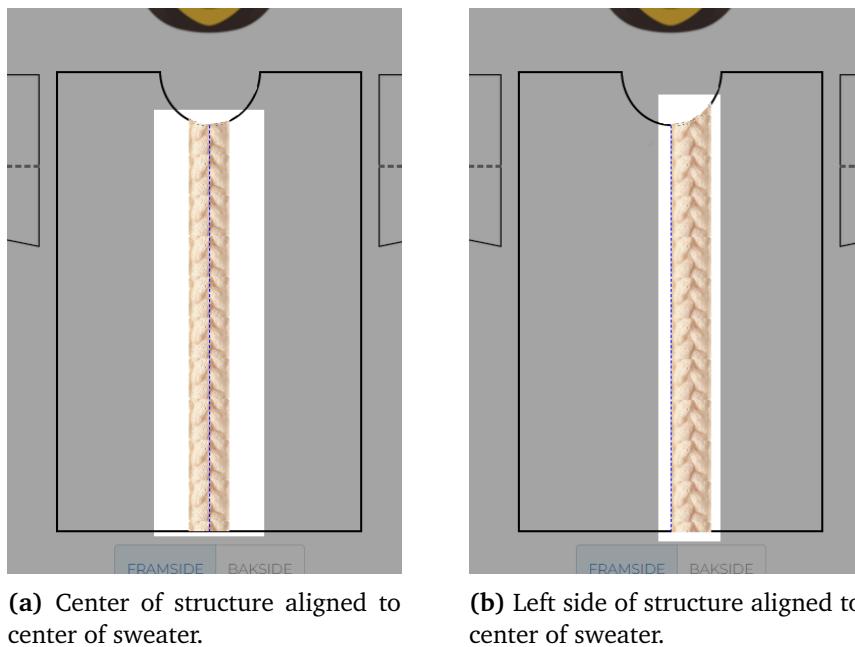
Figure 5.6: Guidelines in React Prototype 1. The guideline is showed as a blue dotted line.

5.3   React Prototype 2

An overview of the second iteration of the functional prototype implemented using React, is shown in Figure 5.7. It is integrated into Dreamknit's website, and similar to the first React prototype (Section 5.2), the focus has been on structures. This iteration has a few improvements compared to the previous version, but the overall process of adding structures is still much the same.

Figure 5.7: React Prototype 2 with structure step.

5.3.1 Accordion

The five steps in the design process are displayed in an accordion, where the structure step has a similar style to the other four steps (Figure 5.7). The structure panel contains the options showed in (Figure 5.12a). These options are related to structures and use the same styling as the other options in the accordion. The first option determines whether the front and back body should be alike or different. When the option is set to alike, any modification of structures on one side of the body is automatically executed on the other side as well.

The second option controls whether the left and right arms should have similar or different structures. When the option is set to different, the left and right arms can be edited separately, but only one arm is shown when set to similar. The view buttons shown in Figure 5.12b changes accordingly, and displays *Left arm* and *Right arm* when the option is set to different, and only *Arms* when set to alike.

The buttons for adding structures were previously placed in the accordion panel (Section 5.2), but were moved to the toolbar in this iteration. Section 5.3.3 describes the toolbar.

5.3.2 Visualization and Direct Structure Manipulation

Figure 5.8a and Figure 5.8b show how structures can be added to both the front body and the arms. Unlike the first React prototype (Section 5.2), the body and arms are not displayed simultaneously but are instead divided into separate views. Structures are also placed directly on top of the same visualization as shown in the previous steps in the design process. However, the arm visualization shown in Figure 5.8b is only visible during the structure step and provides a view of the

sweater from the side. It is only possible to add structures to the top of the arms in this iteration, the side pointing outwards when the arm is alongside the body. Therefore, it provides a lower degree of freedom regarding structures on the arms compared to the first React prototype (Section 5.2).

The images for braids and twists have been changed from photographs to black and white sketches, as seen in Figure 5.12. In this way, the structures are more in line with the style of the visualization.

(a) Front body   **(b)** Arm
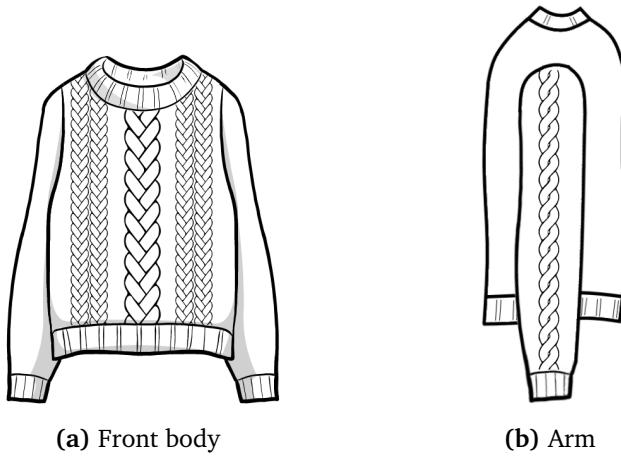
Figure 5.8: Sweater visualization with structures in Version 3 of prototype.

Structures are moved by dragging directly in the visualization, and while dragging, the resize- and delete buttons are hidden. It is also possible to move a structure selection using the arrow keys. When clicking a structure, it will be selected as shown in Figure 5.9a. The color will change to blue, and the user is presented with two blue resize buttons and one delete button. The resize buttons can be dragged to modify the width of the structure. The structure width is constrained to four discrete values (20, 40, 60, or 80 pixels), and structures will snap to these values while resizing using drag. If the *CONTROL* or *SHIFT* key is pressed while clicking a structure, the user can select multiple structures, as shown in Figure 5.9b. This allows the user to modify multiple structures simultaneously since actions like move, resize, align, copy and delete will apply to all structures in the selection.

Different mouse cursors are used during structure manipulation. Only default CSS cursors are used in this project [43]. When hovering over a structure, the *pointer* cursor is used, indicating that the structure can be selected by clicking. Selected structures display a *grab* cursor, while the *grabbing* cursor is used while dragging. However, if a structure is dragged to an invalid position, the *not-allowed* cursor is shown instead.

When dragging a structure close to the middle or sides of the sweater, a guideline, as shown in Figure 5.10a, is displayed to the user, and the structure snaps to this guideline. This provides support for the user to align structures precisely. Unlike the first React prototype (Section 5.2), these guidelines now also works for

(a) Selected structure

(b) Two selected structures
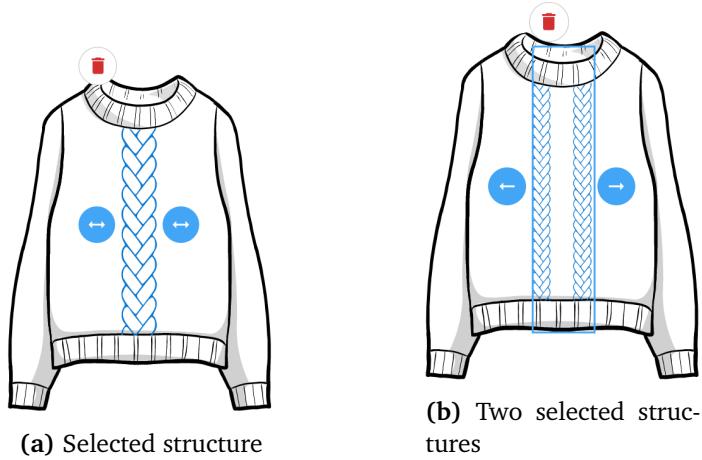
Figure 5.9: Structure selection in Version 3 of prototype.

multiple structures, which Figure 5.10b demonstrates. The guidelines will then consider the group of structures as one unit, allowing the unit as a whole to be aligned. The group's center can, for example, be placed in the center of the sweater.

(a) Guideline

(b) Multi-select guideline
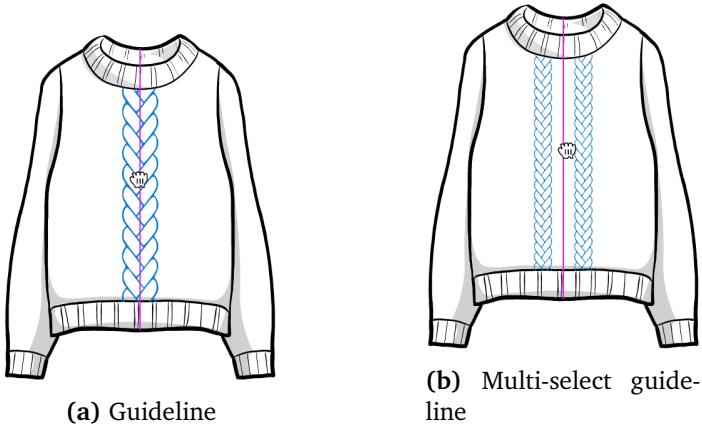
Figure 5.10: Structures guideline in Version 3 of prototype.

5.3.3 Toolbar

Figure 5.11 shows the toolbar, where different tools related to structures are located. Structures are added to the sweater by dragging from the structure buttons in the toolbar to the sweater visualization, as shown in Figure 5.12c. The same thumbnail image as in the toolbar is shown until the pointer is over the droppable zone on the sweater, then the structure is displayed as it will be when dropped. The buttons can also be clicked to add a structure.

Figure 5.11: Toolbar in Version 3 of the prototype.

In addition to the structure-buttons, the toolbar (Figure 5.11) also includes other tools. The leftmost buttons control undo and redo, allowing users to undo and redo their actions. The copy-and-paste buttons are located to the right of the structure buttons. These will allow the user to copy one or more structures to another place on the sweater. The rightmost buttons are the align buttons, allowing one or multiple structures to be aligned to the sweater's left, center, or right side. Buttons that can not currently be pressed are disabled, and all buttons will show a tooltip when hovering over them.

(a) Structure-options. **(b)** View buttons. **(c)** Drag to add structure.

Figure 5.12: Parts of the interface in Version 3 of prototype.

Some actions in the prototype have corresponding keyboard shortcuts, found in Table A.1 (Appendix A.1). This can allow the user to perform actions more quickly and provides an alternative method of executing tasks.

5.4 React Prototype 3

The third React prototype was the last iteration implemented during this project. There were no significant changes in this iteration compared to the second React prototype (Section 5.3), but instead several minor changes concerning structures. The overall design process is the same, while the interaction with structures was the focus.

Figure 5.13 presents an overview of the third React prototype. Dreamknit's navigation bar at the top was made slightly shorter (from 10% of viewport height to 64 pixels). In addition, the back button is moved to the far left to make room for the toolbar. Except for these changes, the layout is very much the same as before.
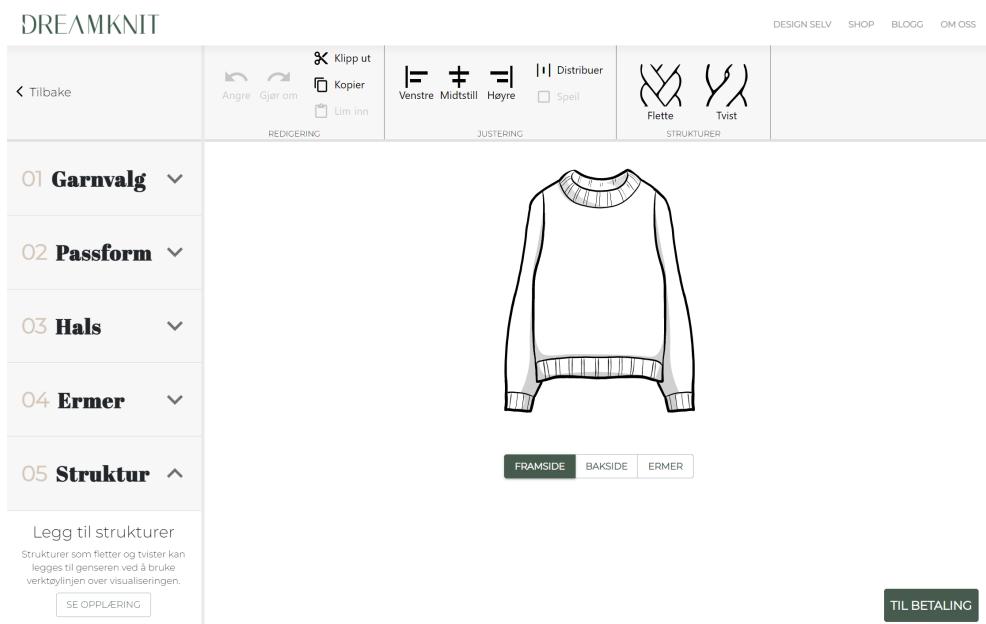
Figure 5.13: Overview of React Prototype 3.

5.4.1 Accordion

The accordion is presented in Figure 5.14, and the structure panel is greatly simplified compared to the previous iteration (Section 5.3). Operations related to structures are completely moved to the toolbar, and the structure panel only contains some explaining text and a button that starts a tutorial.
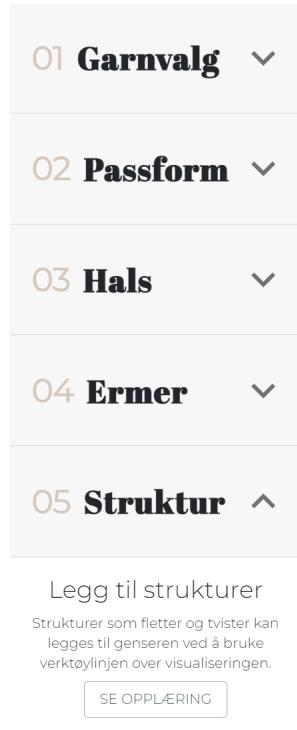
Figure 5.14: Accordion in React Prototype 3.

The tutorial provides an introduction to structures and explains the different tools that are available to the user. The tutorial is divided into seven steps, where each step highlights the tool in question and provides an explanation, as seen in Figure 5.15. For example, Figure 5.15a shows the first step in the tutorial and consists of a text description that explains how to add structures to the sweater using the buttons in the toolbar. Notice that the user can either press *Next*, which continues to the next step, or *Skip*, which exits the tutorial. In this way, the user can always choose to skip the tutorial. Two of the steps also include an image in addition to a textual explanation. The distribute step is one of the two and is displayed in Figure 5.15b. The image supports the textual description in order to provide an easy-to-understand explanation.

5.4.2 Visualization and Direct Structure Manipulation

The visualization is the same as the second React prototype previously presented in Section 5.3. There is, however, one improvement related to the movement of
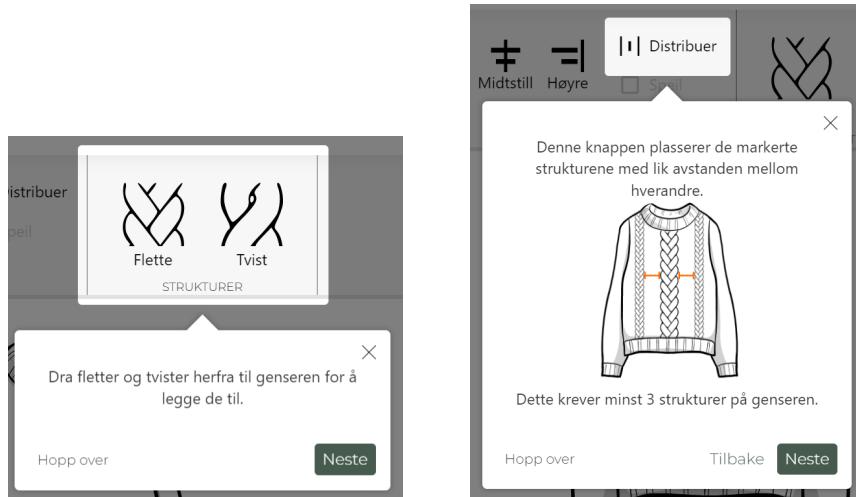
(a) Step 1 explains adding of structures

(b) Step 3 explains the distribute tool

Figure 5.15: Steps in tutorial in React prototype 3.

structures. When dragging a structure near another structure, it will snap to the edge of the other structure, as seen in Figure 5.16. In addition, a guideline is displayed, which provides the user with feedback. This expands upon the guidelines added in the first React prototype (Section 5.2). Therefore, this iteration provides more advanced alignment functionality when directly moving structures.
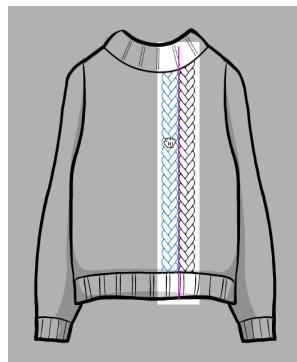
Figure 5.16: Structure guidelines in React Prototype 3.

It is possible to select multiple structures using CTRL+click or SHIFT+click, as in React Prototype 2. In addition, this iteration introduces selection by dragging, and works as Figure 5.17 illustrates. A rectangular area is formed using the drag's start position and current position as the corners for the rectangle. Any structures inside this rectangle are selected. A structure does not have to be completely inside the rectangle to be selected, as long as a part of the structure is inside the rectangle.
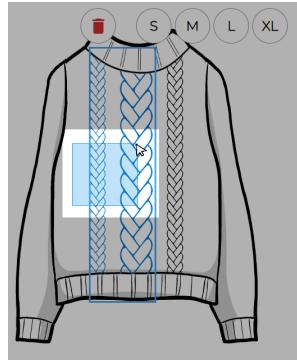
Figure 5.17: Selection by dragging in React Prototype 3. Structures inside the blue rectangle will be selected.

Both the first and second React prototypes, described in Section 5.2 and Section 5.3 respectively, provided drag functionality for resizing structures. This version uses buttons to resize one or more structures, as seen in Figure 5.18. Four different sizes are provided: small (S), medium (M), large (L), and extra-large (XL). When changing the size of a structure, the middle of the structure stays in the same spot. This allows for resizing a structure placed in the middle of the sweater without misaligning the structure.

Sometimes resizing is not possible without causing overlapping structures. If a structure can not fit in the same position after resizing, it will be moved to a new location if possible. If, for example, a structure is placed to the edge of the sweater, and then the width is increased, the structure will be slightly moved towards the center to make room for the wider size of the structure. This happens automatically when resizing, but only when necessary.

By selecting multiple, it is also possible to resize more than one structure at a time. Performing a resize on multiple structures will set the size on all structures to the selected size. Figure 5.17 shows a small and medium structure selected. Notice that none of the resize buttons are highlighted, which is the case when different sized structures are selected.

Figure 5.18: Resize buttons in React Prototype 3.

5.4.3   Toolbar

Figure 5.19 shows the toolbar in the third version of the React prototype. The toolbar is displayed when the structure step is first opened. After that point, it is always visible.
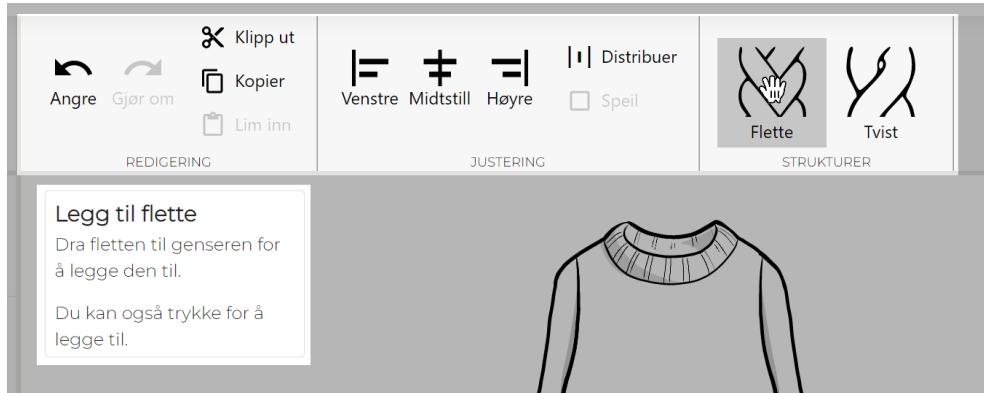
Figure 5.19: Toolbar in React Prototype 3 with tooltip for braid-button showing.

Compared to React prototype 2 presented in Section 5.3, the toolbar is considerably larger in this iteration. The buttons have varying sizes; the braid- and twist buttons are the largest, the undo, redo and align icons are slightly smaller, and copy, paste, cut, distribute and mirror all have the smallest icon size. All buttons also have a text label in addition to an icon. The buttons are separated into three groups: Edit, adjustments, and structures. The edit group contains undo, redo, cut, copy and paste. Adjustments include align buttons, distribute, and mirror. Lastly, the structure group consists of the braid- and twist buttons. The groups are separated using a line, and each group has a small text label with the group name.

When hovering over a button in the toolbar, the button is highlighted, and a tooltip is shown as seen in Figure 5.19. Compared to the previous iteration, this tooltip is not positioned right next to the button but instead below the toolbar as Figure 5.19 shows. In addition, the tooltip is more comprehensive, including a heading and up to several sentences with a description. The tooltips in React prototype 2, previously presented in Section 5.3, included only a few words with description.

Mirroring the front and back body uses the toolbar's mirror button. Unlike React Prototype 2, this is a one-time operation, meaning there is no automatic link between the front and back sides of the sweater. Users who want to mirror their structures to the other side will have to press the mirror button explicitly. If the button is pressed while on the front side, the structures from the back will be placed on the front, and vice versa when viewing the back side. Any existing structures will be deleted after mirroring, and a confirmation dialog, as shown in Figure 5.20b, is displayed if one or more structures will be deleted. When changing to either the front or back, and the other side contains structures while the current

side is empty, the dialog shown in Figure 5.20a is automatically shown. This will ask the user if they want to place the structures from the other side onto this empty side. The left and right arms can not have different structures in this iteration. Both arms are thus identical, and mirroring the arms is therefore not possible.
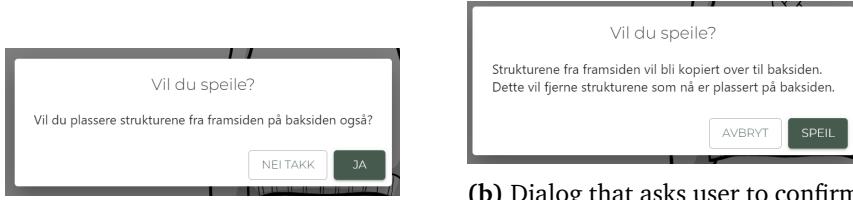
(a) Dialog that asks user if they want to mirror the front to the back. This is displayed when changing to the backside if the backside is empty.

(b) Dialog that asks user to confirm the mirror operation. This is displayed after clicking the mirror button in the toolbar, but only if there are existing structures that will be deleted after mirroring.

Figure 5.20: Mirror dialogs.

Structures can be placed with equal spacing using the distribute button, and the image in Figure 5.15b illustrates how distribution works with three structures. The left and rightmost structures will remain in the same spot, and the structure(s) in between will be positioned so that the selected structures have an equal distance from one to the next. For this reason, distribution requires at least three structures. Note that distribution does not align the structures to the middle of the sweater and therefore does not necessarily lead to symmetry. It is also possible to distribute a subset of structures because only the selection is distributed. If no structures are selected, the default behavior is to perform distribution on all structures currently visible. This is also the behavior of cut, copy, and alignment.

In addition to copy and paste, this iteration also introduces the cut operation. This will remove the selection and put it on the clipboard, which can later be pasted to another location. The keyboard shortcut for cutting is CTRL+X.

5.5 Implementation

This section will present the final version (React Prototype 3) from a more technical perspective and dive into some details related to implementing the functional prototype. It begins with discussing the software architecture from different perspectives. After that, third-party packages are disclosed before mentioning some known limitations.

5.5.1 Software Architecture

The software architecture is described using the 4+1 view model [44]. The logical, process, development, and physical views are presented, followed by a brief description of scenarios.

5.5.1.1 Logical View

TypeScript was heavily used under the development of React Prototype 2 and React Prototype 3. Different global datatypes were created and can be categorized into two groups: Geometry and Structures.

The Geometry datatypes represent primitive geometric shapes, namely consisting of points and rectangles, as well as encapsulating fundamental geometric behavior. It is crucial to use a coordinate system with a well-defined reference point when manipulating geometric elements. Any calculations between objects should utilize the same coordinate system, or the calculation will produce incorrect results. For this reason, each geometric datatype explicitly defines which reference point the element is relative to. Figure 5.21 shows an example of this, where a point can either be an *AbsolutePoint* or a *ContainerPoint*. However, both classes inherit from the same base class, *Point*, so common logic can be extracted and reused. The difference lies in what the point coordinates are relative to. For an *AbsolutePoint*, the origin will be on the top left of the page. On the other hand, a *ContainerPoint*'s origin is at the top left of the sweater visualization. In retrospect, *SweaterPoint* might be a more accurate name for *ContainerPoint*, but renaming will be left for future development.

The reason for having two different coordinate systems is to represent different types of events conveniently and reliably. For example, click events from the mouse are represented by an *AbsolutePoint*, while the position of structures is represented by a *CoordinatePoint*. The benefit of positioning structures relative to the visualization itself, is that one can be certain the structure stays in the same spot, even when the visualization is moved on the page, that could happen if the user for example decides to resize the window or scrolls.
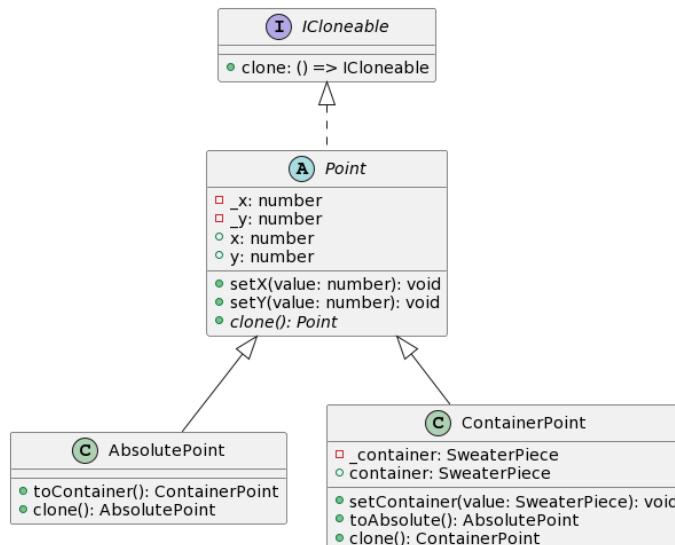
Figure 5.21: Class diagram of types representing geometric points.

The other type of geometry used is rectangles, which work in a similar way as the points. Figure A.1 shows a class diagram of the rectangle datatypes. A rectangle has a position, which is either an *AbsolutePoint* or *ContainerPoint*, and it will consequently be called either *AbsoluteRectangle* or *ContainerRectangle* based on which type of point is used to represent the position. The position is the top left corner of the rectangle, and along with values representing width and height, a complete rectangle can be produced. A structure is represented by a *ContainerRectangle*, which contains methods for calculating if two rectangles overlap or if one rectangle is inside another. This is useful for ensuring that no structures overlap or that a structure is always placed inside the sweater piece.

On the other hand, an *AbsoluteRectangle* is used when selecting an area by dragging. Overlapping between this *AbsoluteRectangle* and a structure's *ContainerRectangle* determines what structures will be selected. Converting between the different coordinate systems is, therefore, a convenient feature that is provided by both rectangles and points. By decoupling general and mathematical features from logic more specific to the current application, rectangles and points provide low-level behaviors and explicit types that can be used across multiple components.

Structures are represented by the model seen in Figure 5.22. A unique identifier is used to distinguish structures from one another, and enums are used to represent the *StructureType* and what *SweaterPiece* the structure is placed on. Even though an explicit *StructureSize* exists, the size of a structure is determined by a *ContainerRectangle*. This is to enable flexibility and increase the modifiability of the prototype. It was considered likely that a more continuous resizing of structures would possibly be desirable to implement in the future. Therefore, the groundwork is done, and the given solution still works for a limited discrete amount of structure sizes.
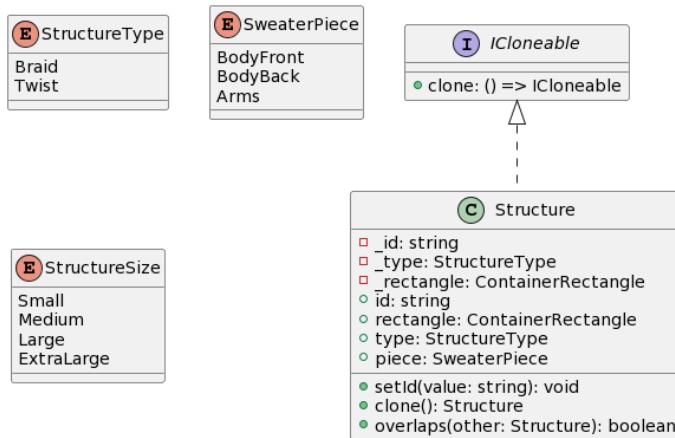
Figure 5.22: Class diagram of Structure type together with global enums.

The *Structure*, *Point* and *Rectangle* classes all implements the *ICloneable* interface. This allows an object to be copied using the Prototype Pattern [45]. By calling

the *clone* method defined in *ICloneable*, a new instance of the current object will be created and returned, where all the fields are the same as the original. Each concrete class, or prototype, will define its implementation of the *clone* method. In this way, even private fields can be copied over. The implementation details of making a clone are left to the specific class implementation, but for this project, it was decided that cloning an object will make a deep clone. Everything will be reinstantiated when cloning, even fields that point to other reference types. When for example a *Structure* is cloned, its corresponding *ContainerRectangle* is also cloned. This ensures that modifying a clone will never interfere with the original in any way.

The Prototype Pattern is useful in this project for state management in React. According to the React documentation, modifying state directly will not re-render a component, meaning that every state modification should be done using *setState* (or the corresponding *useState* hook) [46]. Modifying a complex object, like a *Structure*, that is stored in state should therefore be done in an immutable way. Creating a new object each time state changes could perhaps seem bad for performance reasons, but following the rules of React can also be beneficial in terms of performance. As the React documentation puts it: "React uses several clever techniques to minimize the number of costly DOM operations required to update the UI" [47]. Performance has also not been the top priority in this project, and having the expected logical behavior is more important. Therefore, following the rules set by React is a good idea, and the Prototype Pattern provides a convenient way of immutably updating the state.

When adding structures to the sweater by dragging from the toolbar, the structure is displayed in full when it is over the visualization's dropzone (see Section 5.3.3 for more details). Figure 5.23 shows a state diagram that explains this behaviour in more detail. A small image, called a thumbnail image, is displayed when pressing down on either the braid or twist button in the toolbar. The thumbnail is shown at the current mouse position until the mouse is over the visualization, where a full image of the structure will be displayed on the sweater. The cursor will be either *grabbing* or *not-allowed*, depending on whether or not the preview is overlapping any existing structures. Therefore, feedback is given to the user in the form of *not-allowed* cursor if the structure can not be placed at the current location. When releasing the mouse button, a structure will be added to the sweater if the position is valid. If a structure can not be placed at the current mouse position, a structure will not appear on MouseUp, and the process is terminated.

While dragging a structure, it will sometimes snap to a guideline. This behaviour is described from the user's perspective in Section 5.2.2, Section 5.3.2 and Section 5.4.2, while more technical implementation details will be presented in the following section. A guideline can be defined as a position in which the structure could move to, in order for it to be aligned to something else. This *something else* defines what *type* of guideline it is, and at this point there are two different types of guidelines: Sweater Guideline and Structure Guideline. In other words, a
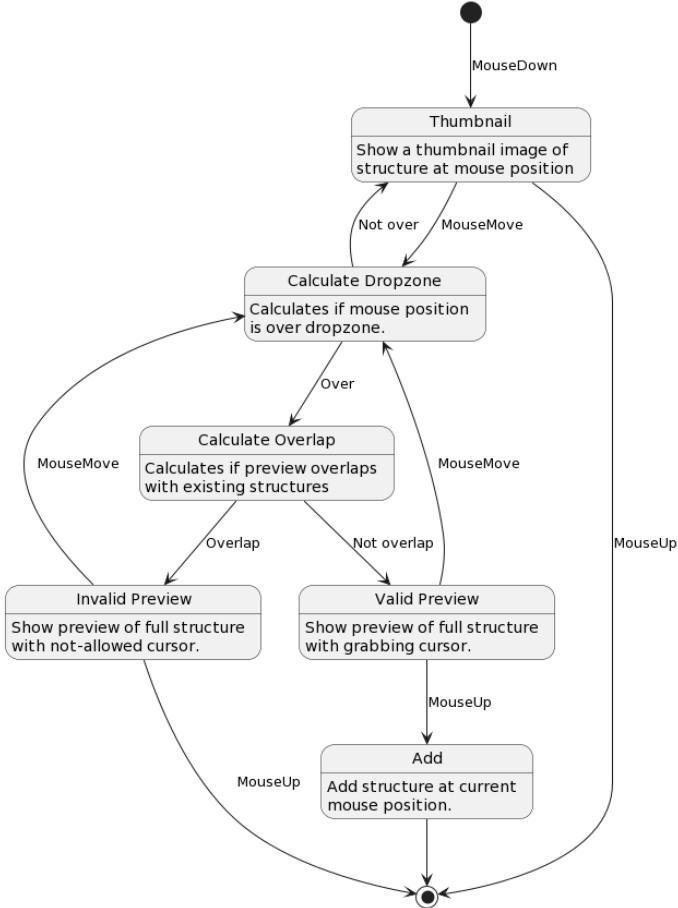
Figure 5.23: State diagram explaining preview mechanism when adding structures.

guideline is a number that represents a potential desirable position of a structure.

Sweater guidelines were introduced in React Prototype 1, and attempt to assist alignment of structures relative to the sweater itself. Figure 5.24 shows sweater guidelines in magenta. One can see five such guidelines in the figure, which are static and fixed, meaning that they will not change as structures are added to the sweater. Guideline 1 (G_1) makes it possible to align a structure to the left, and Equation (5.1) shows that G_1 is always 0 when the reference point is the sweater itself, meaning that a *ContainerPoint* is used.

$$G_1 = 0 \tag{5.1}$$

G_7 does the same thing as G_1 but to the right. Note that G_7 does not seem to be positioned all the way to the right. However, since a guideline represents the position a structure can move to, one has to consider that the placement of a structure is represented by a *ContainerRectangle*. This means that the position
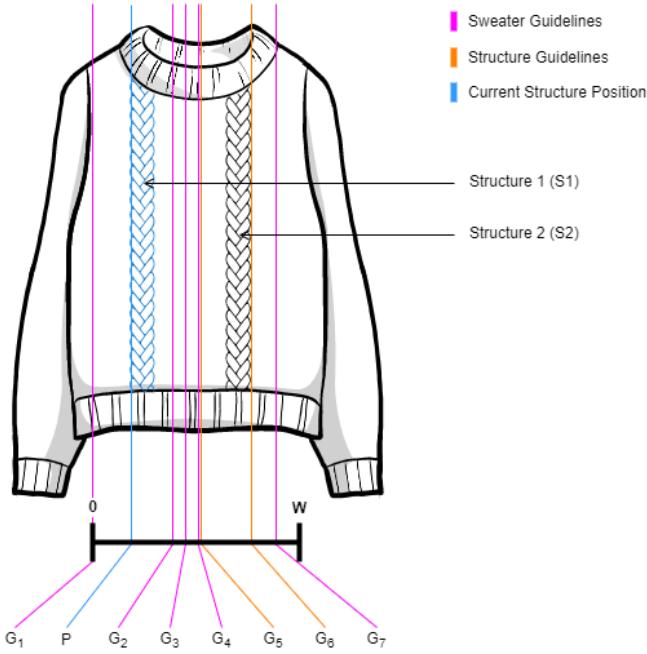
Figure 5.24: Illustration of possible guidelines for the selected (blue) structure. A structure's position will snap to one of these guidelines if the distance is small enough.

of the structure, as a number, is where the left side of the structure is placed, as seen by the position (P) in Figure 5.24. Equation (5.2) shows the formula for calculating G_7, which is not only dependent on the width of the sweater (W) but also the width of the selected structure ($S1$.width).

$$G_7 = W - S1.width \tag{5.2}$$

G_2, G_3, and G_4 are quite similar and only differ with half the width of the selected structure. Their formulas are given in Equation (5.3), Equation (5.4) and Equation (5.5) respectively. All formulas take the center of the sweater, $\frac{W}{2}$, and subtract an offset which positions the structure either with the right edge of the structure in the center (G_2), the middle of the structure in the center (G_3) or the left edge of the structure in the center (G_4).

$$G_2 = \frac{W}{2} - S1.width \tag{5.3}$$

$$G_3 = \frac{W}{2} - \frac{S1.width}{2} \tag{5.4}$$

$$G_4 = \frac{W}{2} \tag{5.5}$$

Structure Guidelines are more dynamic than Sweater Guidelines because they depend on the other structures on the sweater. The purpose of Structure Guide-

lines is to position the edge of a structure right next to the edge of another. In this way, the number of Structure Guidelines is completely reliant upon the number of structures on the sweater. Figure 5.24 shows an example where there is only one other structure on the sweater, thereby producing two Structure Guidelines, G_5 and G_6. Equation (5.6) shows how G_5 is calculated, where the width of the selected structure ($S1$) is subtracted from the position of the structure to align to, $S2$. Equation (5.6) shows how G_6 is calculated, which is equal to the right edge of the structure to align to, $S2$. The formulas given in G_5 and G_6 are computed for all structures, except for the one that is being dragged.

$$G_5 = S2.position - S1.width \tag{5.6}$$

$$G_6 = S2.position + S2.width \tag{5.7}$$

When all Sweater and Structure Guidelines are computed, the result is a list of numbers representing the position of the different guidelines in the horizontal dimension. This list is converted into a new list, D, where each item represents the distance between the selected structure's position (P) and the given guideline. Alternatively, in other words, how far the structure would have to move in order to hit the guideline. Equation (5.8) shows how this is calculated for all n guidelines.

$$D = |P - G_1|, |P - G_2|, ..., |P - G_n| \tag{5.8}$$

In the next step, the item with the lowest value in D is extracted, which will be the guideline with the shortest distance from P. If the distance is smaller than a given threshold, the guideline is chosen, and the structure can snap to it. If, on the other hand, the distance is larger than the threshold, the guideline is too far away, and no snapping will occur.

5.5.1.2 Process View

The structure interaction is integrated into an existing design process. Figure 5.25 presents one possible way of going through the whole process and describes the context surrounding the structure interaction. Note that Dreamknit developed this design process, and it therefore existed before this project began. The user begins designing by visiting the yarn page, where several yarns are fetched from the backend and displayed in the user interface. However, the functional prototype did mock this API call, and no request was sent over a network. Instead, all yarn data were hard-coded into the frontend application, which provided a simpler development experience (see Section 5.5.1.3). The process is nevertheless the same, and the user must choose one of the displayed yarns.

After choosing yarn, the user is redirected to the design page. This is where the sweater itself will be designed. Size, fit, length, neck, and sleeves are selected, and structures are also added. Note that there is a suggested order of choosing the options, which is in the order seen in Figure 5.25, but this order is not forced upon

the user. In addition, having multiple accordion panels open simultaneously is supported, and changing the different options can be modified without navigating to a new page.

When the user is happy with their design, they can go to payment, which navigates to the summary page. An order summary is displayed, and the user can confirm the order. Payment is done using a third-party payment provider, but payment is not included in Figure 5.25 because it is not crucial for understanding the design process. However, it is important not to forget the payment step since it can significantly influence the user experience. After payment, a request would be sent to the backend, where the knitting recipe will be generated. Finally, the recipe is sent back to the user interface and downloaded as a pdf document to the user's machine.

Generating the knitting recipe was out of scope for this project, and therefore it was not necessary to invoke the final order request to the backend. The prototype stopped after reaching the summary page and did not allow the user to proceed. The implementation for generating a recipe in the backend was not created yet, meaning that returning a correct recipe would, in any case, not work correctly.
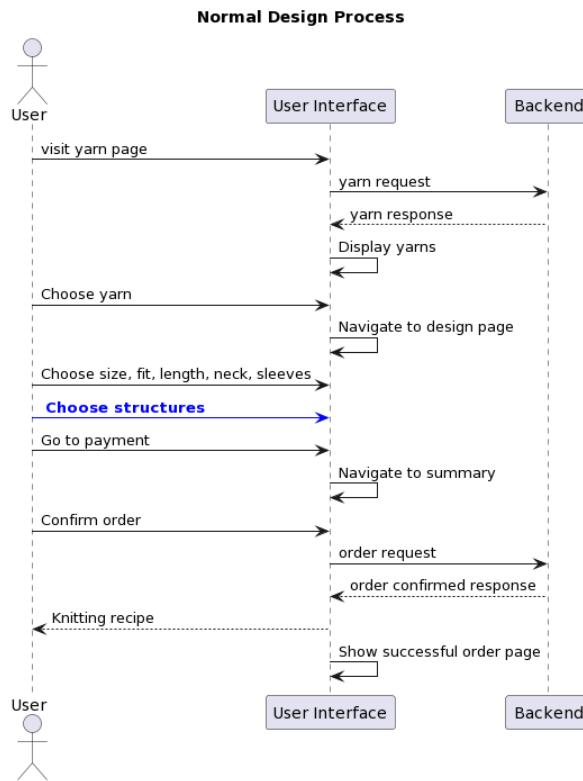
Figure 5.25: Sequence diagram of a normal successful design and order process.

5.5.1.3   Development View

Due to the collaboration with Dreamknit, the functional prototype had to be integrated into Dreamknit's existing application. Their code repository was forked, and a new *Structure* package was added. Changes outside this package were kept to a minimum to make it easier to merge the changes back into Dreamknit's working code repository. Modifying the existing code structure could produce merge conflicts since Dreamknit would continue working on its solution in parallel with the prototype development.

TypeScript (TS) was used to implement the Structure package and was decided in collaboration with Dreamknit. Their existing code base was written in vanilla JavaScript (JS), but they had plans to convert their solution into TS, meaning that many of the packages would likely change soon. For this reason, isolating the Structure package as much as possible would also be beneficial. In addition, TS adds additional capabilities on top of JS, and provides richer language features, like generic classes, as well as tighter integration with code editing software, resulting in a convenient developer experience by catching errors earlier in development [48]. Although alignment with Dreamknit's plans was beneficial, the primary motivation for utilizing TS was to take advantage of the improved developer experience and thereby increase the development speed.

As mentioned in Section 5.5.1.2, calls to the backend were mocked in the functional prototype. The prototype's goal was to test a new feature, namely structures. As shown in Figure 5.25, the backend would only be involved at two points during the design process. Firstly, the collection of yarns was fetched from the backend. This was relatively simple to mock, as the yarns could be hard coded and returned directly from the React prototype. Secondly, the order would be sent to the backend, and a recipe returned. By limiting the focus to the creation of the sweater design, the last step of buying the recipe was considered out of scope. Since only one call had to be mocked, it required low effort. In this way, the backend was unnecessary for the prototype and resulted in a more straightforward development environment. Additionally, the backend included an algorithm for generating a recipe from a design specification, and the specifics of that implementation were considered somewhat sensitive, according to Dreamknit. By mocking one API call, which was relatively easy to do, access to the implementation became unnecessary, and this issue was circumvented.

A component diagram of the Structure package is presented in Figure 5.26. The *Context* component contained logic for mutating and storing state. Using the React Context API, which provides a way of passing data between components without manually passing props down the component tree [49], the state was shared across multiple components. The React documentation suggests using this API sparingly because it makes component reuse more difficult [49]. For this reason, only data that was considered to be global, like the structures that were put on the sweater, was added to this context.

The *Hooks* component consisted of custom React Hooks that other React Com-
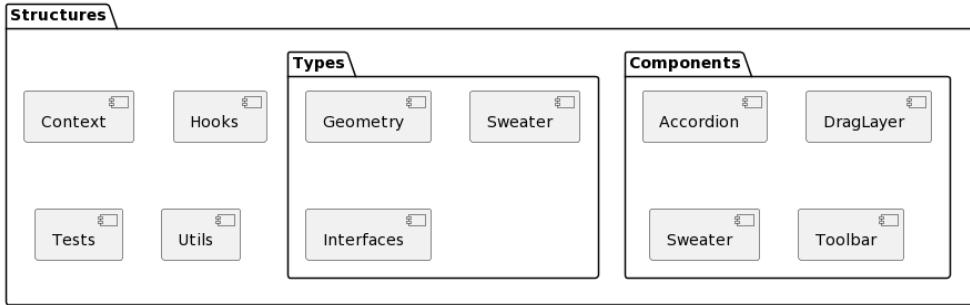
Figure 5.26: Component diagram of structure package.

ponents used. Hooks is an API that React provides and allows a functional React Component to interact with React's features. Making custom hooks help share stateful logic between React Components [50]. *useStructures* is an example of a custom hook and provides access to the structures stored in the global Context and logic for adding and modifying the structure data. In this way, *useStructures* provides functionality that other React Components can use to *hook* into structure-related behavior.

Pure TS functionality that provided various logical behavior was put in *Utils*, which is short for utilities. The utilities are not dependent upon React specifically, and by decoupling pure logic from React, testability, and maintainability are improved. To further improve testability, Dependency Injection (DI) was also used. Firstly, every utility implemented an interface. Secondly, when one utility had to use another, it would only use its interface. This way, the implementation of a utility was separated from its contract, allowing a different implementation to be used during testing. Unit testing the utilities, therefore, became easier, both because of DI and the fact that utilities contained more or less pure logic and were not dependent upon React. A functional React Component does not necessarily have this characteristic, and stateful data can highly influence the behavior, making it more challenging to unit test. Removing React as a dependency improves maintainability because the same logic can be used across different frameworks.

The *Tests* component includes unit tests related to *Utils* and *Types*. Testing of React components was not prioritized in this project, and only pure TS behavior was tested using unit tests. Utilities had 53% code coverage, while tests for Geometry and Sweater types had 84% and 100%, respectively. See Appendix A.3 for full code coverage report. Using dependency injection for utilities made unit testing easier because the implementation of dependencies could be modified and therefore mocked during testing. Tests were run during local development and in an automated CI/CD pipeline when the code was pushed to Gitlab. The pipeline involves both unit tests and end-to-end tests using Cypress. While the unit tests are excellent for catching errors in an isolated component, end-to-end tests are meant to check the integration between components. As previously mentioned, the API calls to the backend are mocked and not particularly relevant for the structure in-

teraction itself. Therefore, the cypress end-to-end testing does not test the whole system, including the backend, but focuses on the interaction with structures.

The *Types* package includes TS the classes and interfaces previously presented in . The *Geomtry* component contains Rectangle and Point

5.5.1.4   Physical View

The solution used a client-server architecture, where the client was created using React, and the server used Django. However, the server-side was not in focus and was, as mentioned in Section 5.5.1.3, not necessary to run the functional prototype. Deployment of the prototype was also not needed, as it ran locally during test sessions. The client would run the program in their web browser, and since API calls were mocked, no calls would go over the network. However, if the prototype were to be deployed into production, it would need to make HTTP requests to the API endpoints exposed by the web server.

5.5.1.5   Scenarios

The application's overarching use case is allowing users to design sweaters. Different customization options are available, and each user can choose what options to use. The prototype explicitly focused on customizing structures, like braids and twists on the sweater. Section 5.4 describes the functionality of React Prototype 3 in more detail.

5.5.2   Third-party Packages

A few third-party packages were utilized in the prototype. Firstly, UI components from Material UI were used. Material UI is a component library for React [51], which follows Material Design, a design system developed by Google [52]. This was a constraint set by Dreamknit, as they already used this library.

Initially in React Prototype 1, jQuery UI was used to implement drag and drop behaviour [53]. However, the integration with React turned out to be somewhat tricky. A guide from React's official documentation was used [54], but still problems related to state management occurred. Specifically, the state would have to be synced between React and jQuery UI, and sometimes they would fall out of sync, leading to unexpected behavior. React Prototype 2 therefore used a different library, called React DnD, which integrated more tightly with React [55].

A custom drag layer was used with React DnD in order to show the desired preview image of structures. While dragging an element, the original element would be hidden, and a new element would be added to the document as a custom drag layer. This was necessary to control the behavior of dragged elements in detail. The drag layer would, for example, show a small thumbnail image while dragging a structure from the toolbar but display a full structure when the mouse came over the sweater visualization.

Jest was used for running unit tests [56]. It was already configured as the default test runner by Create React App [57]. In addition to Jest, *Moq.ts* [58] was used to implement mocking. It is a library inspired by the C# Moq library [59], and provides a simple way of mocking. The functionality for mocking an interface implementation was beneficial and was something for which the built-in Jest mocking behavior lacked support. Another reason why Moq.ts was used was previous experience with the C# equivalent, and therefore the development of unit tests could be done faster.

5.5.3 Known Limitations

As the primary goal of the prototype was to get insights into its usability, it had some limitations. Firstly, supporting different web browsers was not prioritized, and only Google Chrome was used during development and testing. Section 6.6.1.2 presents the pilot test for User Test 3 and revealed that the prototype did not work properly with Tobii's browser. Therefore, there could be similar limitations in other browsers than Google Chrome.

Table 5.1 shows that all end-to-end tests with Cypress passes in Google Chrome 101, Edge 101, Electron 94 and Firefox 100. Cypress was not run using Internet Explorer or Safari because they are not supported [60]. Even though browser compatibility seems quite good, the end-to-end tests could be expanded to check a broader range of scenarios. The basic functionality does, however, seem to work properly across several major browsers.

Table 5.1: Cypress test results in four different browsers.

Test	Google Chrome 101	Edge 101	Firefox 100	Electron 94
Home Page	✅	✅	✅	✅
Basic design flow without structures	✅	✅	✅	✅
Basic interaction with one structure	✅	✅	✅	✅
Copy and paste structures	✅	✅	✅	✅
Resize structure	✅	✅	✅	✅
Selection and de-selection of single structure	✅	✅	✅	✅

Chapter 6

Results

This chapter presents results from the research done in the project. It begins with a short summary of previous results: questionnaire, user test 1, and interviews. This work is necessary to understand the context around this thesis' results. After that, results from this thesis are presented: user test 2, design review, user test 3, and user test 4 are presented. All sections follow a chronological order, meaning that the first section (questionnaire) happened before the second section (user test 1) in the project timeline.

6.1 Questionnaire

A questionnaire was conducted to gather data about user preferences. It was distributed using Facebook and Instagram, and 197 people answered the questionnaire. Rosita's thesis goes into the questionnaire in more detail [41].

The majority of people that answered the questionnaire were women (99%), while 1 participant identified as neither man nor woman. No men answered the questionnaire. Most participants belonged to the age group 18-26 (40%). Figure 6.1 shows the distribution of self-reported knitting competence. The majority of people placed themselves in either the intermediate or advanced category.

The two most popular answers for what participants do with their knitted items were using it themselves and giving it to others (172 and 162 answers, respectively). This means that a substantial portion of users knits for themselves and others.

The degree of modifications to knitting recipes increased as the self-reported knitting competence increased, meaning that more advanced users tend to make more modifications to their recipes. Most participants had tried structure-knitting before (89%), and braids and twists were the most popular structures. Having the same structure on the front and back of a sweater was a popular choice (29%), but having it sometimes similar and sometimes different was the most popular (43%).
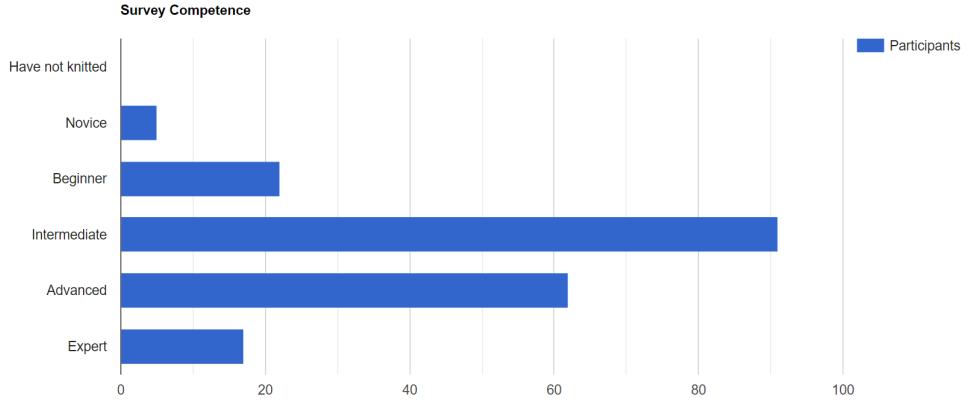
Figure 6.1: Distribution of self-reported knitting competence from the question-naire.

6.2 User Test 1

Between December 2 and December 12, six remote user tests were performed over Zoom. A summary of the results is given in this section, while a full description can be found in Hans' specialization project report [42]. The sessions tested three different Figma prototypes, where each prototype had a varying degree of freedom. Ultimately, the one with the highest degree of freedom, and direct manipulation, seemed most compelling for users.

4/6 users perceived thumbnail images as very positive. It was beneficial to see what the structure looks like before adding it to the sweater. It is a good idea for people who perhaps do not know what a twist or a braid looks like.

Placing multiple structures on the same piece was preferable for 3/6 users. However, 1/6 users did not think it was necessary, and the other 2/6 users did not mention this particular factor. Therefore, providing users with the option of placing several structures on the same piece could satisfy all users since it would be up to the user to decide how many structures to put on the sweater.

5/6 users tried dragging structures from a menu onto the sweater (in alternative 1), even though the prototype did not support this. However, it suggests that this is an intuitive way of adding structures.

Directly modifying the position and size of structures by dragging was preferable by 4/6 users. While the other 2/6 users did not comment specifically on this behavior, they did prefer to add structures by dragging. It is therefore not unlikely that they would prefer to continue with drag interactions after adding the structure using drag.

5/6 users experienced initial confusion around which side is left and right in the visualization. For example, when looking at the front side of a sweater, the sweater's left arm is to the right. This mismatch was somewhat confusing, at least initially. After thinking for a moment, they did, however, figure it out, and when

asked about this in the discussion, they did not have significant problems with it.

6.3 Interview

Rosita held five interviews during the fall of 2021, described in more detail in her thesis [41]. This section provides a summary of key points.

5/5 participants reported that the social media platform Instagram was used to gather inspiration. Instagram is a social networking service for sharing photos and videos [61], meaning that pictures and videos are sufficient for obtaining inspiration for knitters. Friends and colleagues are, however, also mentioned as inspiration sources.

Braids were the most popular type of structure that participants used (4/5). Other structures included moss stitch (2/5) and brioche stitch (2/5). The intermediate and advanced users had all knitted structures before, while the beginner had not, which suggests that it requires some degree of experience in order to be able to knit structures.

2/5 users reported that they test their knitting tension after they have begun knitting and that they know their approximate knitting tension, likely through experience. Options for customization of structures were also discussed, and length (4/5), width (4/5), neckline (2/5), and shoulders/sleeves (2/5) were some of the factors users would like to customize on a sweater.

6.4 User Test 2

Between February 5 and February 7, four remote user test sessions were performed over Zoom. Hans participated as an observer in these sessions, while Rosita was primarily responsible for the execution and analysis. A more detailed description of the results for User Test 2 can be found in Rosita's thesis [41], while this section provides a summary of key results.

In task 1, 3/4 users tried to place one braid at the top of each arm, as they wanted to have a structure going from the top of the shoulder down to the sleeves. All users wanted to have symmetrical placement of structures, both for the arms and the body. 1/4 users had a perfectly symmetrical design in task 1, while the other 3/4 had slightly misaligned structures. Furthermore, the different sizes of structures were not fully discovered by all users, and in task 1, one user did not notice the smallest size. Another did not notice that resizing was possible at all.

All users had some problems related to adding structures to the sweater. One user did not figure out how to add structures and eventually gave up. All of them tried clicking instead of dragging, either on the structure button or on the button and then on the visualization. 3/4 of users still managed to figure out how to drag structures onto the sweater.

Moving and resizing structures was problematic for several users, primarily for two reasons. Firstly, the users would sometimes move or resize one structure

while intending to modify another. Overlapping structures was problematic for this reason because it was not straightforward to select the correct one. Secondly, moving would sometimes be performed while the user wanted to resize, and vice versa. This issue was especially frequent with small structures.

Placing structures next to each other was difficult because guidelines did not support this behavior. When a structure was placed close to a sweater guideline, it would snap to that guideline, making it impossible to place it closer to another structure. The head above the visualization got little positive feedback. Half of the users stated it was unnecessary, while the other half did not pay much attention to it.

6.5   Design Review

A design review was conducted in collaboration with a senior engineer at the Department of Computer Science at NTNU on March 3, 2022. He is also responsible for the UX lab's operation and development, making him a good candidate for reviewing both the design and the HCD process. In addition, Dreamknit contributed with their extensive domain knowledge, as well as a good understanding of who their users are. The goal of the design review was to evaluate the sketch before implementing the next iteration of the prototype in React.

6.5.1   Process

The review session can be described as a standalone design critique that included an expert. A standalone design critique involves giving feedback on a design, often as a group discussion, and analyzing whether it satisfies the objectives [62]. Then, the design is presented, and the participants comment and provide their perspectives on the interface design.

An expert review is a design review where a UX expert evaluates an interface design to uncover usability problems [11]. Heuristic evaluation is also a commonly used method in HCD and focuses on analyzing a design using well-known heuristics [63]. The distinction between an expert review and heuristic evaluation can sometimes be blurry. However, in addition to looking at heuristics, an expert review also assesses the design based on known usability guidelines, principles of usability-related fields, and the expert's previous experience [11]. In this way, an expert review involves a broad range of techniques, such as heuristic evaluation.

Since the session combined a standalone design critique with an expert review, in the way that the expert participated in the critique, benefits from both approaches was obtained. This way, the participants provided valuable feedback based on the design sketch from multiple perspectives.

6.5.2 Issues

The design review's feedback was positive overall, but a few interesting items came up. Firstly, the resize handles can be misinterpreted at first glance (see Figure 5.9). It was unclear to both Dreamknit and the expert whether the resize buttons would move the structure or change its width. The arrows on the button can indicate both move or resize, and can therefore be a potential source of confusion. In addition, it is natural to think that the buttons can be clicked, but they can only be dragged in reality.

The expert had an interesting point related to executing the upcoming user test. Choosing different colors of the sweater is a feature that Dreamknit already has implemented but is not significant for the actual editing of structures. The users might spend much time adjusting the color instead of interacting with the structure step. Therefore, the color feature could be temporarily removed from the interface and thus bring more focus to the structure step. More focus on the structure step is probably a good thing, but removing the color option for the sake of a user test also brings potential downsides. Problems with the color feature will not be discovered if the feature is not there during the user test. The expert also mentioned that entering a hexadecimal value for the color is probably not suitable for the target group.

Dreamknit mentioned that the align operations are similar to existing text editors like Microsoft's Word [36], where you align text. Therefore, many users likely have encountered similar functionality before and can leverage that experience. However, the horizontal distribution of structures is an operation that most users probably have never encountered before, according to Dreamknit. This is something to keep in mind, and further testing will hopefully shed light on how well the users understand the alignment and distribution operations.

Another issue that came up was the fact that the arms are smaller than the body, which can potentially bring different challenges compared to the body. However, the Figma sketch focused only on placing structures on the body; therefore, it was difficult to assess this problem precisely using only the Figma sketch.

6.6 User Test 3

Between March 22 and March 26, six user tests were performed at NTNUs UX-lab. The lab was set up with a desktop computer, where a web camera recorded the user's face. In addition, a table-mounted eye tracker from Tobii was used to record the eye movements of the user with a sampling rate of 120 Hz (Tobii Pro X3-120). See Appendix B.1 for more details about the test setup. Each test took between 14 and 36 minutes, and the participants received a gift card of 100 NOK each.

Table 6.1 presents the demographics of the participants in user test 3. T3U2-T3U6 have quite similar demographics, even though their knitting competence and especially the number of sweaters knitted varies. T3U1 is the only participant in the age group Over 55.

Table 6.1: Demographics of participants in user test 3.

User	Age	Gender	Knitting competence	Sweaters knitted
T3U1	Over 55	Female	Novice	1-3
T3U2	18-26	Female	Intermediate	More than 8
T3U3	18-26	Female	Advanced	1-3
T3U4	18-26	Female	Intermediate	4-8
T3U5	18-26	Female	Intermediate	More than 8
T3U6	18-26	Female	Intermediate	4-8

The time spent on each task is presented in Figure 6.2. Except for T3U5, all users spent more time on Task 1 than Task 2 and 3. The duration of the discussion depended on how much the user had to say and how much time they had to spare.
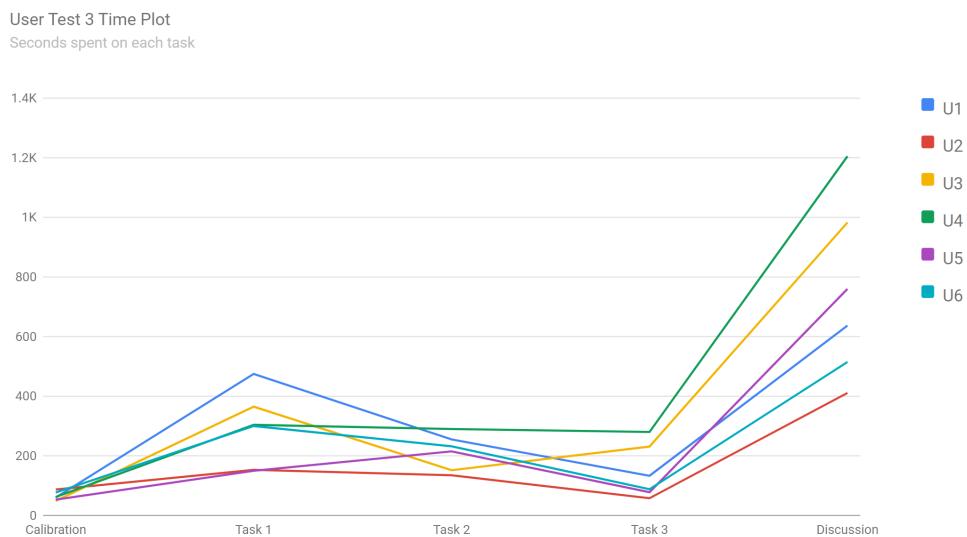
Figure 6.2: Time in seconds spent on each task in user test 3.

6.6.1 Preparation

Tasks were prepared according to guidelines presented in Section 2.1.4. This section presents the tasks in more detail, followed by the results from running a pilot test before the actual test sessions.

6.6.1.1 Tasks

When creating tasks for usability testing, the tasks should be realistic and engaging for the user (Section 2.1.4). In addition, wrapping the task in a story could make the task more interesting for the user, helping the user get in the right mindset. For these reasons, the tasks for user test 3 tried to put the user into a realistic context.

A full description of each task was handed to the users on a piece of paper and can be found in Appendix B.2.

Task 1 asked the user to find a new knitting project to keep them busy during the coming Easter break. The task was meant to simulate what the users would do when they visit Dreamknit's website. The task left the user free to explore the interface as they would in a real scenario.

Task 2 asked the user to design a sweater they could give as a present to a friend's upcoming birthday. They were shown a photograph of a sweater their friend had previously said they liked. Likely, users often look at images of sweaters to find inspiration. Dreamknit, for example, is quite active on social media such as Instagram, where they share photographs of their sweaters. This way, the task aims to place the user into a realistic scenario. The image of the sweater also had structures on it, forcing the user to try out the structure functionality.

Task 3 continued the story from Task 2 and revealed that their friend is fond of structures. The user was therefore asked to place two more structures on the sweater and remove any structures on the backside. The task was meant to test the distribution of structures since three structures would be placed on the front. In addition, it would test that the user understood how to have different structures on the front and the back.

6.6.1.2 Pilot Test

A pilot test was completed on March 17 at NTNUs UX-lab. Unfortunately, the test participant was not a knitter, but the pilot was nonetheless helpful, as it uncovered a few technical issues.

The prototype did not work correctly inside Tobii Lab's web viewer, and Google Chrome had to be used independently from Tobii Lab. It is unclear what browser Tobii is using for their web viewer, but since the prototype did not work correctly, it is unlikely to be Google Chrome (It was later discovered that Tobii implemented their own browser). At this stage, the prototype had not been tested on other browsers than Google Chrome, and therefore this issue was unexpected. The workaround with running the browser separately from Tobii Lab and recording the entire screen did, however, seem to work without impacting the user test result.

The computer screen was also different from the screen used during the development of the prototype. The screen especially had low contrast, making it difficult to see the view buttons below the sweater visualization. This was corrected by changing the buttons' colors to increase the contrast between the buttons and the background. The button text was also changed to bold.

The align buttons in the toolbar did nothing when no structure was selected or if the structure could not be placed in that location due to lack of space in the new spot. This was confusing for the user, and therefore the buttons would now be disabled when aligning is not possible. By giving feedback as well as constraining the user in the form of disabled buttons, the adjustment would hopefully help to

Table 6.2: Overview of key factors in User Test 3.

Factor	T3U1	T3U2	T3U3	T3U4	T3U5	T3U6	SUM
Used drag to add structure	0	1	0	1	1	1	4
Wants to choose yarn last	1	0	1	0	1	1	4
Wants more realistic visualization	0	1	1	1	0	0	3
Changed back-/front structure accidentally	0	0	1	1	0	1	3
Used resize	1	1	1	0	0	0	3
Worried about knitting difficulty	0	1	0	1	0	0	2
Used undo	1	0	0	0	0	0	1
Used copy/paste	0	0	0	0	0	0	0
Used align buttons	0	0	0	0	0	0	0
Used multi-select	0	0	0	0	0	0	0
(Used move by arrow keys)	0	0	0	0	0	0	0

mitigate the issue.

Resizing the arms' structures was impossible when the structure was placed in the middle. It was not enough space to resize it to only one side without going outside the borders of the arm. If the position also moved when resizing, the structure could have been placed within the borders. However, this improvement would require too many resources to implement, and it was decided to wait until the next iteration.

The user also noticed that structures did not appear on the arms when viewing the front and back and were also missing in the summary. This can be confusing, but due to time constraints, it was not prioritized.

6.6.2   Key Factors

User Test 3 revealed several interesting key factors, and Table 6.2 presents how users interacted with important interface factors. Each factor will be presented in the following sections.

6.6.2.1   Used drag to add structure

4/6 users preferred to drag structures from the toolbar onto the sweater when adding a new structure to the design. T3U1 stated that clicking was preferable over dragging, while T3U3 never discovered that dragging was an option. It is

possible that T3U3 would also prefer dragging if she knew it was possible, but this factor was however not discussed with T3U3.

T3U4 used click to add in Task 1 (see Section 6.6.1.1), but then changed to dragging in the subsequent tasks. She did not realize dragging was possible at first but would prefer dragging over clicking.

6.6.2.2 Wants to choose yarn last

4/6 users expressed difficulty choosing the yarn before making the sweater's design and wanted to choose the yarn at the end. However, most users found it hard to choose yarn, and none of the users liked to think of knitting tension and needle size when choosing yarn.

T3U1 was confused when confronted with the yarn selection and spent 2 minutes and 20 seconds choosing yarn in Task 1. When she finally chose a yarn, she said: "Aha, there is the fit (passform), it was here I wanted to go.".

T3U2 did not show any significant problems with choosing yarn, and the order of the steps was not specifically discussed with T3U2.

T3U3 felt overwhelmed when choosing the yarn, and stated she would probably leave the website at that point, had she visited it by herself. She usually picks a recipe and then chooses yarn based on the recipe. Knitting tension was confusing, and she wanted more guidance when choosing yarn.

T3U4 thought it was logical to choose yarn first because it may have significance for subsequent choices. However, specific examples of such choices were not given.

T3U5 stated it was "difficult to begin choosing yarn". She had a very specific idea of how the arms and neck would look like, and wanted to choose that first.

T3U6 mentioned that structures could have an impact on what yarn to choose. When a sweater has many structures, the yarn should have little "fluff" (Et garn som ikke loer). Therefore, it is logical to design the sweater first to see how it will look before the yarn is chosen.

6.6.2.3 Wants more realistic visualization

Half of the users wanted a more realistic visualization of the sweater. Both T3U2 and T3U3 expressed difficulty visualizing the arms and would prefer a 3D model to see around the whole arm. T3U3 and T3U4 proposed showing a photography of a sweater to make it easier to visualize the product's appearance.

6.6.2.4 Changed back/front structure accidentally

Half of the users modified structures on either the front or back on accident while editing structures on the other side. When the front and back are set to being similar, editing on one side will automatically edit the other side as well. This feature resulted in accidental edits, where users meant to change only one side but did not realize the other side would also change.

4/6 users (T3U2, T3U4, T3U5, T3U6) glanced between the structure options and the visualization while modifying the options.

T3U1 was confused by the structure options in the left menu in Task 1. The option for similar/different arms was especially confusing because "you have to have two arms which are the same". Eventually, she understands that the arms option is about structures only, 2 minutes 19 seconds after she first opened the Structures panel. She expresses confusion about the structure options but did not accidentally place any structures.

T3U2 had no problems. After changing the front/back option, the glance immediately goes to the visualization, then back to the structure options in the left menu. She looks up and down at the structure options. She then changes the view of the visualization.

T3U3 placed structures on accident. She started placing structures before she had seen the structure options. In the discussion afterward, she mentioned that she never understood the structure options and did not notice them too much. She suggests that the options should be placed in a more eye-catching location.

T3U4 changed the options in Task 1 and correctly understood how they work. In Task 2, however, she still modifies the other side on accident. At first, she thinks the front/back option is about the length of the sweater. Glance moves between structure options and visualization when she changes options. She also changes the view of the visualization.

T3U5 understood structure options without problems. She noticed the left menu more than the view buttons. In Task 1, she barely glanced over structure options. The panel is open for 2 seconds. The glance also goes between structure options and visualization.

T3U6 changed the other side accidentally in Task 1. She concluded that it was impossible to have different structures on the front and back, as she overlooked the structure options. The glance immediately went to the visualization after changing the structure option.

6.6.2.5   Used resize

Half of the participants resized the structures on the sweater.

T3U1 tried to click the resize button when she wanted to move the structure. After reading the tooltip, she understood the resize buttons' behavior. When she wanted to resize in Task 3, she changed the structure's width without problems.

T3U2 used resize without problems. She dragged the resize button on the first try and did not click it. "I liked that feature, that you could add braids and choose how thick they should be". After resizing, she moved the structure's position to the middle of the sweater.

T3U3 did not click the resize button first and dragged successfully the first time she tried. When changing the width of a structure for the first time, she smiled slightly and looked pleased. "Oh, you can change the width, okay". Unfortunately, she did not manage to change the width of the structures on the arm because a

wider structure would not fit. She did not understand why this was not possible but stated that it was a shame she could not do this and moved on.

T3U4 read the tooltip but did not seem interested in changing the width of structures.

T3U5 did not notice the resize buttons while doing the tasks but noticed them during the discussion. She did not try to click the resize buttons. She initially thought the resize buttons were used to move the structure and did not spend much time thinking about them.

T3U6 did not interact with the resize buttons.

6.6.2.6 Worried about knitting difficulty

2/6 of users were worried about how difficult it would be to knit the designed sweater, especially regarding structures. T3U2 and T3U4 were hesitant to add structures because it would make the recipe harder to knit. Instead, T3U4 suggested adding simpler structures, like knit and purl structures (rett og vrang) and brioche knitting.

T3U1, T3U3, and T3U6 added structures to the sweater in Task 1, while T3U2, T3U4, and T3U5 did not. The reason why T3U5 did not add structures was not discussed.

6.6.2.7 Used undo

One user used the undo and redo feature. However, this was not a very popular feature, and users seemed to edit structures to fix mistakes instead of using undo directly.

6.6.2.8 Used copy/paste

None of the users tried the copy or paste functionality.

6.6.2.9 Used align buttons

None of the users successfully used the align buttons in the toolbar. 4/6 users (T3U2, T3U4, T3U5, T3U6) never tried to interact with the align buttons, while the remaining 2/6 users (T3U1, T3U3) tried to use them but were unsuccessful and gave up.

T3U1 clicked the align buttons while no structure was selected and was confused when nothing happened. After explaining the feature to T3U1 during the discussion, the user preferred to use align buttons rather than moving structures by dragging.

T3U2 did not notice align buttons. She also would prefer direct manipulation with guidelines when aligning structures.

T3U3 clicked the align buttons when no structure was selected. "If there is any solution to this, I am not smart enough to find it".

T3U4 never interacted with align buttons. Instead, she hovered over copy, paste, and align buttons once when looking for how to change color. Presumably, she read the tooltips and did not find what she was looking for.

T3U5 did not notice align buttons. During the discussion, she had a positive attitude towards align buttons, and said she probably would have used them, had she known about them.

T3U6 did not notice align buttons. She would not use these buttons and preferred direct manipulation with guidelines.

6.6.2.10   Used multi-select

None of the users tried to select multiple structures.

6.6.3   Eye Tracking

An eye-tracker was used during the user test. The data retrieved from the eye-tracker were primarily used to enrich the video recording by overlaying the user's gaze on top of the video recording. Reviewing the videos revealed that users look back and forth between the visualization and the accordion in steps 1-4. After changing an option, they will immediately look at the visualization to see what changed. This can also be observed in the gaze plots in Appendix B.4, where most saccades happened between the visualization and the left menu.

A heatmap that combines all six users' eye-tracking data is presented in Figure 6.3. The visualization is quite red, meaning it received much focus. The accordion received a considerable amount of focus, as well as the left side of the toolbar. The right side of the toolbar did, however, draw little attention, about the same amount as the payment button. Individual heatmaps for all users can be found in Appendix B.3.

6.7   User Test 4

Six user tests were conducted between May 3 and May 13. As with User Test 3, they were conducted at NTNUs UX-lab with the same setup. A desktop computer with a web camera recorded the participant's face, while a table-mounted eye tracker from Tobii recorded eye movements. All participants received a gift card of 100 NOK this time as well.

Due to recruitment difficulties, several users had already participated in previous test sessions. T4U1, T4U2 and T4U6 participated in User Test 3 (as T3U4, T3U2 and T3U3 respectively), while T4U3 participated in User Test 1 (as T1U2). T4U4 and T4U5 had not participated in any previous testing during this project.

Table 6.3 presents the demographics of all participants. 4/6 users were intermediate, and all except T4U4 had knitted sweaters before. They were all female and in the age group 18-26.

Figure 6.3: Heatmap on design page in User Test 3. Note that the toolbar was only visible when the structure step was opened.

Table 6.3: Demographics of participants in User Test 4

User	Age	Gender	Knitting competence	Sweaters knitted
T4U1	18-26	Female	Intermediate	4-8
T4U2	18-26	Female	Intermediate	More than 8
T4U3	18-26	Female	Intermediate	More than 8
T4U4	18-26	Female	Novice	0
T4U5	18-26	Female	Intermediate	4-8
T4U6	18-26	Female	Advanced	1-3

6.7.1 Preparation

Guidelines for how to conduct a usability test were used to create tasks for User Test 4 (see Section 2.1.4). The tasks are presented in this section, followed by the pilot test results.

6.7.1.1 Tasks

User Test 4 was prepared in a similar way to User Test 3, and three tasks were created. The structure step was in focus this time, meaning that the tasks were more specific to the structure interaction. The full description of the tasks can be found in Appendix C.1.

Task 1 asked the user to design a sweater they could use during the summer. Furthermore, the sweater should contain braids or twists, thereby forcing them to interact with the structure functionality. The reason for having this task was to first set the context around structures since they had to go through steps 1-4. It

also forced the user to explore the structure interaction.

Task 2 presented an image of one large braid with two twists on each side and asked the user to add this to their design. This allowed the user to continue from Task 1, so yarn did not have to be chosen again. The task also asked the user to ensure that the structures were symmetrically placed and would test if they managed to use the available tools to make this happen.

Task 3 continued from Task 2 and asked the user to cover the whole sweater with structures by placing three twists on each side of the braid in the middle, resulting in 7 structures. An image that showed this pattern was also presented in the task. In addition, the same pattern should be placed on the back side of the sweater. This task would test two things. Firstly, interacting with many structures could bring new challenges. It would be interesting to see if users would use different tools, like copy and paste, when the number of structures increased. Secondly, the mirror functionality would hopefully be used to place the same pattern on the backside.

6.7.1.2 Pilot Test

A pilot test was held on May 2 at NTNU's UX lab with one of Dreamknit's developers. He was very familiar with steps 1-4 but had little involvement in developing the structure step. The pilot helped test the technical setup and received the developer's first impressions of the new design of the structure functionality. A few bugs were also discovered.

He liked that structures could not overlap and preferred direct manipulation with guidelines over using buttons in the toolbar. Guidelines that helped place structures in between each other with equal spacing would also be helpful.

The resize buttons could be confused with the sweater size chosen in step two, and he would choose buttons over dragging to resize. Resize buttons provide a safer and more explicit interaction. He also mentions that the contrast of the resize buttons was low, so the color of the selected button was changed.

He tried to select multiple structures by dragging and prefers dragging over Control+click to select multiple. However, a bug that caused a structure to be deselected when clicking in the toolbar made it impossible to operate on only one structure, and this bug was fixed before the actual tests.

He mentioned that align functions are already familiar from Microsoft Word or Google Docs. However, he does not immediately understand the difference between alignment to center, distribution and symmetry. In this version, a symmetry button was added below the mirror button but was removed as the functionality was not completed in time. The operation was going to make the design symmetric when used. He mentioned that distribution should also consider the distance from the edge to the structures. Therefore, this was asked the users during the discussion part, see Section 6.7.2.2.

Mirroring should be in the opposite direction, according to him. When you are happy with your design, you most likely would like to mirror that to the other side.

Table 6.4: Overview of key factors in User Test 4.

Factor	T4U1	T4U2	T4U3	T4U4	T4U5	T4U6	SUM
Used align	1	1	1	1	1	1	6
Used distribute	1	0	1	1	1	1	5
Mirrored wrong side by accident	1	0	0	1	1	1	4
Used Ctrl/ Shift+Click to select	1	0	0	1	0	0	2
Used copy/paste/- cut	0	0	1	1	0	0	2
Used undo/redo	0	0	1	0	0	0	1
Used drag to select	0	0	0	0	0	0	0
Understood dis- tribute	0	?	0	0	0	0	0

He also mentioned that it should be possible to mirror only a single structure.

The tooltips displayed when hovering over a button in the toolbar took about 1 second to appear. This was the default behavior for tooltips in Material UI, but was quite annoying, according to him. Therefore, the delay was set to 0, causing the tooltip to appear immediately when hovering over a button. Since the tooltip was not covering up anything when displayed, it would not be a problem to show the tooltip instantly.

6.7.2   Key Factors

Several interesting key factors regarding structure interaction emerged during User Test 4. An overview of these factors is presented in Table 6.4, and each factor will be described in more detail in the following sections.

6.7.2.1   Align

All users used the alignment operations in the toolbar. T4U2 used the left and right align buttons after dragging the structures to the edge to double-check that they were placed all the way to the edge. T4U5 also used the buttons to align to the left and right but aligned by dragging for centering. She mentioned that she had more confidence that they were aligned when using the buttons.

T4U6 mentioned that align buttons could be more useful if the structures were smaller and required fine adjustments.

6.7.2.2 Distribute

5/6 users tried to distribute structures using the distribute operation, but none of them understood what distribution would do. Distribution was used when the user wanted to make the sweater symmetrical, and it was confusing when the design did not become symmetrical. T4U1 did not notice that the design did not become symmetrical and continued believing that the design was, in fact, symmetrical after distribution, even though it was slightly misaligned.

Both T4U3 and T4U4 did not find the term *distribute* intuitive, and T4U3 mentioned that "distribute is perhaps a word that not many people are familiar with". T4U4 suggested using the word *fordel* (Norwegian) instead. T4U6 also used this word to understand what distribution would do: "is it to have them equally *fordelt*?".

T4U4 wanted to mark multiple structures and drag to increase the distance between them. She was familiar with more advanced editing tools and mentioned that this behavior is possible in Figma.

5/6 users preferred that distribution only made the spacing between the structures equal, where the spacing between the edge and the outer structures should not be included in the distribution. An illustration can be found in Appendix C.1.4 (Figure C.3). T4U4 did not have any particular preference but preferred direct manipulation when distributing.

6.7.2.3 Mirror

4/6 users mirrored the wrong side by accident, causing their work to be overwritten with the wrong pattern. They misunderstood the direction in which the mirroring would occur. None of them used undo when this happened but instead added the pattern again manually. They did try to use mirror once again, and this time they read the dialog carefully.

5/6 users wanted mirroring to be in the opposite direction, such that mirroring will place the structures from the front to the back when the front is viewed. However, T4U6 thought it was logical the way it was, even though she initially mirrored the wrong side by accident.

All users mirrored the front to the back using the dialog automatically shown when moving to an empty back side, while all users except T4U2 additionally used the mirror button explicitly.

4/6 users (T4U1, T4U2, T4U3, and T4U5) saw the need for mirroring only the selection to the other side. T4U1 mentioned that this could be useful when wanting to align a structure between the front and the back.

Half the users (T4U3, T4U5, and T4U6) wanted to mirror a structure around the center of the sweater to achieve symmetry. The selected structure would be placed to the other side (left to right, or right to left) after such an operation.

6.7.2.4 Structure Selection

None of the users tried to drag to select structures, while 2/6 users tried to use Control+click to select multiple structures. None of the users discovered that dragging could be used to select structures, but the discussion after the test revealed that T4U3 preferred dragging over Control+click when selecting multiple. T4U4 and T4U5 liked using Control+click, and T4U1 liked to have the option to use both. T4U5 mentioned that she "did not know it was possible to select more than one structure at all" but also observed that Control+click was necessary if you wanted to select structures on the side without selecting any in between.

When no structures are selected, an operation, like copy, will be performed on all structures currently visible. T4U1, T4U2, T4U3, T4U4, and T4U5 liked this behavior, while it was not discussed with T4U6. T4U3 mentioned that it was unnatural and would think that nothing happened when nothing was selected. Even though she did not find this behavior intuitive, she did find it convenient.

6.7.2.5 Edit Operations

The operations under the *edit* section in the toolbar includes undo, redo, copy, paste and cut. These operations were used to a small extent during User Test 4, and their usefulness was questioned. For example, two users used copy, paste, or cut, while one used undo or redo.

When asked about the undo functionality, T4U1 answered that "it does not take a long time to remake it, since you do not have that many choices". It is easier to control what is happening by directly manipulating structures rather than using the tools in the edit section, according to T4U3. Even though T4U3 and T4U4 used copy, paste, or cut, they did not find the operations very useful. T4U4 would instead use the mirror functionality than copying and pasting a structure.

T4U3 was the only user that used undo or redo. She said it "was very nice to have an undo button". However, when using undo, she reverted a modification on the arms while viewing the front side and did not notice that the arms had changed.

6.7.2.6 Mobile

All users said it would be easier to use a PC compared to a mobile device when designing a sweater. 4/6 users (T4U2, T4U3, T4U4, and T4U5) mentioned that it would be practical to use a mobile phone when designing but would probably switch to a PC since the interactions were quite complex. T4U4 could imagine herself trying out a design on the phone but would finish the design and order using a PC. T4U6 preferred to have much space when working and would search for inspiration on other tabs while working on a PC.

A simple mockup of a mobile version was presented to each user (see Appendix C.1.5). Even though it might be challenging to get an accurate impression from a static image, it provided rough feedback on a mobile version. None of the

users had any strong opinions regarding the mockup, but a few comments did, however, come up. T4U2 and T4U6 would prefer to have the steps vertically rather than horizontally. The visualization still had to remain in view while scrolling. T4U3 liked that the scrolling was horizontal. Both T4U3 and T4U6 would prefer to zoom in on the visualization. T4U5 mentioned that she had more control with a computer mouse than with touch and was therefore concerned if she would be able to place structures with high precision.

6.7.2.7 Other Factors

None of the users saw the need to introduce a locking functionality, where structures could be locked in a particular position. Locked structures would have to be unlocked in order to be able to move them again. T4U4 noted that locking is useful when elements are layered on top of each other in order to select the right element. T4U3 said that locking could be useful with many structures, but it could also be a hassle to introduce another tool. Locking was not discussed with T4U1.

Buttons were used for resizing structures instead of dragging, and none of the users had any complaints about this. T4U5 said it was "easy to use buttons" and noted that dragging would be helpful if it were continuous sizes instead of predetermined ones. She also wanted a size between Small and Medium. T4U6 also mentioned that "as long as it is the same sizes, buttons are good". It is worth noting that T4U1, T4U2, and T4U6 used the previous iteration of the prototype (React Prototype 2), where resizing was done by dragging. Still, they did not find it annoying to resize using buttons instead of dragging.

No users went through the tutorial. T4U1 said it was "like choosing to read the instructions or not. You can do it if you want, but it is nice to have it there." Half the users (T4U1, T4U2, and T4U4) would prefer if the tutorial did not begin automatically when entering the site for the first time. T4U3 would probably go through the tutorial quickly if it did start automatically, while the remaining two users would not mind if a dialog appeared but would probably skip it.

Four users read the tooltips that appear when hovering over a button in the toolbar and found them helpful. However, T4U2 did not bother reading the tooltips, and T4U5 did not notice them and would prefer to have the tooltips closer to the corresponding button.

6.7.3 Eye Tracking

An eye-tracker was used the same way as in User Test 3. The eye-tracking data primarily enriched the video recording, thereby making qualitative analysis easier. It was, for example, easy to see when users were reading the tooltips. They often went quiet when reading, and without eye-tracking data, it would be harder to determine why they went silent.

A heatmap was also produced from the eye-tracking data, as seen in Figure 6.4. Heatmaps for each individual user can be found in Appendix C.2. The visualization received much of the focus, while the adjustment and structure sections in the

toolbar also received considerable focus, albeit less than the visualization. The tooltip, shown under the undo buttons in Figure 6.4, received about the same amount of attention as the adjustment and structure parts in the toolbar, which is coherent with the observation that many users read the tooltips. The editing, especially undo and redo, part of the toolbar attracted little attention.

The accordion received almost no focus compared to the visualization, toolbar, and tooltips. It is worth noting that the tasks in User Test 4 primarily revolved around structures. Therefore, steps 1-4 would only be chosen in Task 1. In addition, five users (everyone except T4U5) were already familiar with Dreamknit's existing website, where steps 1-4 are implemented. Consequently, users spent, on average, nine times longer with the structure interaction than steps 2-4. Since step 1 is on a different page, it was not included in the calculation.
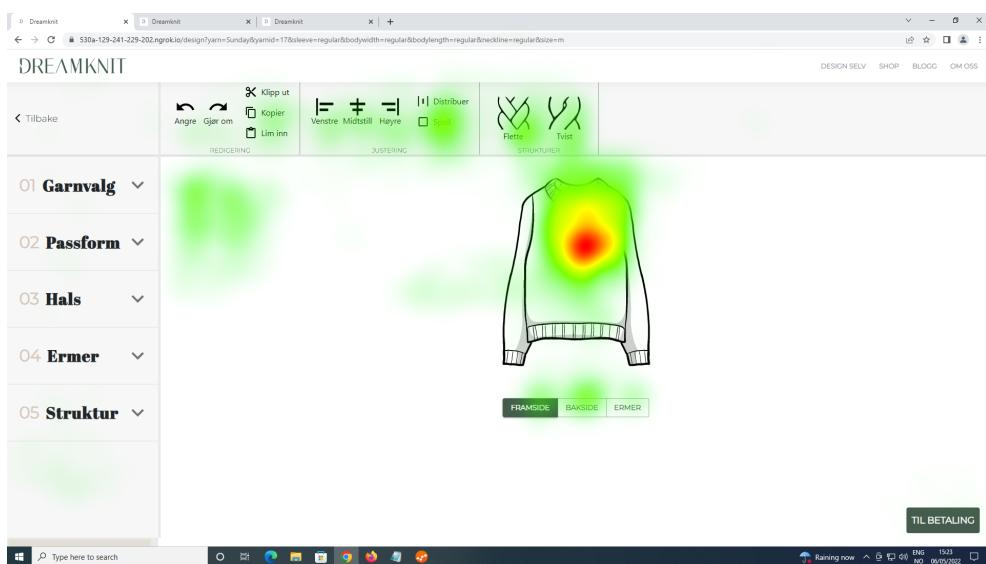
Figure 6.4: Heatmap of design page for all users in User Test 4.

Chapter 7

Discussion

This chapter includes a discussion of the work done in this project. The work was done in collaboration with another student, but the prototype development used results from the collaboration. See Section 4.3 for more details regarding the collaboration. This chapter will therefore begin with discussing User Test 2. Even though it was not directly a result of this thesis, the prototype development still used results from User Test 2. After that, the design review is discussed before reviewing the results from the remaining two usability tests. The work is discussed in chronological order, similar to the presentation of the results in Chapter 6. Lastly, a discussion regarding the overall research validity is presented.

7.1   User Test 2

Results from user test 2 were used for further development of the functional prototype, even though it was primarily conducted by Rosita [41]. Design decisions implemented in Section 5.3 used the result from usability testing, and factors related to the visualization, tools, and direct manipulation are presented in this section.

7.1.1   Visualization

The visualization changed considerably in React Prototype 2, and utilized Dreamknit's existing sweater visualization. Previously, implementing structure interactions using Dreamknit's visualization was considered too complex from a technical perspective, but this was achieved by using the CSS property *clip-path* in React Prototype 2. Reusing the same visualization saved time and created a more cohesive experience for the user, as the visualization remained the same between the different steps, thus improving the interface consistency (Section 2.1.5). Furthermore, the degree of realism also arguably increased since the previous version consisted of more primitive shapes. The level of realism was still on a sketch level and quite a bit away from a photograph. Rosita also suggested that the visualization should become more detailed [41].

The photographs used to represent structures were swapped with black and white images in the same style as the visualization. One could argue that photographs produce a more realistic experience than black and white sketches. However, the photographs used did not necessarily accurately represent the final product. It is not a trivial task to envision how a braid or twist will look when it is knitted. Factors like yarn, knitting tension, and placement on the sweater can significantly influence the structure's appearance. In this case, the photograph was also overlaid upon a primitive visualization, and it is unclear if combining illustrations with different levels of detail is a good idea.

While React Prototype 1 separated the front and back into separate views, React Prototype 2 also made a separate view for the arms. This way, the user's attention would be focused on one piece at a time. Avoiding visual clutter is a method for reducing the cognitive load for the user [64]. If users often work on one piece at a time, displaying only that piece could reduce unnecessary cognitive load by removing elements that the user does not currently care about. On the other hand, if users utilize several pieces together when deciding how to make the current piece, showing all pieces simultaneously might provide valuable and useful information to the user. In this way, separating the pieces into separate views might increase or decrease usability, depending on the degree to which users utilize multiple pieces simultaneously to make design decisions.

The arms were displayed from a different angle in React Prototype 2, strengthening the case for splitting the arms into a separate view. Furthermore, explicitly changing the perspective using buttons could be less mentally straining for the user than viewing the sweater from different angles simultaneously. For this reason, it is reasonable to think that users would prefer to work on the body and arms separately.

Using the visualization from Dreamknit, the arms would also be visible from the front and back, but they would lay alongside the body. This would not allow for the placement of structures directly on the top of the arm, going from the shoulder to the wrist. The results from User Test 2 showed that placing structures in such a manner was lacking in the interface. React Prototype 2 prioritized this kind of placement by viewing the arms from the side. However, it provided less customization opportunity because it would not be possible to place structures on the underarm. Adding even more perspectives would be necessary to accomplish this and was not prioritized.

After feedback from the design review, the option to change color in the visualization was removed. Having it there could cause users to spend much time adjusting the color to their liking, and since this project was primarily concerned with structure interactions, the feature was removed. Users might still want to change the color of the visualization, but it was not the focus of the upcoming test sessions. The box showing how much yarn would be needed was also removed for the same reason.

React Prototype 1 introduced a head above the visualization that was supposed to help the user understand the currently shown perspective. It would show the

face when viewing the front and turn away when viewing the back. Since users from User Test 2 did not find this feature especially helpful, it was removed in React Prototype 2. However, it is possible that this idea could be further developed by providing a more realistic face, or perhaps an entire person wearing the sweater. The available data from User Test 2 did nevertheless indicate that further improvements to the head were something that should not be highly prioritized.

Both the Figma Prototypes and React Prototype 1 were concerned with confusion regarding which side is right and left on the visualization. They tried to combat this issue by adding labels beside the right and left arms, indicating which side the arm belonged to. This turned out to be a somewhat artificially made problem because the symmetrical placement of structures seems to be the norm. If the left and right sides are the same, it does not matter which side is where. The issue only occurred when explicitly asking users to place structures on only one side of the sweater, arguably a task that does not represent a realistic user behavior. Symmetry seems to play an important role for users, but a further examination of this factor could be justified, as the number of participants was relatively low. Nevertheless, these labels were removed in React Prototype 2 to reduce unnecessary clutter.

7.1.2   Tools

Options for mirroring the front and back and arms were provided in React Prototype 2. The questionnaire showed that having similar structures on the front and back is quite normal, and mirroring the front and back is a reasonable feature to include. However, User Test 2 showed that the structure interaction was quite different from steps 2-4 and interrupted the user's flow. The same kind of radio button was used under the structure panel for steps 2-4 to improve consistency between the steps.

Various tools were added in React Prototype 2 and were placed in a toolbar above the visualization. Structure buttons were moved out of the accordion panel to distinguish the structure interaction from other steps since it was quite different. Since other tools were also added, it seemed natural to group these buttons into a common section, which is what the toolbar aims to do. Therefore, it was placed at the top, which is similar to other tools like Microsoft Word, Microsoft PowerPoint, and Figma. Interestingly enough, FigJam has its toolbar at the bottom of the screen. Therefore, it is not evident that the top is the best placement, but it did seem like a reasonable starting point.

Each button in the toolbar showed a tooltip when hovering over, giving a short description of the given tool. This tooltip gave a slightly longer explanation than the label over the structure buttons in React Prototype 1. Since users from User Test 2 reported that understanding how to add structures was a problem, the longer description would say "Drag to add a braid/twist", rather than "braid" or "twist". When dragging a structure from the toolbar over the sweater, the thumbnail would be shown until it was in a valid position where it could be dropped.

Then it expanded and was displayed as it would be if dropped at that point. This feature was inspired by FigJam (see Section 3.1.2) and provided the user with clear feedback about where the structure would be placed. Expanding over the dropzone also made it clear when the structure could be validly dropped.

The mouse cursor would also change when hovering over a toolbar button to convey the appropriate action. For example, a *grab* cursor would show over the structure buttons, while a *pointer* cursor was used for the other buttons, and a *not-allowed* cursor was displayed over disabled buttons. This would improve the feedback to the user by providing visual cues to help the user understand what actions were possible on the different buttons.

Tools for aligning structures to the left, center, and right were added. This behavior worked similarly to aligning text in Microsoft Word, Microsoft PowerPoint, Google Docs, and Figma. This way, the alignment buttons would be familiar for users with experience using standard text editing software. In addition, having explicit buttons for alignment and guidelines when dragging provided an alternative way of modifying structures. Although direct manipulation was well received by users in both User Test 1 and User Test 2, this was a relatively inexpensive feature to add and could potentially reveal circumstances where users would prefer buttons over dragging. Since users have different opinions and preferences, having multiple alternatives for alignment could be reasonable.

Copy, paste, undo and redo operations were also added. These are standard operations found in software like Microsoft Word, Microsoft PowerPoint, Figma, FigJam, and Custom Ink. The operations were available as buttons in the toolbar, but to cater to more advanced users, they could also be performed using keyboard shortcuts.

7.1.3   Direct Manipulation

Resizing small structures turned out to be problematic, as User Test 2 revealed. Users would have to be precise to resize and not move the structure. React Prototype 2 introduced larger buttons used for resizing that was placed next to the structure. This way, it would be possible to move the structure by dragging on the structure and resize by dragging the resize buttons. Directly manipulating the size by dragging was kept the same, as User Test 2 did not report any dissatisfaction amongst users regarding the dragging itself, but rather mistakenly resized when wanting to move. Additionally, one user (UT4) in User Test 2 wanted larger braids, so one more size was added.

A delete button was added that made it possible to remove structures explicitly. In React Prototype 1, structures could only be removed by dragging them off the sweater. Having a more explicit and definitive option for deletion would improve learnability. Custom Ink had a similar delete button next to their elements, and both the delete and resize buttons got inspiration from their solution.

One or more structures could be selected in React Prototype 2. The structure's color changed to blue, and a blue box appeared around the selection, providing

the user with visual feedback. The delete and resize buttons were only visible on a selection, thereby reducing unnecessary clutter. This way, a structure would have to be selected to operate on it, be it resize, delete, align or copy. Furthermore, an operation could be performed on several structures simultaneously, and by that improving efficiency.

Structures could be moved by dragging but also using arrow keys. Pressing the left or right arrow keys would move the current selection in the given direction by 1 pixel. If Control or Shift were pressed simultaneously with an arrow key, the selection would move by 10 pixels instead. This behavior is similar to the one found in Figma Design Figma and FigJam and allows for precise adjustment down to the pixel level.

An issue from User Test 2 was that structures would overlap on the sleeves. In React Prototype 2, structures would therefore not be able to overlap. Having overlapping braids or twists is not possible in a knitting design or would at best produce a highly complex knitting recipe. Therefore, it makes sense to constrain structure placement in this way. It is possible that other types of structures could support overlapping, but overlapping does not seem to be suitable for braids and twists.

7.2   Design Review

The resize buttons seemed a bit ambiguous for the experts, where they could be misinterpreted as moving the structures rather than resizing them. In this way, it was a potential mismatch between the perceived affordance and what the user could do with the resize buttons [65]. However, it was not enough time to address this issue in React Prototype 2, and it was pushed back to the next iteration. Read more about further development of resize buttons in Section 7.4.

Distribution also did not make it to React Prototype 2. Since Dreamknit pointed out that this functionality is probably new to most users, it would be important to explain it sufficiently. A tutorial and elaborate tooltips would be added in React Prototype 3, and is further described in Section 7.4.

It was mentioned that placing structures on the arms could pose new challenges due to the small space available. However, any solutions for this problem were not discussed, but a zooming functionality could make it easier to manipulate smaller structures. It is also unclear if the current arm visualization (see Figure 5.8b) is sufficient, as structures can not be placed around the whole arm. Since no other solutions were proposed, the arm visualization was implemented from the side perspective, and further feedback would be gathered during User Test 3.

The expert provided helpful feedback regarding the practical execution of the upcoming user test. For example, removing elements that could steal valuable time during the session, like color changing, could help steer the session towards the issues in focus. On the other hand, one must be careful not to remove necessary functionality that will influence the tested functionality. Changing the color was

removed in React Prototype 3 since it was considered insignificant for the structure interaction and to avoid the risk of users spending too much time fiddling with different colors.

7.3 User Test 3

When testing React Prototype 2 in User Test 3, several interesting results were discovered. The results are presented in Section 6.6, while this section contains a discussion about the results. Design decisions made to the final functional prototype, React Prototype 3, are explained in this section. Firstly, general factors are discussed, followed by the visualization, tools and direct manipulation.

7.3.1 General

Figure 6.2 shows the time each user spent on each task. However, time spent on each task is not very useful in this case, as participants will spend a substantially longer time on tasks when asked to think aloud [9, p. 83]. Some people will also spend more time talking than others, and thinking aloud is not the natural way the user will use the product. They might spend time sharing their opinion or talking about different elements on the screen, and longer time spent on a task does not necessarily mean that the user had difficulty completing it. In this way, a qualitative approach was more useful in this case.

Even though most users from User Test 3 reported that choosing yarn as the first step was overwhelming, React Prototype 3 did not change the order of the steps in the design process. This has to do with scope, and modifying the context in which the structure interaction was placed was simply out of scope for this project. Devoting the available resources to improving interactions more specific to structures was considered a better return on investment. Changing the order of the steps was therefore left for further development, and moving the yarn step later in the design process was, in fact, something Dreamknit implemented into their solution.

When opening the structure accordion panel, some users did not see the panel's contents in User Test 3 since it was off-screen. Therefore, the panel was automatically scrolled into view in React Prototype 3.

7.3.2 Visualization

Several users from User Test 3 expressed difficulty with visualizing how the final product would actually look like (see Wants more realistic visualization). Even though the black and white sketch is arguably more realistic than the more primitive shapes used in React Prototype 1, it is still just a sketch. E-commerce sites like Amazon, eBay, Nike, and even sites where consumers buy knitting recipes like Pickles.no, often include a photograph of the product that will be purchased. It is no wonder that people want to know what exactly they are buying. It is arguably

even more important when purchasing a knitting recipe for a sweater because you might spend several weeks knitting it. If it did not turn out the way you anticipated, much effort and the money used to purchase the recipe and yarn would be wasted. Showing a photograph of the sweater is challenging from a technical perspective because a high level of customization produces a lot of different design combinations. It would be unfeasible to knit all possible design combinations to take photographs of them. T3U4 suggested showing a small preview of stockinette stitch to visualize what the current yarn would look like. This idea could be investigated further and expanded to include some sample photographs of knitted sweaters. This way, photographs could support the sketched visualization instead of replacing it. Even though this is an interesting idea, it was not prioritized in the development of React Prototype 3.

7.3.3 Tools

Since half of the users changed the back or front side accidentally (see Changed back/front structure accidentally), so the mirror functionality was changed. The automatic mirroring lacked feedback, and some users were unaware of changing the sweater's other side because it was not currently in view. In React Prototype 3, the user had to explicitly press the mirror button in the toolbar or use the dialog that appeared when moving to an empty side, as described in Section 5.4.3. Having operations performed automatically requires that the user understands the mechanism. By removing an automatic mirroring feature, one might assume that efficiency would decrease because users would have to work more manually and spend more time executing their tasks. This is, however, only the case if the automatic feature performs as the user expects. When the feature results in accidental and unintended modifications, it works against the user and reduces efficiency. It is seldom only one way of solving a usability problem, but adjusting the mirror functionality to a more manual approach seemed like one possible and inexpensive solution.

The distribution tool was introduced in React Prototype 3 and would help users make a symmetrical pattern. The distribution behavior was taken from Figma Design, where you can distribute selected elements. The two elements on the edges will stay in the same place, and the elements in between will be positioned with equal spacing. Unlike aligning, this operation is not found in text editing software like Microsoft Word and Google Docs. An explanation was therefore added in the tooltip, as well as in the tutorial. The tutorial also had an image to help visualize what distribution would do. By distributing and then aligning all structures to the center, it would be possible to make a symmetrical design.

The toolbar was made considerably larger in React Prototype 3. The icons were made larger to utilize the available space better and improve the tools' visibility. It was unclear if users understood what the different tools did based only on an icon. A text label next to each button was therefore added. The heatmap in Figure 6.3 revealed that the right side of the toolbar was hard to notice, and therefore

the buttons were moved closer together and grouped into groups. These groups were similar to the ones found in the toolbar of Microsoft Word and Microsoft PowerPoint. These two products also inspired the positioning of tooltips. Yavari found that frequently used buttons should be close to the product visualization [**yavari_MC_toolkit**], which is what React Prototype 3 aims to do.

The operations align, copy, paste, undo and redo were barely used during User Test 3. It is reasonable to think that these kinds of operations become increasingly relevant as the complexity of a system increases. Undo, for example, is only useful if it saves time and effort. When undoing an operation manually is effortless, having an undo tool becomes less convenient. However, this is not necessarily why these tools saw little use, and another explanation could be that users did not understand them. React Prototype 3 added more elaborate tooltips, text labels next to buttons in the toolbar, and a tutorial, to help users understand the tools more easily. If users still did not want to use these tools, a lack of understanding would be a less probable reason.

7.3.4   Direct Manipulation

Users struggled to place structures right next to one another in both User Test 2 and User Test 3. Structures would therefore snap to each other in React Prototype 3, in addition to having the guidelines in the center and edges of the sweater piece. Direct manipulation seemed desirable for users, and improving the placement of structures was therefore prioritized. It would have been implemented already in React Prototype 2 if more resources had been available. More guidelines are likely necessary to support direct manipulation, especially for distributing structures symmetrical. However, the features are implemented one at a time, and testing could gather valuable insights even before all the desired functionality is in place.

Separate buttons were introduced for resizing structures. These buttons were supposed to make it easier to resize smaller structures, and that problem was not seen during User Test 3. Only half of the users did, however, use the resize functionality, and the resize feature, therefore, seems to be somewhat hidden. In an attempt to improve the visibility of resizing, explicit radio-type buttons were added instead of having a drag interaction. Removing the more direct dragging approach is surprising since direct manipulation seems appealing to users. The more explicit radio buttons would, however, increase visibility and, therefore, might also improve learnability. Moreover, since the size of structures was limited to 4 options, radio buttons could be sufficient.

The data would suggest that direct manipulation is better than using buttons for resizing. However, modifying the drag implementation would require more resources than adding radio buttons. Implementation difficulty should not steer the development in an HCD process, but at the same time, one must be realistic with the resources at disposal. Therefore, this approach was a cheap way of finding out something new, and it would be interesting to compare resize by drag and

resize with buttons. If it turned out that the buttons were terrible, it would provide more confidence with the drag approach. If, on the other hand, it turned out the buttons were a good option, that would be an interesting finding. In this way, this decision had symmetry of outcome, meaning it would produce value no matter the result.

7.4 User Test 4

The last iteration of the functional prototype, React Prototype 3, was tested in User Test 4. The results are found in Section 6.7 but discussed in this section. The section begins with a brief discussion regarding general factors and the visualization before tools and direct manipulation is discussed in more detail.

7.4.1 General

The tutorial was not used by any users in User Test 4. Showing an automatic dialog the first time the page is entered, with the possibility to skip, would probably be a good idea. Even though 5/6 users noted that an automatic dialog would be slightly annoying, they did not think it would be too invasive if it were possible to skip it. Having it displayed automatically could be very useful for some users, especially people not very used to computers, according to T4U3. As more advanced tools like distributing and mirroring were somewhat misunderstood in User Test 4, increasing the visibility of the tutorial could help avoid misunderstandings.

7.4.2 Visualization

Two users from User Test 3 suggested a three-dimensional (3D) visualization of the sweater (see Section 6.6.2.3). This would be especially useful for visualizing the arms, according to T3U2 and T4U3. Expanding the visualization to the third dimension is interesting and could be investigated further. However, a substantial amount of resources would have to be devoted to such an expansion. It is not clear at this point if it is truly necessary or desirable for users to have a more complicated visualization. It is likely that such a modification would not only bring positive effects but could also bring new usability issues that must be solved. For these reasons, a 3D visualization was considered out of scope for this project. However, it would be reasonable to explore it further as it could provide a more realistic preview of the sweater.

7.4.3 Tools

The expanded tooltips were quite well received during User Test 4. One user did not notice them, and another did not bother reading them. This would suggest that the tooltip positioning is not invasive and slightly out of view. The majority (4/6) did, however, still read them and found them helpful. The tooltips could

also have been placed closer to the corresponding button, but having such large explanations right next to the button would perhaps obstruct the view of other tools in the toolbar. Following Microsoft Word, where tooltips are displayed below the button being hovered but still under the toolbar, could be one approach worth testing. Another approach for increasing their visibility could be to display a dialog the first time a tooltip is shown and explain that a description of each tool will be presented upon hover.

Undo, redo, copy, paste and cut were still not used very much in User Test 4. Users reported that these tools were not necessary, as they would modify structures manually when needed. After mirroring the incorrect side and losing their work, no one used undo. This would be the perfect occasion to utilize the undo functionality, but it was still not used by any of the four users who made this mistake. Showing a message after operations like mirror and distribute, where the action can be undone, could improve the visibility of undo. This is in line with design guidelines from Material Design [66]. The copy, paste, and cut tools did not appeal to users in User Test 4. One approach would be to remove the buttons from the toolbar but still have these functionalities available through keyboard shortcuts. This solution is seen in Custom Ink, where copy, paste, and cut do not have explicit buttons. If they are, in fact, unnecessary, removing them would reduce clutter in the toolbar.

The heatmap shown in Figure 6.4 shows a slight improvement in the visibility of the toolbar, compared to Section 5.3 (heatmap seen in Figure 6.3). It seems as if distribute and mirror are the buttons that received the most attention in the toolbar. One reason could be that users were less familiar with these operations, as they are not found in popular text editing software like Microsoft Word and Google Docs. Exploring these operations and trying to understand them would draw more attention. More standard operations like undo, redo, copy, paste, cut, and alignment would, on the other hand, not require as much investigation by the users, as they were already familiar with these kinds of tools.

It is also possible to see more isolated areas around each button compared to the React Prototype 2. Buttons were grouped into three groups. For example, one can distinguish between the alignment group and the structure group in the heatmap in Figure 6.4 and would suggest that users managed to distinguish the groups from one another.

The direction of mirroring structures should be reversed. Since all users mirrored the incorrect side in User Test 4, it would strongly suggest that the direction should be opposite. One problem that can occur when reversing the direction is that users do not see the change made since the side that is not in view will be modified. A solution to this potential issue could be automatically changing to the other side after mirroring, providing the user with visual feedback.

The alignment tools in the toolbar were used by all users in User Test 4. This would suggest drastically better visibility for the align buttons compared to React Prototype 2. However, it is worth noting that half of the users participated in User Test 3 and were already familiar with the align tools. Even with this in mind, the

other half of the users still used these buttons for the first time. The larger icons and text labels, and perhaps tooltips also, could positively impact the visibility of the align buttons, as they were more used in React Prototype 3.

Using align buttons and dragging with guidelines were used to align structures in User Test 4. Two users mentioned that they felt more confident when using align buttons to ensure that structures were properly aligned. Interestingly, both these strategies were used for alignment, and having explicit align tools in the toolbar seems reasonable, even though alignment can also be done using direct manipulation.

Distribution was misunderstood by all users in User Test 4. During this project, not a single user preferred an unsymmetrical design. This might be preferable for some users in some circumstances, but the currently available data suggest that an unsymmetrical design is extremely rare. It would therefore be reasonable to distribute structures such that they become symmetrical. However, the details around how this would be achieved are up for discussion. With a given design, it would be multiple ways of making it symmetrical. For example, if three braids are placed on the sweater unsymmetrically, the middle structure would have to be placed in the center. The left and right ones are, however, more tricky to place. Should the left one be moved closer to the middle or edge? Alternatively, is it the right one that should move? Perhaps both should move, but then what distance should be placed between them? Such a tool would have to answer these types of questions. In this way, some mechanism for accurately deciding how symmetry would be achieved would be useful and perhaps necessary.

7.4.4 Direct Manipulation

Using direct manipulation to distribute structures could help answer some of the questions previously mentioned. By involving the user in the operation, instead of having a more or less automatic tool, their input would shed light on their intention. By dragging in the same manner as in Figma Design and FigJam, the distribution distance would be decided. When the structures are placed symmetrically, dragging in such a way should preserve the symmetry.

None of the users utilized the new drag to select functionality in User Test 4. Selecting multiple structures was, in general, not something many users were looking for (only 2/6). Showing the tutorial automatically could also help to shed light on features like drag to select. There were differences in users' preferences; some liked dragging, some liked clicking, and some liked both (see Section 6.7.2.4). Having multiple ways of performing a task caters to the needs and preferences of different users.

Furthermore, selecting all structures as a default when nothing was selected seemed like a convenient functionality. T4U3 thought this behavior was unnatural but still convenient. Interestingly, a feature can be both unnatural and useful at the same time. If this were investigated only by asking users, they would perhaps report that this behavior was strange and undesirable. This demonstrates the

strength of performing a user test compared to, for example, an interview because what users say and do is not always the same.

Resizing using buttons instead of dragging was a slightly controversial design decision since users liked direct manipulation. It was especially valuable to get feedback from the three users that also participated in User Test 3 since they had already tried resizing with drag. None of them found it cumbersome to resize using buttons, suggesting that buttons are a viable option, at least when having only four sizes to choose from. It is quite interesting that using direct manipulation is not always desirable. Having buttons where all sizes are visible seemed to reduce uncertainty around which sizes were available and were easy to use. It is, however, very likely that dragging directly on the structure is a better approach for resizing when more size options are available.

If these results were to be generalized, it would suggest that direct manipulation is less useful for systems with a low degree of freedom. However, since these tests were performed with relatively few participants, one should be careful with generalizing these results to other circumstances. Further studies into this would therefore be necessary to prove such a general theory. The overall research validity is discussed further in Section 7.5.

7.5 Research Validity

Research can be biased in numerous ways, and it is naive to think that bias can be entirely eliminated [67]. The best we can do is to be aware of a research project's significant biases and take measures to mitigate them. This project is no different, and this section presents identified biases and measures taken to mitigate them.

7.5.1 Sampling Bias

Participants were primarily recruited using social media channels, producing a sampling bias. A sampling bias is an error caused by how people are selected to participate in a research project [68]. The primary recruitment strategy would not include users that are not on social media. Likely, many knitters are not using social media, and including these perspectives was a challenge.

The majority of users that participated in usability testing were females in the age group 18-26 (82%). However, the questionnaire's respondents (see Section 6.1 and [41]) had only 40% in the age group 18-26. The demographics for users participating in usability testing should therefore have matched the questionnaire's participants. In this way, the users recruited for usability testing did not reflect the whole population in the recruitment pool, where the requirement pool itself did not necessarily reflect the entire population.

Recruitment difficulties were the primary reason for the sampling bias, and several different channels should be used when selecting participants [68]. The ongoing COVID-19 pandemic made it difficult to recruit users outside of social media by, for example, talking to people outside a yarn shop or shopping mall.

Recruiting users for remote usability test sessions was somewhat easier due to COVID-19 infection considerations, but also from a practical perspective. It is arguably lower effort required from the user to participate from the comfort of their home compared to traveling to a UX laboratory. There are however other benefits of meeting participants physically, including having a controlled environment, utilizing eye tracking, and better social communication with users.

Users were asked if they had friends who could also participate in usability testing, which attempted to include users who might not otherwise have been willing to participate in testing. The recruitment did not rely upon this strategy, and it turned out the be quite inefficient. Nevertheless, it required little effort from the research team, and one user was recruited this way (T4U5).

7.5.2 Acquiescence Bias

An attempt was made to select users outside the social media channels by testing two family members of the team (age groups 41-55 and over 55). The first family member had a connection with Dreamknit but not with the test moderator, while the second member was directly related to the moderator. The participant with relation to Dreamknit would have a lower risk for acquiescence bias, but the directly related user had a considerable risk for acquiescence bias.

Acquiescence bias happens when the participant is inclined to agree with whatever the test moderator presents [67]. Regardless, it was considered beneficial to risk potential bias to gain perspectives from users in a different age group. In addition, practical difficulties with using the system would also become apparent independent of bias, thereby exposing obvious usability problems.

7.5.3 The Hawthorne Effect

Users might behave differently when they know they are being observed. This phenomenon is called the Hawthorne Effect [69]. It is not easy to remove this effect in a usability testing scenario. However, best practices for conducting usability testing were used as guidelines for performing the tests (see Section 2.1.4). For example, explaining that the sessions were not meant to test the user, but the prototype attempted to put the participants at ease. Additionally, a table-mounted eye tracker was used in User Test 3 and 4, which is less intrusive than a head-mounted one.

7.5.4 Expectancy Bias

People tend to agree with whatever the test moderator says and can modify their behavior to match what they expect the researcher wants to see [69]. Following best practices in usability testing (Section 2.1.4), communication with participants was kept as neutral as possible during testing. The moderator would not lead the user in any way, even if the user asked for help. In a normal situation, it would be very tempting, and even polite, to offer help to someone who needs it.

Deviating from this normal behavior was challenging and sometimes created a slightly uncomfortable atmosphere. However, it was crucial to reduce expectancy bias, and help was therefore kept to an absolute minimum during testing.

The test moderator also did not have expert-level experience with running usability tests. A more experienced test moderator would perhaps be more effective in putting participants at ease without revealing any hints. Thorough preparation and pilot testing were used to minimize this risk, but they can not substitute real-life practical experience. Making users feel comfortable is essential for the test results, but reducing expectancy bias was considered more important. Therefore, help or hints was not offered to users unless strictly necessary, even if they became frustrated.

Using incorrect data to make design decisions is arguably worse than using no data because it would produce a false sense of confidence. Therefore, it is crucial to be aware of any bias that influenced the results. Sampling, acquiescence, expectancy bias, and the Hawthorne Effect were four noteworthy biases identified in this project. Additionally, leading questions were also identified as a bias in the interviews (Section 6.3).

Chapter 8

Conclusion and Future Work

This chapter presents the important results in the conclusion, followed by ideas for future work. The visualization, direct manipulation, optimization for mobile, and validation testing are some areas that could be worked further upon.

8.1 Conclusion

This thesis investigated a product configurator for creating a customized design for a knitted sweater. It built upon work done by Rosita Høybakken [41] and a specialization project [42]. A functional prototype was implemented in react, tested during two usability tests with eye-tracking, and examined during a design review. An existing product configurator from Dreamknit was expanded upon to add functionality for adding structures like braids and twists to a sweater design.

RQ1 was answered by exploring different types of interactions in Dreamknit's configurator. Users found modifying structures using direct manipulation desirable. Using drag when adding structures to the sweater was preferable, as it was intuitive and allowed structures to be directly placed at the desired location. Modifying placement by dragging was also intuitive for users. However, modifying the width of structures was tested with both direct manipulation and radio buttons, where radio buttons received slightly higher satisfaction amongst users. The degree of freedom for changing widths was considerably lower than for placement. One hypothesis for why this is the case would be that direct manipulation is most useful when the degree of freedom is high. The hypothesis could make sense, but further testing is required to prove such a general theory.

Structures could be selected, which would show a delete button close to the given structure. None of the users had problems deleting structures using this method. In addition, multi-select, undo, copy and paste were not popular features among users. Users would instead perform actions manually using direct manipulation than the tools, as long as the complexity was low and manual editing was quick. This would suggest that using direct manipulation is easier to learn and more satisfactory than using more indirect tools, even if the tools would offer a quicker and more efficient alternative.

RQ2 aimed to investigate visualizations in product configurators and was answered by trying different forms of visualizations. Two primary visualizations were tested: splitting the sweater into several primitive shapes and using more realistic sketched images. The first approach did not support the placement of structures directly on the top of the arms, but users were surprisingly okay with the low level of realism, as long as they could place the structures where they wanted. This would suggest that supporting the proper placement of elements is more important than a high level of realism in visualizations for product configurators.

Furthermore, the visualization is an effective feedback mechanism, and it should update to reflect changes in options immediately. Users' gaze would immediately go towards the visualization after changing an option to verify what happened. The visualization would not change for certain options in User Test 3, creating uncertainty among users. This way, any customization adjustments should be displayed in the visualization to provide clear feedback to users.

Sketched visualizations seem like a viable option in circumstances where photographs are not feasible. However, it is challenging to convey the texture of a sweater through a sketched image, which was a limitation of the tested visualization.

8.2 Future Work

Direct findings from User Test 4 is discussed in Section 7.4, where possible improvements of the prototype are described in detail. This section provides a higher-level description of possible areas that can be worked on further.

8.2.1 Visualization

During this project, two primary methods of visualizing the sweater were tested. Investigating alternative methods of visualization would be interesting. Ideally, a visualization should support placing structures on the top side of the arms and around the entire sleeves. Splitting the arms between front and back, such as in the Figma Prototypes and React Prototype 1, did not support placement on the top side of the arms. While React Prototype 2 and React Prototype 3 did support placement on the top side of the arms, they did not support placement around the whole sleeve. Therefore, the visualization for the arms could be investigated further.

Testing a 3D visualization of the sweater would be interesting. It could, however, bring new challenges, especially in terms of interactions and added complexity. At this point, it is unclear whether a 3D visualization is necessary or even desirable to users. Further studies could be conducted to collect more data about how reasonable a 3D visualization would be.

Combining real-life photographs with the visualization could increase the level of realism. Even a photo shown beside the regular visualization could help users visualize how the sweater will look. Such an image could represent how the

sweater's texture will be, which is something a sketched visualization does not offer. This step could also be taken further by integrating a more realistic texture in the sweater visualization itself.

8.2.2 Direct Manipulation

Features for supporting direct manipulation of structures should be further improved upon. Guidelines for supporting distribution, such as in Figma Design, FigJam and Microsoft PowerPoint, should be added. Additionally, guidelines for placing two structures with equal distance from the center or edge, such as in Microsoft PowerPoint, would also probably be useful.

8.2.3 Mobile

According to statistics from Dreamknit's Google Analytics (see Appendix E), 77% of their website sessions use a mobile device. The bounce rate is three times higher on mobile devices than on desktop devices, where 36% of mobile users will leave the website right after arriving, compared to 12% on desktops. Furthermore, the average session duration is 1 minute 37 seconds on mobile, compared to 2 minutes 57 seconds on desktop. These factors suggest that mobile users' attention spans are shorter than desktop users. Providing a satisfying mobile experience would therefore be important for attracting mobile users, which is the majority of visitors for Dreamknit.

Two mockups of a mobile version was showed to users in User Test 4 (see Appendix C.1). Feedback from this was quite limited and did not produce any particular useful insights. Further work on optimizing the experience on a mobile device would be interesting. Designing for a smaller screen that utilizes touch input instead of a computer mouse will bring new challenges. In addition, mobile devices will likely be used on the go, for example, on the bus, where lighting conditions and the environment could produce disturbances.

8.2.4 Validation Testing

During this project, the primary types of usability tests conducted were exploratory and assessment. Before releasing a product into production, performing validation testing would reduce the risk of releasing a product that customers find unacceptable. When the time comes to integrate the new structure functionality into Dreamknit's final product, one approach would be to expose the new version to users incrementally. For example, one could identify if the new version contains significant errors by comparing key statistical measurements, like bounce rate and purchases, between the old and new versions. However, this method would not produce qualitative feedback, which a validation test could, and does not replace the need for running a validation test.

8.2.5   Other Ideas

Providing templates for standard designs could be interesting to investigate further. Templates could be a convenient way of creating typical sweater designs and serve as inspiration for users. Perhaps users could create their own templates and share them with others. If such a network was created, users could also share photographs of their knitted sweaters, allowing them to see precisely how a particular design will look.

Several users from User Test 3 and User Test 4 mentioned that they preferred to purchase items, in general, on a desktop computer. It is, therefore, possible to imagine a scenario where a user starts to design something on a mobile device and continues with the final details and payment on a desktop device. Usability tests where participants would use both a mobile and desktop device (in the same session) could be interesting to investigate.

The selection of yarn could be further improved and is, in fact, something Dreamknit has been working on in parallel to this project. Reordering the steps such that yarn becomes after design, is one of the factors Dreamknit is already working on implementing. Since structures are not yet part of Dreamknit's website, structure modification must be integrated into the other processes. Yarn selection and structures depend on each other, meaning that certain types of yarn are not suited for creating structures. Further studies into how one could integrate yarn selection with structures could help users choose the suitable yarn for their sweaters.

Dreamknit's concept could be further expanded to support other garments like gloves, scarfs, socks, or hats. Sweaters are quite complicated and take a considerable amount of time to knit. Providing smaller garments could be easy to implement while also being faster to knit and could be especially useful for beginners.

The questionnaire (Section 6.1) included a question for determining if users would be interested in purchasing a finished sweater instead of only a knitting recipe. Even in a population primarily consisting of intermediate and advanced knitters, 20% could consider purchasing a finished sweater. Integrating Dreamknit's design tool with a third party that offers machine knitted sweaters based upon a custom recipe is something to consider.

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Appendix A

Prototype

A.1 Keyboard Shortcuts

Table A.1: Keyboard shortcuts in prototype version 3.

Key	Action
CONTROL+C	Copy selection
CONTROL+V	Paste
DELETE	Delete selection
BACKSPACE	Delete selection
CONTROL+Z	Undo
CONTROL+Y	Redo
Arrow keys	Move selection by 1 pixel
CONTROL+Arrow keys	Move selection by 10 pixels
ESCAPE	Deselect selection

A.2 Rectangle Class Diagram
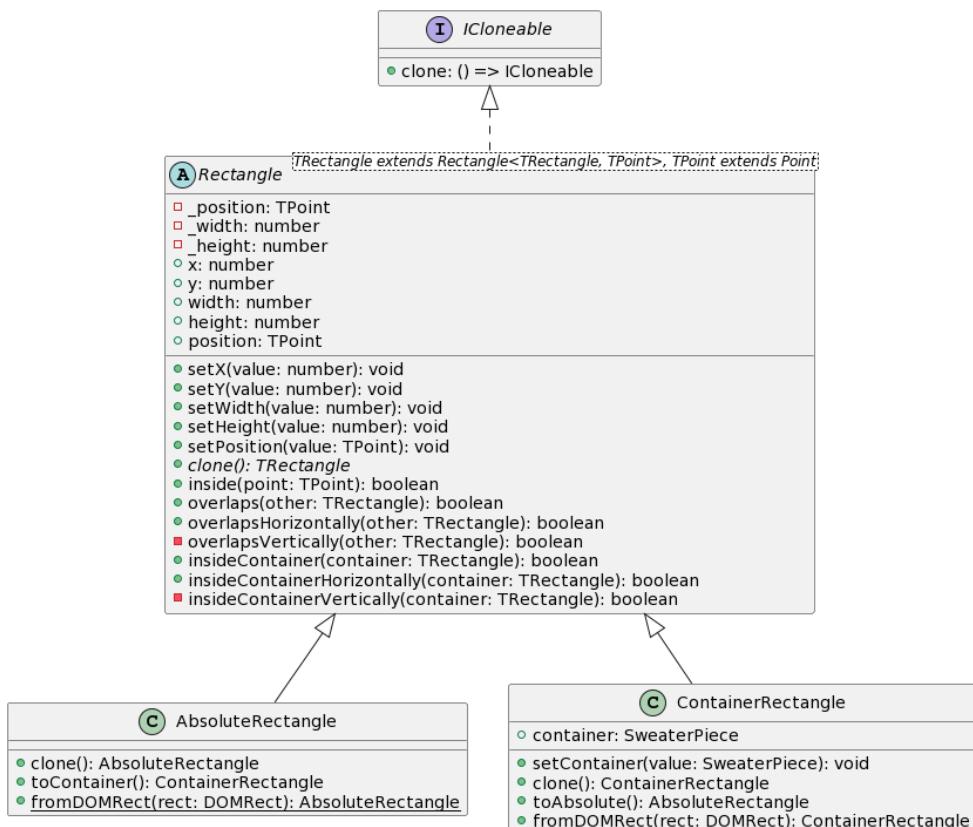
Figure A.1: Class diagram of types representing geometric rectangles (React Prototype 3).

A.3 Code Coverage

File ▲		Statements			Branches			Functions			Lines	
Structures		0%	0/0		0%	0/0		0%	0/0		0%	0/0
Structures/Interfaces		0%	0/0		0%	0/0		0%	0/0		0%	0/0
Structures/Types		0%	0/0		0%	0/0		0%	0/0		0%	0/0
Structures/Types/Geometry		83.58%	56/67		96.15%	25/26		81.4%	35/43		83.61%	51/61
Structures/Types/Sweater		100%	13/13		100%	2/2		100%	9/9		100%	12/12
Structures/Utils		53.66%	132/246		49.37%	39/79		54.84%	34/62		52.51%	115/219

Figure A.2: Code coverage of unit tests in prototype.

Appendix B

User Test 3

B.1   Test Setup

The test was setup at NTNU's UX lab, where a windows desktop computer was used together with external microphones, web camera and a Tobii Pro X3-120 eye-tracker. Figure B.1 shows a photograph of the test setup for User Test 3.
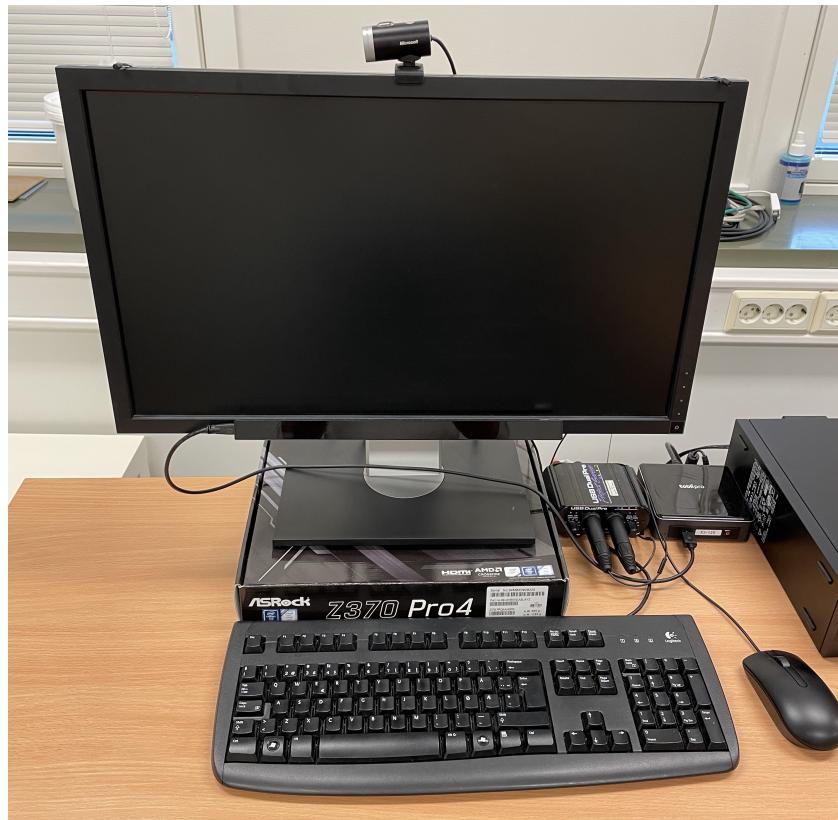
Figure B.1: Test setup for user test 3 (Same for user test 4)

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B.2 Tasks

All the tasks from User Test 3 are presented in the following sections. The tasks are written in Norwegian, and were handed to the users on a piece of paper.

B.2.1 Task 1

Påsken nærmer seg, og du leter etter et nytt strikkeprosjekt som kan holde deg opptatt i påsken. Du havner på Dreamknit sin nettside, for å sjekke ut hva som finnes der. Lag et design for en genser som du kunne tenke deg å strikke. Oppgaven er ferdig når du er fornøyd med designet. Du trenger ikke fullføre kjøpet.

B.2.2 Task 2

En god venninne av deg har snart bursdag, og du tenker å strikke en genser til henne. Hun har tidligere snakket om en genser hun synes var veldig fin, som vises på bildet (Figure B.2). Design en genser som ligner på denne genseren, som du tror din venninne vil like.

Figure B.2: Image of sweater in Task 2

B.2.3 Task 3

Du kommer på at venninnen din er veldig glad i strukturer. Derfor lurer du på hvordan genseren vil se ut med flere strukturer. Prøv å legg til en tvist på hver

side av fletten på bolen. Du kjenner venninnen din godt, og vet at hun heller ikke liker å ha struktur på baksiden av bolen. Endre designet slik at venninnen din vil bli fornøyd med bursdagsgaven.

B.3   Heatmaps

Heatmaps for each individual participant in User Test 3 is presented in this section.
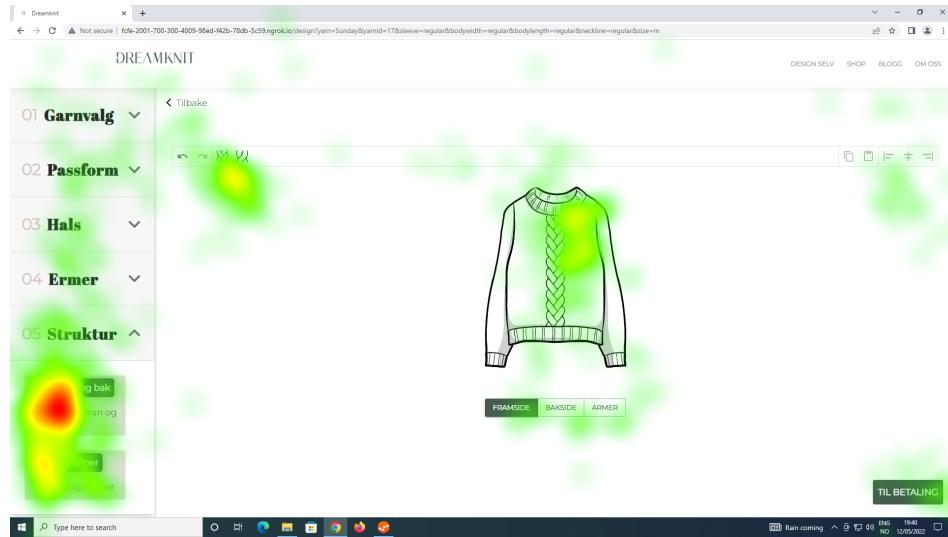
Figure B.3: Design page T3U1
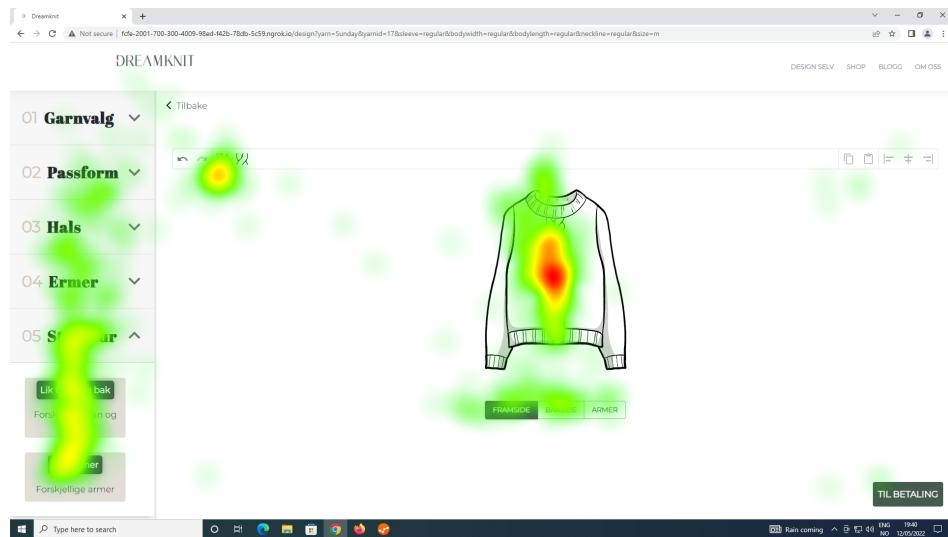
Figure B.4: Design page T3U2
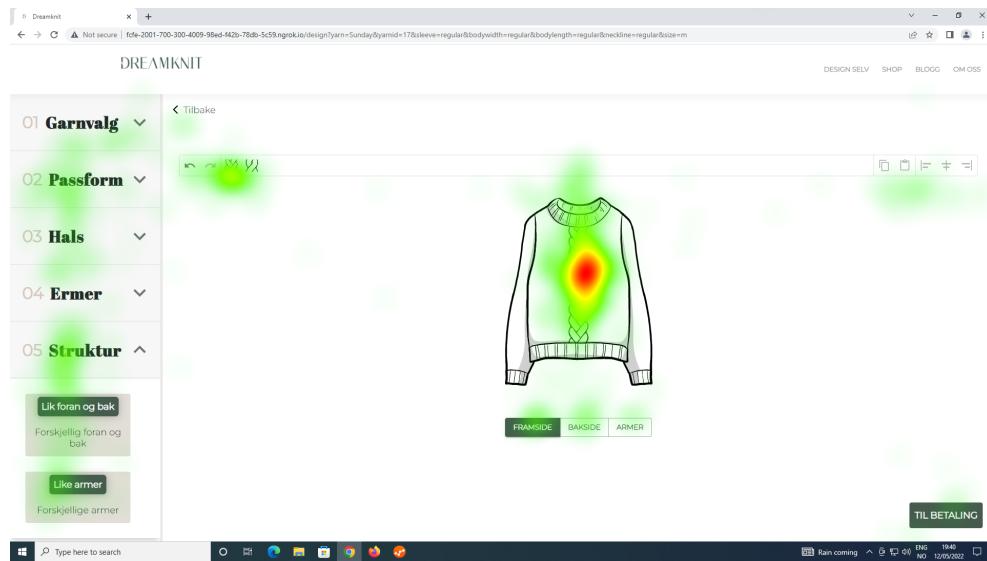
Figure B.5: Design page T3U3
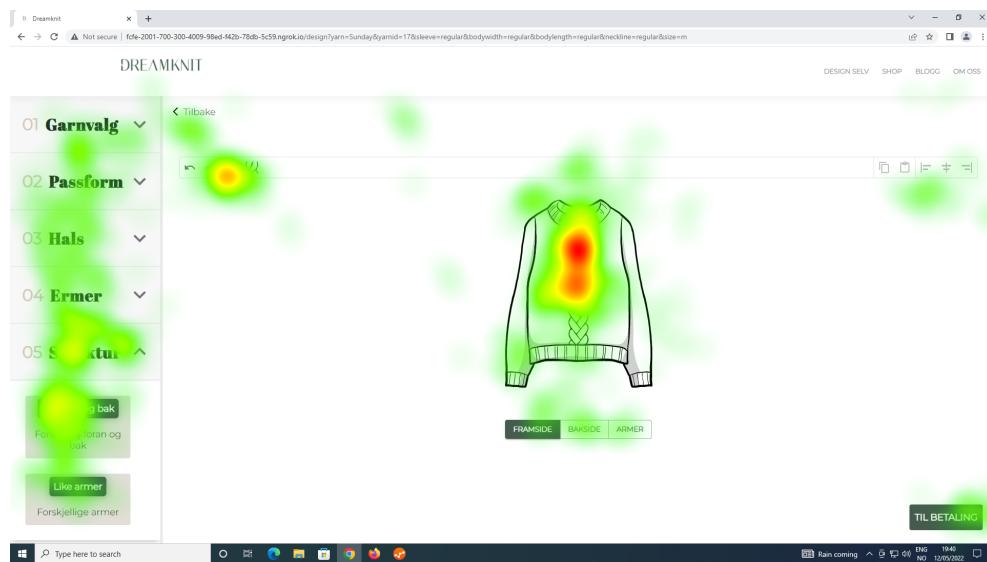
Figure B.6: Design page T3U4

Figure B.7: Design page T3U5
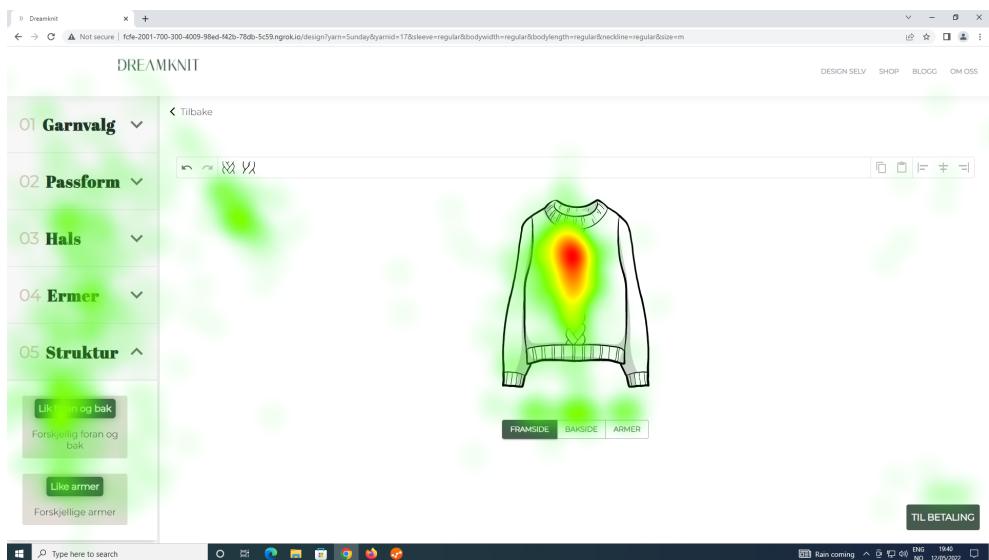
Figure B.8: Design page T3U6

B.4 Gaze Plots

Gaze plots for participants in User Test 3 is presented in the following section.
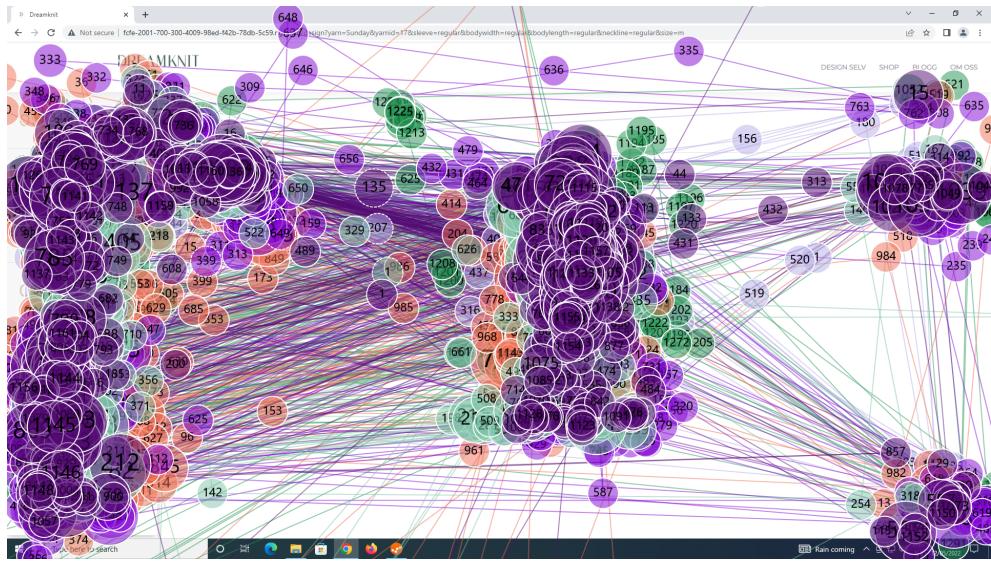
Figure B.9: Design page T3U1-T3U6
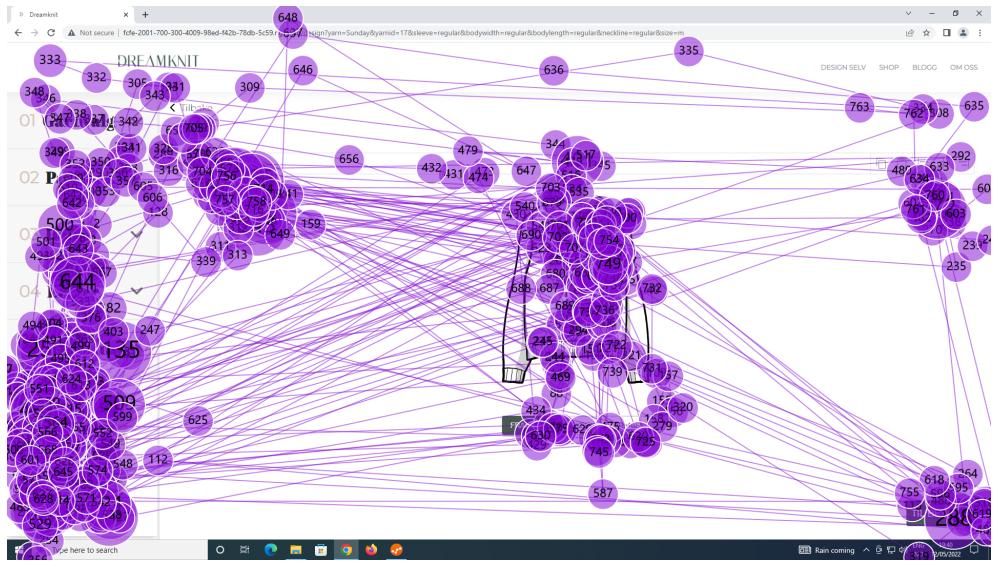
Figure B.10: Design page T3U1
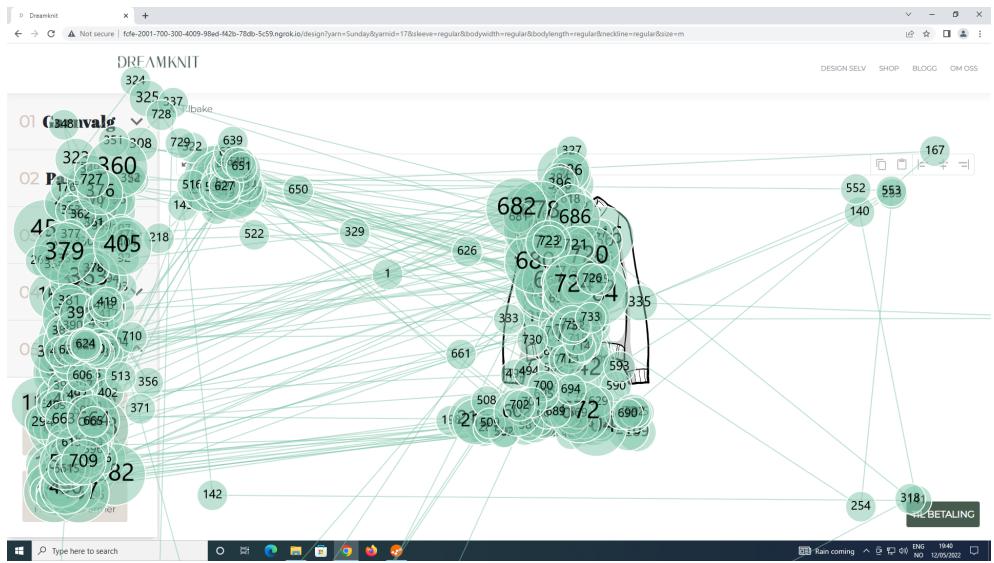
Figure B.11: Design page T3U2
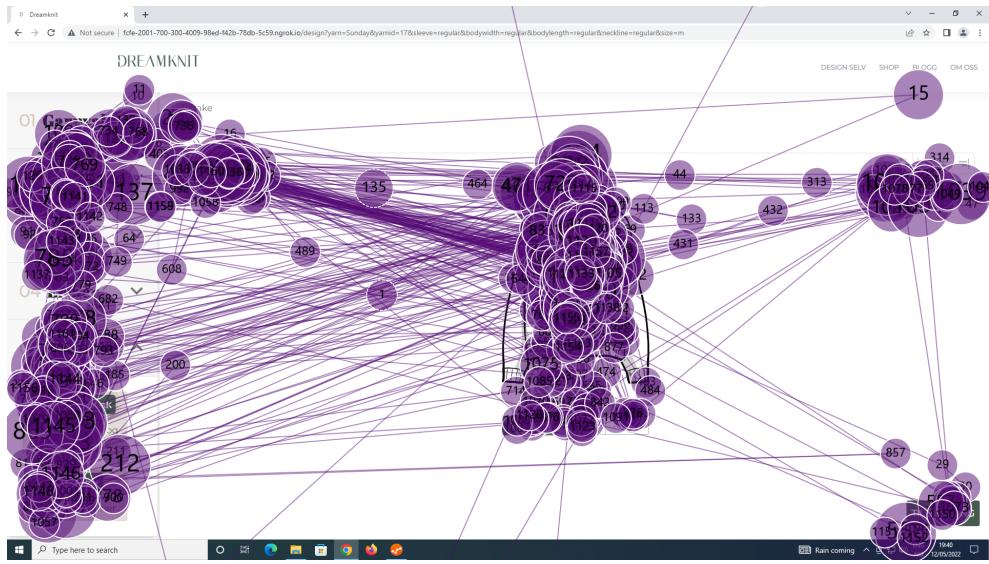
Figure B.12: Design page T3U3
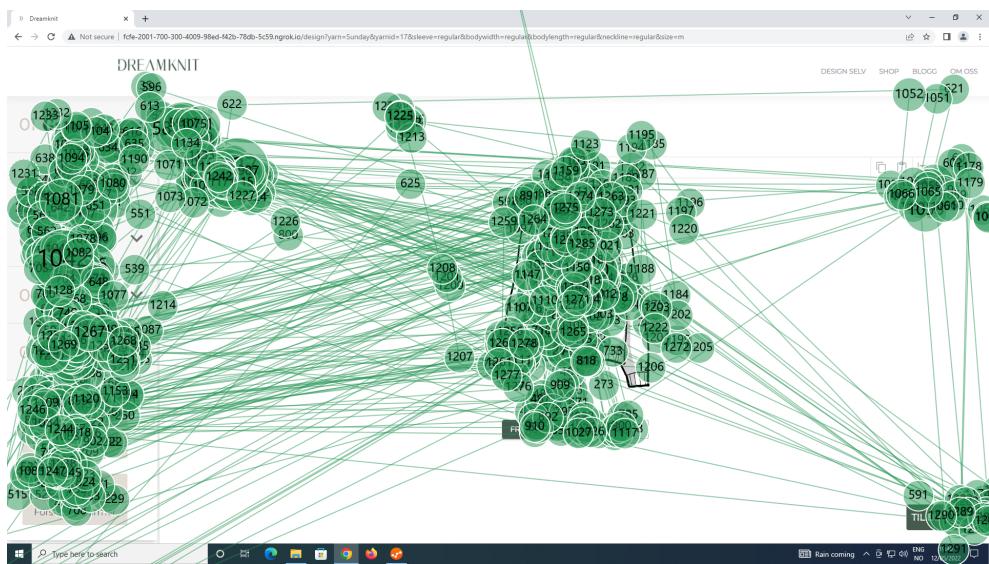
Figure B.13: Design page T3U4
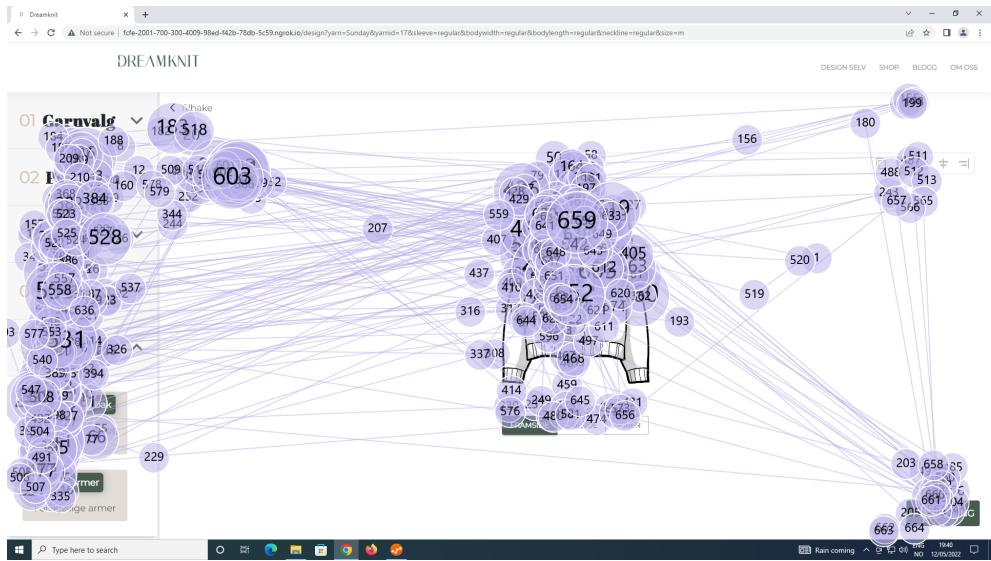
Figure B.14: Design page T3U5
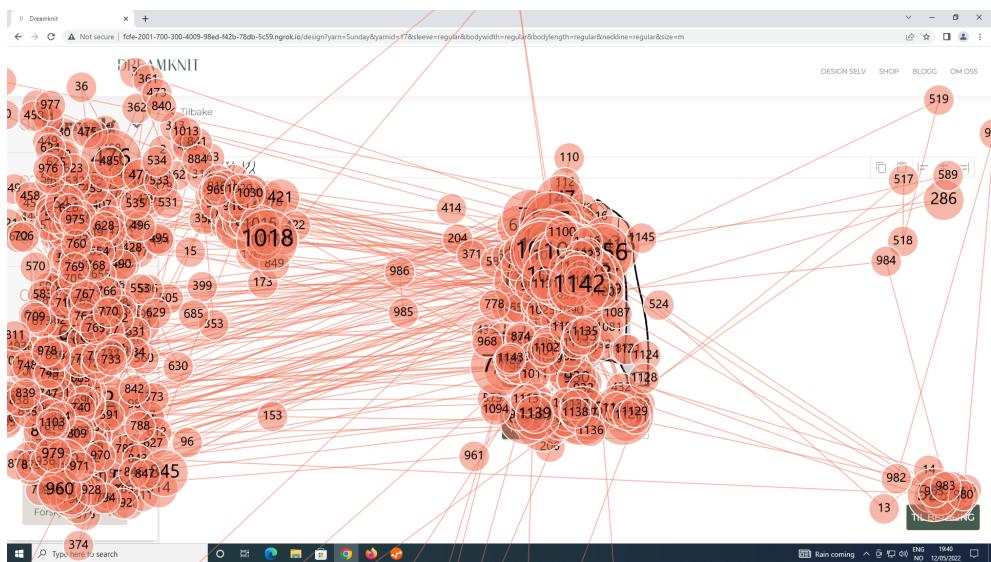
Figure B.15: Design page T3U6

B.5   Transcripts

The full transcripts of each session in User Test 3 is presented below. Each transcript has a summary page in the beginning, followed by the actual transcript. Because the sessions were held in Norwegian, the transcripts are also written in Norwegian.

T3U1

Dato: 22. mars 2022
Tid: 11:00-11:30
Sted: UX-laben NTNU Gløshaugen

Navn: ███████ ████████
Alder: Over 55 år
Kjønn: Kvinne
Strikkekompetanse: nybegynner
Gensere strikket: 1-3

Oppgave	Fra	Til	Varighet
Kalibrering	00:00	01:00	1 m (60)
Oppgave 1	01:00	08:55	7 m 55 sek (475)
Oppgave 2	08:55	13:10	4 m 15 sek (255)
Oppgave 3	13:10	15:23	2 m 13 sek (133)
Diskusjon	15:23	26:00	10 m 37 sek (637)

Oppsummering

Testen gikk bra, og brukeren klarte alle oppgavene uten for store problemer. Det tok derimot litt tid, og brukeren ble litt forvirret noen ganger. Hun virket litt stresset, og sa selv at hun ikke var veldig datakyndig.

Eye-trackeren hadde problemer med å tracke øyene, og derfor manglet det store deler av data for øyebevegelsene. Brukeren lente seg flere ganger nært skjermen for å se hva som sto der, og myste samtidig. Det kan tyde på at brukeren hadde vanskeligheter med å se alle detaljene på skjermen.

- Oppgave 1
    - Forvirret over at hun må velge garn først.
    - Trykker på "Design selv", selv om hun allerede er på denne siden. Hun leser overskriften "Velg garntype", og forstår ikke at hun allerede er på "Design selv" siden.
    - Scroller mye opp og ned.
    - Bruker 2 m 20 sek på å velge garn.
    - Velger steg 2-4 ganske raskt. Hun har brukt Dreamknit sin nettside før, så disse valgene var nok litt kjent fra før.
    - Skjønte ikke like armer først. Forstod det derimot senere at det var snakk om like strukturer på begge armene.
    - Ingen problemer med å bytte visning av genseren (Fram, bak, armer).
    - Problemer med å flytte på strukturer. Forstår ikke hvordan man gjør det, og bruker 2 m 12 sek på å finne ut av dette.
    - Prøver å justere flette uten å ha noen markert. Da skjer det ingenting, som er forvirrende.
    - Bruker angre og gjør om uten problemer.
    - Hun *trykker* i toolbaren for å legge til strukturer.
    - Syntes ikke den ble veldig pen, men hun "får ikke noe karakter på den". Dette er en svakhet med testen.
    - La til strukturer på genseren.
- Oppgave 2
    - Litt forvirret igjen på garn-siden, scroller opp og ned. Husker ikke med en gang hva som skal gjøres. Bruker 09:21-09:41 (20 sek) for å velge garn.
    - Virket som hun valgte garn bare for å komme videre.
    - Bildene ble ikke lastet inn riktig, og siden måtte refreshes, dette tok 30 sekunder av tiden på oppgave 2.
    - Plasserer tvist i stedet for flette på framsiden. Er ikke sikkert hun klarer å se forskjell på strukturene.
    - Plasserer ikke fletten på armen sentrert. Venstre kant av flette på midten.
    - Drar for å flytte strukturer.
    - Litt usikker på om armene er lik. Lurer på om hun må snu genseren. (Her ser man jo bare én arm). Hun resonnerer seg frem til at det må være på begge armene siden det står like armer.
- Oppgave 3

- ○ Endrer bredde på tvister.
  - ○ Ordner det "noenlunde likt". Altså distribuering av strukturer tas på øyemål.
- Diskusjon
  - ○ Vil normalt ha like strukturer på armene
  - ○ Foretrekker klikk fremfor draging for å legge til
  - ○ Foretrekker justerings-knapper for å flytte strukturer fremfor å dra de. "Det var mye enklere enn å dra den"
  - ○ Forstod ikke først at struktur måtte være markert for å justere den.
  - ○ PC bedre enn mobil.
  - ○ Savner korte armer. "Sommertopper". Fellingen blir forskjellig med korte armer.

Transkript T3U1

T = Testperson
H = Hans

Kalibrering

Eye-tracker blir kalibrert.

Oppgave 1

Leser oppgaveteksten.

T: Det står ikke noe om at jeg skal velge garn først. Da går jeg utifra at jeg skal finne en som jeg… Det var ikke, nå er jeg allerede på… Der.

Klikker på "Design selv" oppe i navbar. Vi er allerede på denne siden, så ingenting skjer. Hun klikker en gang til.

T: Hmm?

H: Leter du etter noe spesielt?

T: Ja, jeg forstod det ikke sånn at jeg skulle velge garnet først, men det kan jeg jo gjøre, forsåvidt. For jeg vil jo inn på og designe den.

Peker på "Design selv" i navbar.

T: Men jeg må kanskje velge garnet først? Men jeg må tenke. Velg garntype (Leser overskrift).

Scroller ned og oppover siden flere ganger. Hun virker veldig usikker på hva hun skal gjøre.

T: Skal vi se, hva står det nederst her? Nei.

Trykker på annen fane. Det er to faner som også er åpne, som skal brukes i de neste oppgavene.

H: De fanene der oppe er bare for de neste oppgavene.

T: Okei. Nei da får jeg velge et garn.

H: Det er bare å prøve.

T: Ja.

Velger Sandnes, Tynn Merinoull og blir sendt videre.

T: Aha, der var passformen, det var dit jeg ville.

Velger Large på passform. Går fort videre til Hals, og velger V-hals.

T: Spennende. Jeg prøver ballongermer da.

Det er litt problemer med eye-trackeren, men man kan se at blikket flytter seg mellom venstre-menyen og visualisering. Trykker på Struktur til venstre for å åpne menyen, den åpnes utenfor viewport. Hun stopper litt opp, og trykker på Framside under visualisering. Hun finner deretter ut at hun må scrolle for å se Struktur-innholdet. Det tar 7 sekunder fra hun først trykker til hun scroller.

Hun velger forskjellig foran og bak. Bruker litt tid på å se på disse knappene.

H: Hva tenker du om de valgene på venstresiden?

T: Ja det var det. Lik foran og bak, da blir det jo ikke noe, men hvis jeg vil ha en flette foran. Forskjellig foran og bak. Nå er jeg på framside

Trykker på Framside under visualisering.

T: Like armer. Hm. Den skjønte ikke jeg, altså like armer. For man må jo ha to armer som er lik.

Lukker Struktur steg, da går toolbar bort. Hun åpner med en gang struktur-steget igjen for å få tilbake det hun hadde. Trykker på bakside og armer, mens hun tenker. Eye-trackeren plukker opp at hun legger merke til Struktur-knappene i toolbaren.

T: Oi, vent nå.

Trykker på flette og flette blir lagt til på armene.

T: Nei.

Velger Framside. Trykker på legg til flette igjen, og en flette blir lagt til på framsiden helt til venstre.

05:21

Hun trykker på resize-knappen til venstre, så på fletten, så på resize-knappen til høyre. Ingenting skjer. Hun drar resize-knappen til høyre og gjør fletten smalere. Hun prøver det samme med venstre knappen, men fletten er allerede på de smaleste. Ser ikke ut som at hun skjønner hva "not-allowed" cursor betyr.

T: Dra for å endre bredde (Leser tooltip).

Drar høyre-knapp igjen og gjør fletten litt bredere.

T: Men, hvordan skal jeg klare å få en…

Peker på høyre siden av genseren. Hun vil sannsynligvis flytte fletten til høyre.

Trykker på legg til tvist. En tvist legges til på høyre siden av fletten.

T: Oi, hehe.

Trykker på "Gjør om". Altså ikke angre men "redo". Ingenting skjer. Hun skjønner det fort, og trykker deretter på "Angre". Tvisten fjernes. Hun angrer på nytt, og da blir fletten smalere.

T: Men hvordan får jeg plassert den, det lurer jeg på.

Fokuserer på venstre-menyen.

T: Forskjellig foran og bak, nå er jeg foran. Jeg vil ha flette bare foran. Det er på forskjellig foran og bak. Nå skjønner jeg like armer, for du kan jo ha flette bare på én arm selvfølgelig. Men jeg vil ha like armer. Men hvordan får jeg en… Hva skjer her?

Ser mot høyre siden av toolbar. Leser tooltip på kopier og lim inn, og går videre til justeringsknapper. Trykker på Midtstill. Ingenting skjer siden knappen er disabled, fletten på genseren er ikke markert.

T: Mhm.

Trykker på midtstill på nytt. Ingenting skjer. Trykker på legg til tvist og får en tvist på høyre siden av fletten.

T: Jeg tenkte at hvis jeg skulle plassere den.

Trykker på slett for å fjerne tvisten hun nettopp la til.

Trykker på angre og tvisten kommer tilbake. Trykker på Gjør om og tvisten går bort igjen.

T: Hmm. Nå må jeg tenke vet du.

Blikket går fra venstre-menyen til visualisering til betalingsknapp til høyre siden av toolbar.

T: Jeg må jo få flyttet på den.

Trykker på juster til venstre. Tar så tak i fletten og drar det mot høyre. 2 m 12 sek etter at hun først la til fletten. Hun trykker ikke på fletten først, men drar den direkte. Slipper den på midten av framsiden.

07:33

T: Så enkelt kan det gjøres.

Trykker på legg til tvist, og tvist blir lagt til helt til venstre. Hun drar den helt til høyre.

Hun drar en tvist fra toolbaren og skal til å putte den på genseren. Så ombestemmer hun seg og trykker for å legge til i stedet. Kanskje var hun i en "dra-modus" etter å ha flyttet tvisten til høyre, og derfor fortsatte hun først med å dra dra toolbaren også.

T: Vi kan jo ha, jeg vil ha en til. Der ja. Den ble jo fin, haha. Nei men da fant jeg ut av hvordan man plasserte de. Det var jo ikke verst.

H: Ja.

T: En midt og en til venstre og høyre. Sånn skal den se ut.

H: Ja.

T: Da blir det til betaling. Men det trengte jeg ikke å gjøre. Akkurat, så artig. Det er nok de som er mer vant på dataen som finner fort ut hvordan du flytter og sånt. Men jeg klarte det til slutt.

H: Ja, det var kjempebra. Så da føler du deg ferdig?

T: Da er jeg ferdig. Den var ikke så veldig pen, men jeg får ikke noe karakter på det.

H: Jeg synes den var fin.

T: Nei men det var gøy.

H: Ja kjempebra.

Oppgave 2

H: Da kan vi gå over til oppgave 2, så da kan du egentlig gå på den andre fanen helt øverst.

T: Her ja.

H: Så kan du starte på nytt.

T: Mhm.

H: Så kan du lese oppgaven her og bare sette i gang.

T: Okei. Da må vi ha, hmm.

Scroller litt ned og opp på garnsiden. Ser rundt på hele siden.

T: Nå sto det stilt igjen gitt, hvordan kom jeg inn på…

T: Ja, jeg velger det garnet.

Velger Sunday av Sandnes. Virker som hun bare valgte et garn for å komme videre.

Velger Small, vanlig passform og kort lengde.

T: Skal vi se, hun vil ha en halvhøy hals. Og ermer. Ballongermer.

Åpner struktur, men samme som sist gang så havner innholdet utenfor viewport.

Her skjer det en feil på nettsiden, og bildene i visualisering lastes ikke inn. Prototypen ble kjørt fra Hans sin laptop og denne gikk i dvalemodus fordi den hadde stått stille en stund. Dette var nok grunnen for at bildene ikke ble lastet inn.

T: Nå ser jeg ikke den på baksiden men,

H: Nå ser jeg faktisk at det..

T: Vi tar den foran.

Velger forskjellig foran og bak.

H: Jeg ser at det har skjedd en liten feil på nettsiden der.

T: Nei det kom liksom ikke opp noe.

H: Kanskje hvis du kan prøve å laste inn siden på nytt?

10:55

Etter refresh fungerer siden som den skal. Bruker 30 sekunder på å forklare hvordan hun kan laste inn siden på nytt. Dette kan tyde på at brukeren er litt stresset og kanskje ikke så vant til å bruke datamaskin.

11:25

Valgene hun hadde valgt ble husket, hun går fort gjennom alle menyene på nytt for å sjekke at det stemmer. Hun ser ikke alltid på visualisering for å verifisere. Størrelse, passform, lengde ser bare på venstre-meny. Hals, ermer ser på visualisering.

Velger forskjellig foran og bak. Og trykker på like armer, selv om det er like armer som er valgt. Verifiserer også at hun er på framsiden ved å lese på knapp under visualisering.

T: Forskjellig foran og bak. Like armer. Framside.

Trykker på tvist i toolbar og tvist blir lagt til venstre.

T: Hun hadde en sånn kjempestor en.

Drar tvisten til midten. Velger armer. Leser også oppgaveteksten. Trykker på flette i toolbar og den blir lagt til på armen. Hun prøver å dra den til høyre, men bommer på fletten. Hun prøver en gang til. Hun klarer ikke å plassere den helt på midten, men venstre siden av fletten er på midten av armen. Usikkert om hun egentlig ville ha den helt på midten.

T: Ja. Blir det sånn på andre armen også eller? Eller må jeg snu den? Jeg skrev jo like armer, da må det være rett. Mhm, da har den den foran, på forsiden.

Viser framside

T: Med en stor flette (Det er egentlig en tvist, kanskje vanskelig å se forskjell?)

Viser armer

T: Og en litt smalere flette på armene.

H: Ja.

T: Ferdig?

H: Hvis du er fornøyd.

T: Ja, den var ganske pen.

H: Ja.

Oppgave 3

H: Da kommer siste oppgaven her.

T: Mhm. Da må vi gå på den da

Bytter fane og leser oppgave.

T: Hmm, prøv å legg til en tvist på hver side av fletten på bolen.

H: Ja, så dette er en fortsettelse av den andre oppgaven.

T: Okei, skal jeg gå tilbake til den?

H: Ja det kan du gjøre.

Går tilbake til fanen fra i sted. Hun leser oppgaven på nytt.

T: Hvordan genseren vil se ut med flere strukturer, prøv å legg til en tvist på hver side av fletten på bolen.

Her blir hun kanskje litt forvirret, fordi hun la en tvist på bolen tidligere i stedet for en flette.

Hun går til framsiden og trykker på flette-knappen i toolbar.

T: Da må jo den være tynnere. Dra for å endre bredde (Leser tooltip)

Drar venstre resize-knapp og gjør fletten smalere. Hun studerer oppgaven 10 sekunder til.

T: Mhm, jeg er fortsatt på forsiden.

Blikket hennes går frem og tilbake mellom visualisering og venstre-siden av toolbar.

Hun legger til en ny flette. Den plasseres på høyre siden av tvisten midt på. Hun drar venstre resize-knapp å gjør fletten smalere.

T: Er de sånn noenlunde lik tro? Hun liker ikke på baksiden nei, men det er ikke noe på baksiden.

Bytter til bakside.

T: Nei.

Bytter til armer.

T: Og armene er fortsatt sånn. Baksiden er blank og framsiden har fått to ekstra fletter. Ferdig?

H: Ja, hvis du føler deg ferdig så.

T: Ja, artig. Jeg må strikke meg en ny genser, haha.

H: Ja, haha.

T: Nei det var gøy.

Diskusjon

T: Egentlig vet du, hvis ikke jeg hadde vært kjempenervøs for å gjøre feil så hadde det her gått ganske glatt.

H: Jeg synes det gikk kjempebra.

T: Det tok litt tid før jeg fant ut av den der

H: Å legge til ja.

T: Legge til ja. Nei men det blir veldig bra, ble en fin genser.

H: Ja. Har du noen umiddelbare tanker om hvordan det gikk?

T: Nei, jeg synes genseren ble fin jeg. Jeg synes det gikk veldig greit. Det er jo ikke noe vanskelig å finne fram her

Peker på venstre-meny

T: Det som er nytt. De andre har jeg jo vært borti må jeg jo innrømme. Alle slags former og fasonger. Men den strukturen er jo ny.

H: Ja.

T: Og det var gøy.

H: Mhm.

T: Det blir jo en helt annen strikke opplevelse å strikke med strukturer.

H: Ja. Du stusset litt først på armene. Om det var like armer. Hva synes du om det?

T: Du kan jo velge forskjellige armer, at du vil ha struktur bare på én arm for eksempel. Men, forskjellige armer.

Velger forskjellige armer og viser venstre og høyre arm.

T: Hvis man tar bort den på høyre arm da.

Fjerner flette på høyre arm.

T: Så har man fortsatt på venstre. Så er det blank baksiden og fremsiden. Det går jo an, selv om jeg ville funnet det naturlig at det skulle være på begge sidene. Men det er jo et valg man gjør da. Mest vanlig kanskje å ha det på begge.

H: Ja, det er det du ville foretrukket vanligvis, å ha like strukturer på begge armene?

T: Ja. Man kan jo og lage den forskjellig foran og bak sant. Hvis de blir lik, hvis jeg trykker lik da.

Velger lik foran og bak. Ser på framside og bakside.

T: Da blir det jo likedan på baksiden. Ja. Så har jeg en arm med og en arm uten. Artig genser. Ja. Nei det virket veldig forståelig for den ukyndige egentlig, både på data og strikking.

H: Ja.

T: Det blir jo veldig godt forklart hvor er du i genseren liksom. Høyre, bak, foran.

H: Ja. Hva med å legge til strukturer, hva synes du om det?

T: Ja. Det gikk jo veldig greit.

H: Jeg kan jo røpe også at det går an å dra strukturen også på genseren.

T: Å dra den.

Flytter på en av strukturene på genseren.

H: Ja, når man skal legge den til, så kan man enten trykke oppe på den lille knappen.

T: Lille knappen? Nå er jeg ikke med.

H: Helt der oppe i den baren der oppe.

T: Her oppe?

H: Der oppe ja. Så kan man enten klikke på en struktur, eller så kan man dra den på.

Hun prøver å klikke på strukturen på genseren, og klikker på Angre-knappen. Tydelig at hun ikke henger med.

H: Jeg la merke til at du brukte klikk for å legge den til.

T: Ja. Ja okei.

Prøver nå å klikke på strukturen i toolbar, men det er ikke plass. Oransje melding vises nederst til venstre, blikket går raskt til meldingen.

H: Hvis du hadde visst om at det gikk an å dra den dit, hvordan tror du at du hadde foretrukket da? Hvis du skjønner.

T: Hmm. Det er ikke plass til flere nå. Nei, si det. Jeg synes jo det var veldig sånn som jeg gjorde det. At det var bare å dra den frem og tilbake. Sånn.

Drar en struktur på genseren til høyre og venstre.

T: Men kan jeg flytte den med de også?

Peker på angre knappen. Ikonene til angre- og gjør-om-knappene er piler, kanskje hun tenker at pilene skal indikere flytting. Hun virker forvirret og prøver nok å finne ut av hva Hans mener.

T: Angre, da kommer den dit. Gjør om. Nå var ikke jeg med deg, unnskyld meg.

H: Neida det er ingen fare. Det jeg bare mente var at når man skal legge til en ny struktur, så kan man klikke der oppe.

T: Kan man fjerne den?

H: Ja du kan bare ta den bort for å teste.

Fjerner to av strukturene.

T: Sånn. Fjerne.

H: Så når du legger dem til på nytt, så kan du enten klikke der sånn som du gjorde nå.

Hun trykker for å legge til flette.

H: Men du kan også dra den fra knappen

T: Der? (Peker på Gjør-om)

H: Neida, den samme knappen som du var på. Så kan du klikke på den eller dra. Men det er ikke så farlig.

T: Nei. Men det finner man ut av.

H: Ja. Men det var vel klikk som var din preferanse da. Du prøvde også å klikke på knappene oppe til høyre, men da skjedde det ingenting.

T: Her ja.

H: Det var kanskje litt forvirrende?

T: Nei, altså grunnen til at jeg ville borti dem var fordi det var liksom høyre, venstre, sånn at jeg ikke dro den på den siden den skulle være. Fordi jeg skjønte ikke det med det samme.

H: Nei.

T: At jeg kan bare flytte den.

Drar en flette for å vise.

T: Da ville jeg kanskje å prøvd. Okei jeg vil ha den på venstre også brukt de, men det var ikke noe funksjon.

H: Ja. Så grunnen for det var at du må trykke på den først sånn at den blir blå, for å kunne bruke de knappene.

T: Aha.

H: Det var kanskje litt uklart?

Justerer til venstre nå, og får det til siden fletten er markert.

T: Enkelt. Ja. Den må bli blå først ja. Så hvis jeg legger den nå, den er blå. Så vil jeg ha den på…

Justerer til høyre. Snur seg mot Hans og sier:

T: Det var mye enklere enn å dra den.

H: Okei, så du foretrekker det egentlig.

T: Ja. Da blir det jo sentrert skulle jeg til å si. Den blir jo der den skal være vil jeg tro. Hvis jeg har dratt den nå, så kan jeg jo stoppe der.

Drar den rett ved siden av en annen struktur, slik at de overlapper og dermed havner den tilbake til der den var.

T: Eller nei.

Hun prøver på nytt og får nå til å plassere den nært den andre strukturen.

T: Der kan jeg stoppe. Hvis den der er blå, så kommer den på samme plassen på andre siden.

Bruker knapper for å justere.

H: Ja.

T: Ja. Morsomt.

H: Jeg har også et spørsmål til. Hvis du hadde besøkt Dreamknit-nettsiden på egen hånd. Tror du at du hadde brukt en PC eller mobil for å gjøre det.

T: PC.

H: PC, ja.

T: Helt klart. Men det er jo for at jeg synes det blir mer oversiktlig der. Jeg har ikke prøvd det på mobil. Men en ungdom hadde sikkert klart det like bra på mobilen.

H: Ja skjønner. Er det ellers noen funksjoner som du følte manglet?

T: Jeg var litt forvirret når jeg kom inn, når du kom på garn. For jeg har garn, sant. Jeg skal ikke velge garn, jeg skal rett på.

H: Du vil designe genseren med en gang?

T: Ja. For det kan jeg også gjøre, ved at jeg har garnet, også legg inn informasjon om garnet, det har jeg faktisk gjort. Men nå står det stilt, hvordan jeg gjorde det, men. For lengden på garnet sant, velge garn og så, eller hadde garn, så fant jeg passform og sånt etterpå.

H: Ja. Tror du at du ville foretrukket å lagt designet på genseren først, og så skrevet inn sånn garn informasjon?

T: Etterpå ja.

H: Ja. Tror du at det ville vært bedre enn sånn som det er nå, at du velger garn først?

T: Jeg tror jeg ville valgt passformen først. Også garn ut ifra det.

H: Ja, mhm.

T: En annen ting jeg savner, korte armer.

H: Okei.

T: Til sommertopper nå. Det er jo veldig aktuelt nå, i bomullsgarn. Så jeg sa jo det til ████, men da sa hun at du strikker jo bare så langt du vil også.

H: Ja sånn ja.

T: Men da har du jo fellingen og det da, ja. Det kunne vært en med korte ermer.

H: Ja.

T: Men dette var faktisk veldig gøy det.

H: Ja, så bra. Kjempebra, hvis du ikke har noen flere spørsmål så er vi ferdig.

T: Nei, jeg har ikke det. Dette var gøy.

T3U2

Dato: 22. mars 2022
Tid: 13:00-13:30
Sted: UX-laben NTNU Gløshaugen

Navn: ███████████
Alder: 18-26 år
Kjønn: Kvinne
Strikkekompetanse: Viderekommen
Gensere strikket: Mer enn 8

Oppgave	Fra	Til	Varighet
Kalibrering	00:00	01:27	1 m 27 sek (87)
Oppgave 1	01:27	04:00	2 m 33 sek (153)
Oppgave 2	04:00	06:15	2 m 15 sek (135)
Oppgave 3	06:15	07:13	58 sek (58)
Diskusjon	07:13	14:04	6 m 51 sek (411)

Oppsummering

Brukeren gjennomførte testen uten mye problemer, og brukte også kort tid på oppgavene. Hun likte direkte manipulering og synes struktur-funksjonalitet var bra. Hun synes arm-visualisering var litt vanskelig, og hadde foretrukket 3D-figur. Brukeren virket vant til å bruke datamaskin.

- Oppgave 1
  - Bruker 21 sek på å velge garn
  - Tendens til å lukke accordion-steg når hun er ferdig med det.
  - Raskt ferdig.
  - "Jeg synes det er veldig greit jeg. Jeg synes det er veldig oversiktlig."
  - Legger til flette, men fjerner den igjen.
- Oppgave 2
  - Venter litt med å slippe struktur på genseren, venter muligens på Guidelines.
  - Resize uten problem, men må flytte struktur etter resize.
  - Liker struktur-funksjonalitet
- Oppgave 3
  - Strukturer ikke perfekt distribuert.
  - Forskjellig foran og bak, ingen problemer.
- Diskusjon
  - "Jeg synes det var lett å gjennomføre. Jeg skjønte hvordan ting skjedde"
  - Har brukt nettsiden til Dreamknit før
  - Struktur virker litt vanskelig å få strikket i praksis. Tar lenger tid å strikke strukturer. Hun er utålmodig.
  - Raglan mangler. I hvert fall sånn at man slipper å ta opp masker.
  - Liker å dra ting. Dra for å legge til struktur er best.
  - Guidelines var bra. Bedre enn justerings-knapper.
  - La ikke merke til justerings-knapper
  - Vanskelig å visualisere armene. Ikke vant til å se genseren fra den siden. Bedre med 3D-figur.
  - Struktur kunne vært på armene fra framsiden/baksiden også.

Transkript

T = Testperson
H = Hans

Kalibrering

Eye-tracker blir kalibrert

Oppgave 1

Blikket flytter seg mellom garn-kortene mens Hans finner fram oppgaven. Hovedsakelig mellom popluære garn. Blikket går også opp til navigasjonsknapper øverst til høyre.

H: Her skal du få første oppgave, så kan du bare lese den og sette i gang.

T: Påsken nærmer seg og du leter etter et nytt strikkeprosjekt som kan holde deg opptatt i påsken. Du havner på Dreamknit sin nettside for å sjekke hva som finnes der. Lag et design for en genser du kunne tenke deg å strikke. Okei.

Scroller nedover. Blikket flytter seg mellom bildene på garnkortene. Hun bruker 01:42-02:03 (21 sek) på å velge garn. Hun velger Drop Air som er en av de populære garnene.

Hun legger først merke til visualisering på design-siden, men blikket går raskt til venstre-meny.

Hun åpner passform, men endrer ikke noe. Hun lukker passform og åpner Hals. Endrer til høy hals. Blikket flyttes mellom venstre-meny og visualisering. Hun lukker Hals og åpner Ermer. Velger vide ermer. Hun åpner Passform uten å lukke Ermer.

H: Har du vært inne på nettsiden før?

T: Ja det har jeg. Jeg har gjort dette før.

H: Okei, så du kjenner deg litt igjen.

T: Men jeg har ikke sett denne (Struktur).

Ser på Struktur venstre-meny knapper, så på knapper under visualisering. Trykker Bakside og ser på visualisering. Ser så oppe til høyre rett under toolbar, ned på betaling-knapp, nederst til venstre ved siden av venstre-meny, opp til venstre side av toolbar på flette-knapp. Raske bevegelser, scanner nettsiden. Tilbake til Struktur venstre-meny.

H: Hva tenker du om knappene på venstre-siden der?

Scanner litt til: Knapper under visualisering, høyre side toolbar, venstre side toolbar, Struktur, knapper under struktur.

T: De her?

H: De der ja.

T: Jeg synes det er veldig greit jeg. Jeg synes det er veldig oversiktlig.

Velger Forskjellige armer. Ser på visualisering, Framside, Forskjellige armer, Bakside, Venstre Arm, Bakside. Trykker Venstre arm, Høyre arm, Framside.

Trykker Toolbar-flette. Ser frem og tilbake mellom Toolbar-flette og flette på genseren. Trykker Tvist. Drar tvist til høyre, så tilbake til venstre før hun slipper den. Sletter begge strukturer.

Lukker Struktur. Åpner Passform. Kort lengde. Lukker Passform. Åpner Struktur. Ser på View-knapper. Velger like armer. Lukker Struktur.

T: Nei jeg tror jeg er fornøyd jeg.

 H: Ja.

Oppgave 2

H: Da kan du få oppgave 2 her.

T: En god venninne av deg har snart bursdag og du tenker å strikke en genser til henne. Hun har tidligere snakket om en genser hun synes var fin som vises på bildet. Design en genser som ligner på denne genseren som du tror din venninne vil like.

Åpner Garnvalg. Hoverer over Bytt garn knappen. Lukker Garnvalg.

Åpner Passform. Vanlig passform. Vanlig lengde. Lukker Passform.

Åpner Hals. Rund Hals. Ser mellom Venstre-meny og visualisering.

Åpner Ermer. Lukker Hals. Vanlige ermer. Lukker Ermer

Åpner Struktur. Drar flette til midten av framsiden. Prøver å justere selv til midten. (Guidelines vises ikke før man har lagt til strukturen)

Gjør den bredere til venstre. Flytter den tilbake til midten.

T: Jeg likte godt denne funksjonen.

H: Hvordan da?

T: At man kan legge på fletter og velge hvor tykke de skal være.

H: Ja.

T: Og det var veldig lett å justere det til hvordan man ville ha det.

Velger Forskjellige armer, Venstre arm, så tilbake til Like armer.

Drar flette fra toolbar til armen. Ombestemmer seg og drar den tilbake til toolbar-knapp. Dette registreres som et klikk og fletten blir lagt til. Hun sletter fletten. Drar på en tvist på armen. Holder den et par sekunder før hun slipper den på midten av armen, kanskje hun ventet på Guidelines?

Hun prøver å dra resize-knapp til høyre. Drar deretter fletten til høyre, plasserer den på midten ved hjelp av Guidelines. Trykker Bakside. Trykker Framside.

T: Nei jeg tror jeg er fornøyd jeg.

H: Ja.

Oppgave 3

H: Så kommer siste oppgaven her. Det er en fortsettelse av den forrige oppgaven.

T: Ja, du kommer på at venninnen din er veldig glad i strukturer. Derfor lurer du på hvordan genseren vil se ut med flere strukturer. Legg på en tvist på hver side av fletten på bolen.

Drar tvist på framsiden, både til venstre og høyre side. Ikke helt aligned. Trykker Forskjellig foran og bak. Trykker Bakside. Sletter alle strukturer på bakside. Trykker Armer. Trykker Framside.

T: Ja. Da er jeg fornøyd.

H: Ja.

Diskusjon

H: Det var alle oppgavene.

T: Ja.

H: Har du noen umiddelbare tanker om hvordan det gikk?

T: Jeg synes det var lett å gjennomføre. Jeg skjønte hvordan ting skjedde.

H: Ja. Du brukte jo ikke så lang tid så.

T: Men jeg har jo også vært inne på nettsiden før da, på en måte.

H: Ja, de forrige stegene. Enn struktur-steget da?

T: Ja, jeg synes det var en gøy greie. Jeg synes det var veldig lett å skjønne.

H: Ja. Hvis du skulle sagt en negativ ting om den da?

T: For meg virker det litt sånn vanskelig å få gjort i praksis.

H: Ja, å få strikket oppskriften?

T: Ja eller mer sånn å få det til en oppskrift. Men selve design-steget synes jeg var veldig… Jeg likte det at man kunne plassere dem akkurat der man ville og akkurat størrelsen.

H: Ja.

T: Jeg vet ikke om jeg kommer på noe…

H: Nei. Pleier du vanligvis å strikke med strukturer?

T: Nei, jeg har gjort det litt, men ikke så mye. Det er fordi jeg er litt utålmodig. Jeg synes det tar for mye tid.

H: Ja jeg skjønner. Er det noen funksjoner som du føler mangler her?

T: På struktur-steget, eller sånn generelt?

H: Sånn generelt.

T: Ja. Kanskje muligheten til å… Jeg vet ikke hvor mye du vet om strikking, men…

H: Jeg kan litt.

T: Sånn Raglan

H: Ja.

T: Altså liksom sånn som denne kanskje (Peker på genseren sin). Eller kanskje strikke rundt sånn at armene starter av seg selv, og ikke sette de på.

H: Hvordan er det du vanligvis strikker?

T: Jeg liker best å strikke sånn at man slipper å ta opp masker. Fordi her vil du jo strikke en vest først, og så ta opp maskene for å strikke videre. Men jeg liker best når jeg bare kan strikke ned, også har jeg masker der for å strikke videre på armene.

H: Jeg skjønner.

T: Men det handler også om tålmodighet.

H: Ja, jeg skjønner det, det er jo fint å gjøre det på den letteste måten.

T: Ja. Men jeg likte veldig godt dette struktur-elementet.

H: Ja. Det er jo 2 forskjellige måter å legge til strukturer. Du kan enten klikke på det lille symbolet der oppe, eller å dra. Jeg la merke til at først så klikket du, så begynte du å dra mot slutten. Ville du foretrekke den ene over den andre?

T: Jeg er veldig glad i å dra ting tror jeg.

H: Ja.

T: Jeg vet ikke, jeg tror kanskje det er mer, kanskje at det gir litt mer mening for meg. Men jeg vet ikke helt.

H: Ja. Det så jo litt sånn ut også, siden det var den du gikk for etter hvert.

T: Ja.

H: Enn for å liksom aligne strukturene på genseren.

T: Ja.

H: Så fikk du jo opp en sånn strek for å vise at nå er den på midten eller på siden og sånt.

T: Mhm.

H: Du kan også trykker på knappene helt oppe til høyre for å aligne.

T: Oja her. Ja skjønner.

H: Hvordan ut av de to, altså hvis du klikker på en struktur så får du aktivert knappene der oppe.

T: Ja, jeg skjønner. Nå la ikke jeg merke til at de var der på en måte.

H: Nei du dro dem bare.

T: Men jeg synes jo det gikk greit. Men jeg skjønner jo at det er ganske smart, for du kan på en måte, eller da vet du liksom at de flytter seg dit.

H: Ja, skjønner.

T: Men jeg antar jo at den…

H: Tror du at du ville brukt de knappene nå som du vet om de?

T: Hmm, jeg tror kanskje jeg synes det er greit med sånne streker. Men jeg tror kanskje fortsatt jeg ville gått for å gjøre det sånn som jeg gjorde det.

H: Ja.

T: Jeg synes kanskje det vanskeligste var liksom å visualisere armene, på en måte. Jeg synes dette så litt unaturlig ut.

H: Ja.

T: Men, jeg er ikke så vant til å se gensere fra den siden heller.

H: Ja, ville du foretrukket å se armene på en annen måte?

T: Jeg vet ikke, jeg ville kanskje foretrukket det som en sånn 3D-figur, som du kan snu på selv.

H: Ja.

T: For da får du liksom de, da ser du fortsatt hvordan den ser ut her (bolen bak armen)

H: Ja.

T: For det så på en måte litt nakent ut når den var alene.

H: Mhm.

T: Men jeg tror ikke det er noe annet… Eventuelt at man kunne sett strukturen fra framsiden da, på en måte.

H: Ja, at den er på armen når man ser framsiden også?

T: Ja.

H: Alright, nei men hvis ikke du har noen flere ting som du lurer på, så tror jeg vi er ferdig.

T: Ja, jeg synes det var intuitivt.

H: Ja. Nei men kjempebra. Da stopper jeg bare opptaket.

T3U3

Dato: 22. mars 2022
Tid: 15:30-16:00
Sted: UX-laben NTNU Gløshaugen

Navn: ████████████
Alder: 18-26 år
Kjønn: Kvinne
Strikkekompetanse: Avansert
Gensere strikket: 1-3

Oppgave	Fra	Til	Varighet
Kalibrering	00:00	00:49	49 sek (49)
Oppgave 1	00:49	06:54	6 m 5 sek (365)
Oppgave 2	06:54	09:26	2 m 32 sek (152)
Oppgave 3	09:26	13:17	3 m 51 sek (231)
Diskusjon	13:17	29:40	16 m 23 sek (983)

Oppsummering

Testen ble gjennomført uten store problemer. Eye-tracker fungerte bra. Synes layout var "pleasing", ryddig og behagelige farger. Likte å kunne legge til struktur. Visualisering kunne vært mer realistisk.

- Oppgave 1
    - Velger en av de populære garnene
    - Første reaksjon på design-siden etter garnvalg: "Nå er jeg litt usikker på hvor jeg skal trykke faktisk"
    - Endring av størrelse endrer ikke visualisering.
    - Usikker på strikkefasthet
    - Vil ha "garnkombinasjon", altså flere garn samtidig.
    - Liker at visualisering endres etter som man velger
    - Trykker for å legge til flette
    - Vil endre hvilken vei tvistene går
    - Synes struktur var "veldig gøy"
    - Problemer med å endre bredde på armene, for liten plass. Tror at det ikke er mulig.
- Oppgave 2
    - Problemer med lik/forskjellig framside/bakside. Forstår ikke at hun redigerer fram og bakside samtidig.
- Oppgave 3
    - Vil legge til struktur rundt hele armen, ikke bare på "kanten"
    - Vil plassere strukturer helt at med hverandre.
    - Positiv til struktur, ønsker også hull-strukturer og perlemønster.
    - Strukturer ikke nøyaktig distribuert
- Diskusjon
    - Kommenterer at strukturer er litt "skeivt" fordelt
    - Frustrerende at hun ikke klarte å plassere strukturer helt inntil hverandre
    - Vil endre farge, litt "plain" når den er hvit
    - Kunne tenkt seg å se mer realistisk bilde, vanskelig å "visualisere fra en sketch til virkelig". Kunne tenkt seg fotografi.
    - Velger ofte oppskriften først, og så garn ut ifra det.
    - Beskriver gensere med begrepene "fluffy" eller "chunky".
    - Overveldende å velge garn først, særlig siden det manglet litt guiding.
    - Garn kunne vært sortert etter type, ikke bare merke. Også farge
    - 3D-plott av armen hadde vært best, for å se rundt hele.
    - Vanskelig å legge merke til lik/forskjellig knapper på venstre-siden
    - Likte ikke "Farge-splatt", gjorde det ikke lettere å visualisere.
    - Idé om lite utsnitt av strikket firkant hvor man kan se strikkemønsteret uten strukturer. Mer realistisk. Kunne vært lagt på visualisering, mulighet for å skru av/på.
    - Liker bildene de har på instagram, disse bildene har som oftest en person som har på seg genseren. Putter genseren inn i en brukskontekst.
    - Liker at det står antall garnnøster. (På dreamknit.no)
    - Tror hex-input for farge er et søkefelt.

Transkript

T = Testperson
H = Hans

Kalibrering

Eye-tracker blir kalibrert.

Oppgave 1

H: Da er første oppgave her, så kan du bare lese gjennom den å sette i gang.

T: Ja, skal jeg lese høyt eller?

H: Det kan du bestemme selv.

T: Okei. Skal jeg bare forklare underveis hva jeg tenker da?

H: Ja, gjerne.

T: Da ser jeg at jeg allerede er inne på denne siden for å velge garntype. Dette er første side vil jeg anta, for å lage genser. Så det var egentlig veldig oversiktlig. Jeg synes det var et veldig "pleasing" layout, veldig ryddig og behagelige farger. Hmm, velge garn selv, først må jeg bare få litt oversikt over hele siden. Så Populære garn, også Pinnestørrelser.

Scanner siden mens hun scroller nedover. Ser fra venstre til høyre, så til venstre, så til høyre mens hun scroller ned. Hun scroller deretter litt fortere og ser bare på utvalgte garn nå mens hun scroller.

T: Okei, da tror jeg at jeg har lyst på en eller annen fluffy genser. Hmm, her er det veldig mye garn jeg har brukt før. Jeg kjenner at det viste seg at det er veldig mye jeg ikke har brukt, så det kunne vært nice med en oversikt over hva det forskjellige garnene kan brukes til, med eksempler. Det kan man jo finne ut av på egen hånd selvfølgelig og, men… Men okei, jeg velger Air, for den har jeg vært litt borti før. Jeg liker at det er bilder av garnene, det gir litt oversikt. Det er også en av de populære, sikkert derfor jeg tenkte det og, det har jeg vært litt borti.

Velger Drops Air fra Populære garn.

T: Okei.

Ser på Genser, Garnvalg, Tilbake, Dreamknit, Genser, Blogg, Tilbake, Garnvalg.

T: Nå er jeg litt usikker på hvor jeg skal trykke faktisk

Åpner Passform

T: Men hvis man skjønner at man skal gå på Passform, så kan man se på størrelse.

Velger Large, Medium, Large.

T: Der endrer den seg ikke, men det er nå ikke så farlig. Skal vi se hva som ligger her.

Åpner Garnvalg

T: Ja, den har automatisk valgt pinnestørrelse. Man kan ikke velge flere, eller hvor mange garn eller tråder man ønsker å strikke med? Det kunne jo egentlig vært litt nice, hvis man ønsker en som er skikkelig "chunky". Eller kanskje man kan det? Jeg bare sjekker det.

Trykker Tilbake.

T: Hvis man ville ha garnkombinasjon

Fyller inn egne verdier for garnnavn (air), pinnestørrelse (5).

T: Skal vi se, strikkefasthet. Der er i hvert fall ikke jeg såpass rutta at jeg kan si noe automatisk, eller helt ut av det blå, men det kan man jo også bare undersøke litt. Men da velger jeg likevel bare å gå for automatisk Air.

Velger Drops Air på nytt.

Trykker Oversized, Vanlig, Oversized.

T: Ja, her ser man forskjell på vanlig passform og oversized. Det er egentlig bare ermene som endrer seg. Det var litt vanskelig å se kanskje. Jeg ville tenkt at det er mere hele bolen og armene som vil endre seg på oversized. Men jeg har lyst på oversized, og jeg har lyst på kort lengde.

Trykker Kort lengde, vanlig lengde, kort lengde.

Åpner Hals. V-hals. Halvhøy hals. Høy hals. Halvhøy hals.

T: Her var det veldig fint at det var illustrasjoner, etter hvert som man bytter. V-hals.

Åpner Ermer. Vest, Ballongermer, Vide ermer.

T: Jeg har lyst på ballongermer. Nei jeg har lyst på vide ermer.

Åpner Struktur, innhold vises ikke, er utenfor skjermen.

T: Jeg synes det er litt synd at man ikke kan endre på bolen, om hvor smal den er på en måte. Jeg prøver å skjønne hva det er som skjer her, hva er dette?

Trykker Legg til flette. Trykker legg til tvist.

T: Oja, fletter ja.

Trykker legg til flette. Trykker legg til tvist.

T: Det var egentlig veldig stilig. Okei.

Trykker Legg til flette, ikke plass til flere, melding vises nederst til venstre. Hun ser ikke på melding.

Endrer bredden på flette.

T: Oja du kan endre bredde, ja okei. Hvordan fjerner man? Sånn fjerner man. Spennende.

Fjerner fletter, trykker Legg til tvist, plasserer to tvister midt på genseren.

T: Kan man endre hvilken vei disse flettene går? Det hadde egentlig vært nice, hvis man kunne endret på hvilken, om flettene (mener tvist) er flettet utover eller innover, hvis det gir mening. Det har ikke så mye å si på den der (flette), men på den andre (tvist). Okei, jeg vil ha den sånn.

Trykker Bakside.

T: På baksiden så kan jeg ha det samme.

Trykker Armer.

T: Armene. Det her var veldig gøy, det tror jeg ikke var sist jeg var inne på nettsiden.

Trykker Legg til flette på armer, drar til midten av armen. Prøver å gjøre fletten bredere. Det er ikke plass til å gjøre den bredere, så ingenting skjer.

T: Der kan man ikke endre på tykkelsen. Det er kanskje dumt at man ikke kan endre på tykkelsen på flettene på armene. Okei, da er jeg egentlig fornøyd der.

Framside, Bakside, Armer, Bakside.

T: Ja. Da er det bare til betaling, så da har jeg egentlig, da er den good.

H: Ja.

Oppgave 2

H: Da kan du få oppgave 2 her.

T: Takk. Okei. Den var jo egentlig ganske lik den genseren som jeg hadde laget da. Her er det én flette på midten.

Fjerner den ene tvisten, og drar for å flytte den andre tvisten til midten.

T: Det er ikke den samme type flette, dessverre.

Fjerner tvist, trykker Legg til flette, drar til midten.

T: Eller, nei. Ikke helt samme typen. Det hadde vært spennende med litt sånn, eller det er kanskje litt mer sånn design på en måte, men om det var flere forskjellige typer mønster. Jeg likte veldig godt den idéen med at de har inkludert mønster i designet. Det er veldig gøy.

Fjerner flette på armer, trykker Legg til tvist.

T: På armene er det ganske likt som den her typen. Sånn.

Trykker Bakside

T: Baksiden ser man ikke, så da velger jeg at den skal være helt blank.

Fjerner flette på bakside. Det er valgt lik foran og bak, så den blir også fjernet fra fremsiden. Det legger hun ikke merke til siden hun fortsatt er på baksiden. Velger Ballongermer.

T: Armene skal kanskje være ballongermer, ser det litt ut som. Ja, er sikkert det. Og halvhøy hals. Kanskje bedre med rund hals faktisk.

Trykker Framside. Legger nå merke til at flette ikke er der lengre. Trykker Legg til tvist. Drar til midten. Trykker Armer. Trykker Bakside. Fjerner tvist fra bakside. Har fortsatt lik foran og bak, så den ble på nytt fjernet fra fremsiden også.

T: Nå tok jeg å fjernet fletten på ryggen, også havnet den tilbake, når jeg gikk over på ermene. Okei, det er kanskje fordi jeg må velge det helt til slutt. At jeg ikke kan hoppe mellom de forskjellige (stegene)… Det var litt snodig.

Hun tenker at hun må følge rekkefølgen på stegene, og går tilbake til Passform.

Vanlig Passform, vanlig lengde.

T: Jeg ville ikke tenkt at den er oversized, den er vanlig. Og vanlig lengde. Rund hals. Ballongermer. Og Forskjellig bak og foran. Oja det kan godt hende at det var… Umm.

Står "Forskjellig foran og bak", hun leser "Forskjellig bak og foran".

T: På framsiden må jeg igjen legge til den der.

Trykker legg til tvist, drar til midten.

T: Baksiden skal være blank, og ermene. Ja, da synes jeg den lignet ganske mye.

Oppgave 3

H: Ja. Så da er det siste oppgave her, som er en fortsettelse.

T: En tvist på hver side av fletten på bolen.

Trykker Armer.

T: Så armene, legge til en tvist.

Trykker legg til tvist, ikke plass, melding vises nederst til venstre. Ser melding med en gang.

T: Det er ikke plass til flere strukturer.

Flytter tvist helt til venstre, trykker Legg til tvist på nytt. Denne gangen er det plass. Hun trykker Legg til tvist på nytt, men da er det ikke plass.

T: Ja, går det bare med tre (to?)… Det er synd at man bare kan legge til strukturer på kantene holdt jeg på å si, at man ikke kan legge til midt på armen og under. At det ikke følger hele veien rundt. Og her får jeg egentlig bare til å legge til to strukturer, eller to flette på armene. Så jeg klarer ikke å legge til til sammen tre stykker. Jeg vet ikke om det er noen smart måte å gjøre det på.

Trykker Juster til venstre. Juster til høyre.

T: Juster til venstre, juster til høyre. Hvis det er noen løsning på det her, så er ikke jeg smart nok til å finne ut av det i hvert fall. Baksiden er fortsatt helt blank. Legg til tvist på hver side av fletten.

Legger til tvist på framsiden. Gjør den smalere. Drar den mot eksisterende tvist på midten, prøver å sette den helt inntil. Er litt overlapp så den hopper tilbake til der den var.

T: Den vil ikke helt plassere seg der, altså kan man ikke plassere den nærmere. Der funket det. Men der hopper den bare tilbake. Der funket det.

Flytter venstre-tvisten ved å resize, først bredere til høyre, så smalere fra venstre.

T: Så hvis man gjør den bred, så gjør den smal mot den siden man vil ha den plassert. Det var litt upraktisk, at man ikke kan bare flytte det sånn.

Prøver å dra tvist slik at den overlapper med annen tvist, da vil hun ha de plassert rett at med hverandre.

T: Ja, sånn. Da var det ekstra struktur på bolen. Ikke noe bak, og… Oja det er bare på bolen det er man skal legge til ekstra struktur. Ja det var det jeg prøvde på armene. Da var det jeg som leste feil. Men likevel så hadde det være nice å kunne legge mer mønster på armene. Ja, så da skal det egentlig bare være én der. Ja.

Fjerner en av tvistene på armene, og legger den som er igjen på midten.

T: Ja. Så veldig positiv til mønster. Det hadde vært litt gøy hvis det hadde vært hull-strukturer og perlemønster og sånt også. Så det var nice.

Diskusjon

H: Alright, det var alle oppgavene. Har du noen umiddelbare reaksjoner, du var jo veldig flink til å tenke høyt, så det var veldig bra.

T: Ja, nei jeg synes det var veldig gøy. Det var litt vanskelig å bytte på… Og jeg ser at det er litt skeivt der også. (Strukturer på fremsiden er ikke distribuert nøyaktig). Men de liksom, det burde kanskje vært en greie at de plasserer seg på hver side hvis man ønsker det. Sånn at de blir liksom symmetrisk.

H: Ja.

T: Men veldig gøy med mønster. Denne vil ikke plassere seg, den hopper tilbake. Jeg vet ikke om det er noe dere har merket. For denne får jeg plassert helt inntil, men det går ikke med den på venstre siden.

H: Ja, så det er noe vi har tenkt på, å prøve å få den til å skape seg inntil kanten. For sånn som det er nå så, hvis du prøver å dra den over en plass der du egentlig ikke kan sette den da, så hopper den bare tilbake til der den var. Så man må være veldig nøyaktig hvis man skal sette dem helt ved siden av hverandre da.

T: For her så får jeg liksom plassert den helt inntil, sånn. Og det er veldig fint, det funker helt perfekt på den siden der, okei nå funket det ikke nå da, men sånn. Men her, når jeg liksom, der funket det. Men man må være veldig nøye.

H: Ja, mhm. Kunne du tenkt deg at, sånn som du gjorde nå da, at du dro den litt over, at den da satt seg helt ved siden av automatisk?

T: Ja, det ville jeg tenkt var logisk. Var det noe annet jeg tenkte på… Jeg vet ikke om det dukker noe opp sånn helt umiddelbart, men det er kanskje litt vanskelig da, men den er veldig plain når den er helt hvit. Men det er kanskje egentlig litt nice at den er sånn nøytral. Umm…

H: Kunne du tenkt deg å endre fargen på den?

T: Ja, kanskje.

H: Mhm.

T: Også hadde jeg i hvert fall, før jeg hadde bestilt noe da, sørget for å oppsøke bilder av faktisk strikkede eksempler. For eksempel når den er oversized kontra vanlig passform, og størrelsen og sånt. Jeg synes det er litt vanskelig å visualisere det fra en sketch til virkelig, men det er jo ikke så rart da.

H: Ja.

T: Og det gjør jo egentlig ikke så mye på en måte.

H: Ja, kunne du tenke deg å ha et fotografi liksom? Av en ferdig strikket

T: Ja, egentlig. Men har de ikke noen bilder av det? Jeg følger de på Instagram, og da legger de ut masse på en måte.

H: Ja.

T: Jeg anser det som mer fristende å strikke, et produkt hvor jeg ser hvordan det blir. Enn en sånn her hvor jeg kanskje er litt usikker på hvordan den vil se ut da.

H: Ja.

T: Hvis jeg hadde hatt en som var ganske lik, men som var ferdig strikket, så ville jeg kanskje valgt den på en måte. Hvis det ikke var noe helt spesifikt som det der vil ha på en måte.

H: Ja.

T: Og igjen det med garn. Det var veldig mye garn, som er veldig fint, men om de kunne laget en oversikt, eller guide da. Også er det jo veldig mange garn som type tilsvarer hverandre og sånt. Men det er jo en litt annen del av det på en måte.

Trykker på Dreamknit-logo og går til forside på dreamknit.no (produksjon-nettside). Trykker Prøv selv.

T: Veldig fint at det var populære garn og egentlig. Her kan man endre på det ja, det la jeg ikke merke til

Endrer Pinnestørrelse.

H: Når du velger garn, hva er det du vanligvis ser etter?

T: Det er litt sånn følelsen av de, så ofte pleier jeg å handle i butikken. Også pleier jeg å se på hvordan det vaskes og sånt. Og kvalitet generelt. Det er jo veldig mye gode garn, men jeg pleier ofte å ta merker som jeg er kjent med.

H: Ja.

T: Litt avhengig av pinnestørrelse, men ofte velger jeg oppskriften først, og så plukker jeg garn ut ifra det. Så jeg er ikke noe vant til å velge garnet selv, og så… Så det kunne egentlig også vært en greie, hvis jeg sier at jeg vil ha en fluffy genser, eller en sånn chunky genser, men jeg vet ikke helt hvordan garn jeg vil ha. Hadde det vært en liten tid tilbake, før korona, og liksom strikke interessen hitta skikkelig, så hadde jeg ikke klart å gå inn å, okei det garnet vil jeg ha. Da må man være litt viderekommen, tenker jeg.

H: Ja.

T: Så det er veldig fint for de som kan litt om det. Strikkefasthet for eksempel synes jeg er litt forvirrende, så der kunne jeg ikke vært sånn, det hadde ikke gitt meg så mye å kunne endre på det.

H: Nei. Så kanskje litt mer sånn, litt mer guiding på garnvalget.

T: Mhm, det ville jeg tenkt.

H: Enn rekkefølgen da? Foretrekker du å velge garnet før du designet genseren, eller ville du gjort det i en annen rekkefølge?

T: Jeg tror kanskje at jeg ville, hvis jeg hadde funnet denne nettsiden sånn randomt på egenhånd, så hadde jeg sett at oi shit jeg må velge garn, nei men det er ikke noe for meg. Så kanskje egentlig designe genseren først. Og så velge garnet. Faktisk. For min egen personlige del da.

H: Ja.

T: Det er noen garn her, som for eksempel Klompelompe-garnet, det er sånn, det er det jeg strikker babytøy i, jeg ville aldri strikket en genser til meg i det.

H: Okei.

T: Det går jo sikkert an, men jeg ville ikke tenkt at det er det naturlige valget, kanskje. Også ser jeg at de er sortert etter merke, det er kanskje fint på en måte, men jeg ville også kanskje synes det hadde vært litt nice hvis de hadde sortert etter garntype, eller noen garn tilsvarer litt hverandre. For eksempel sånn Pus og Puna, nå sier det kanskje ikke deg så mye, men de som kan litt om det kanskje. At det kunne også vært en måte å sortere det på. Men da burde begge delene vært et alternativ, i så fall. Men det er kanskje litt vanskelig å gjøre også. Men det blir kanskje litt teknisk.

H: Neida, vi tar imot alle tilbakemeldinger med åpne armer.

T: Ja.

H: Du nevnte også litt om struktur på armen, at du kanskje kunne tenke deg å ha det på baksiden, liksom rundt armen, og ikke bare på en side da.

T: Ja.

H: Hvordan ville du ha visualisert det, på en sånn tegning?

T: Hvis det hadde vært et sånn 3D-plott av armen, hvor man kunne snu den rundt selv, det hadde kanskje vært det beste. Så kunne man liksom snurre den rundt hele veien. Så demonterer du fra bolen, sånn individuelt liksom.

H: Ja.

T: I en drømmeverden.

H: Enn sånn på framsiden og baksiden. Det var jo en flette som forsvant noen ganger. Det er et valg der du kan ha lik framside og bakside, så hvis du da redigerer på den ene siden, så blir det også redigert på den andre siden.

T: Oja. Det fikk jeg ikke helt med meg. Men det hadde jeg sikkert lagt merke til hvis jeg hadde vært litt mer nøye da.

H: Kunne du tenkt deg en annen måte, å liksom vist at det var sånn det var? Hadde det vært noen sånne hint der som hadde gjort at du…

T: Det var i hvert fall veldig nøytralt når det sto på venstre siden, på en måte. Så kanskje hvis det hadde stått et annet sted på skjermen. I mere øyesyn liksom. Da hadde jeg lagt mer merke til det.

H: Ja.

T: For eksempel sammen med der hvor liksom der man kunne sette inn nye flette og sånn (toolbar). Da kunne jeg tenkt meg at okei jeg kunne velge om jeg vil ha det på begge sider eller bare den ene. Jeg overså det litt nå, rett og slett.

H: Ja. Okei, så har jeg et siste spørsmål, hvis du skulle ha besøkt Dreamknit, sånn på egenhånd, hadde du gjort det på en PC eller på en mobil?

T: På en PC.

H: På en PC?

T: Ja, det ville jeg. Det er litt mer oversiktlig, og at når jeg skal gjøre noe sånt no så vil jeg også søkt opp garnet. Det er også kanskje en ting at når man velger et garn så er det fint å se fargealternativer. For min del er det litt ett fett hvilket garn, jeg velger mer etter farge.

H: Ja.

T: At jeg vet ish hvordan type jeg vil ha, men jeg velger heller, jeg er ikke sånn at det må være Drops eller at det må være hva det heter for noe. Så hadde det også kunne vært fint å hatt som et alternativ da. Det kunne vært fint.

H: Ja.

T: Og om det kunne vært visualisert på genseren, jeg har vært inne på, de viser en farge med da er det liksom bare en sketch over med sånn bred pensel. Som en sånn highlighter. Litt på utsiden og litt på innsiden.

H: Ja, det er en sånn splatt liksom.

T: Ja. Jeg synes i hvert fall personlig at det ikke var så veldig, det gjorde det ikke noe lettere å visualisere det da på en måte. Hvis det hadde vært strikkemønsteret, eller ikke med fletter og sånt, men ofte når man kjøper garn, så er det et sånn bilde av garnet da, et sånn lite utsnitt av hvor man ser litt strukturen og sånt på en måte.

H: Ja.

T: Så er det ikke bare farge, men det kan være litt spill i garnet også, det hadde vært fint å få.

H: Ja, så litt mer realistisk?

T: Ja. Og det trenger liksom ikke være skalert sånn med størrelser på masker til genseren og sånt, men bare en grå, som man kunne lagt på da. Man kunne også tatt den vekk, fordi hvis man la på en mørk farge av det så er det vanskelig å se flettene og sånt.

H: Okei, hvis ikke du har noen flere spørsmål eller ting som du tenkte på, så…

T: Nei, jeg tror ikke det.

Scroller nedover hjem-siden på dreamknit.no

T: Jeg liker at det er liksom, at man kan se disse bildene her (Fra instagram?). De kjenner jeg at jeg er mest interessert i på en måte. Da får litt mer sånn, okei det er sånn det kan se ut da.

H: Ja.

T: Kanskje egentlig at når man har bestilt den her, jeg vet ikke om det kommer senere, men med størrelser. Hvis det hadde stått noen mål, på en måte. Hva det tilsvarer at det er en medium. Det står kanskje et eller annet sted, men det har ikke dukket opp sånn helt ut av det, jo der står det brystmål. (Samme bilde som på oppsummerings-siden). Ikke sant, men det kunne kanskje kommet frem i størrelser, eller at man kunne trykket seg videre når man valgte størrelse, på en eller annen side. At man puttet sånn informasjon som dukket opp. På en eller annen måte hva som er målene.

H: Ja.

T: Og da kanskje automatisk sånn som det står her, 7 nøster til sammen, Sunday. For eksempel.

H: Mhm.

T: Det kommer kanskje opp senere. Men det hadde vært en idé om det hadde dukket opp litt før da.

H: Ja, kunne du, for eksempel antall nøster da, kunne du tenke deg at det sto oppe i, der du designer genseren?

Trykker på Prøv selv.

H: Det her er faktisk den nettsiden som er der live nå da,

T: Hæ? Oja her står det ja, ikke sant. Det var jo akkurat det jeg spurte etter.

H: Det sto ikke på den som du testet.

T: Nei det gjorde ikke det?

H: Nei. For når du gikk tilbake til den hjem på en måte, så linket den til nettsiden i stedet for.

T: Men den der (Garnmengde) var jo veldig fint egentlig. Ja ikke sant da endrer det seg.

Ser at Garnmengde endrer seg når man endrer størrelse.

T: Det er jo ganske nice, så ser man hva det vil bli, og man kan regne litt på det prismessig.

H: Ja. Så du hadde foretrukket å ha den garnmengden der oppe?

T: Ja. Det ville jeg tenkt, det likte jeg. Her kan man visualisere farge. Den der synes ikke jeg, eller sånn, for det første er det litt sånn, eller kanskje man kan søke farger (markerer Hex-input), men at de forslagene, det er litt få da. Også er det litt sånn, det er så mange forskjellige farger som finnes, så det hadde vært litt mer interessant, at hvis jeg velger dette garnet, så er dette fargene jeg kan få, og det vil se ish sånn ut.

H: Ja, mhm.

T: Ja, hvis det skulle vært helt perfekt.

H: Ja det er dit vi skal.

T: Ja, spennende. Annet enn det så tror jeg ikke det er noe som jeg kommer på. Der vil den ikke scrolle? (Venstre-meny) Oja det er kanskje ikke så mye å scrolle. Jo der ja.

H: Yes, nei men da er vi vel egentlig ferdig.

T: Det var det? Ja supert. Nice. Spennende. Jeg har planer om å få bestilt meg en oppskrift derfra.

H: Ja, det må du prøve på.

T3U4

Dato: 23. mars 2022
Tid: 09:30-10:00
Sted: UX-laben NTNU Gløshaugen

Navn: ▮▮▮▮▮▮▮▮▮
Alder: 18-26 år
Kjønn: Kvinne
Strikkekompetanse: Viderekommen
Gensere strikket: 4-8

Oppgave	Fra	Til	Varighet
Kalibrering	00:00	01:02	1 m 2 sek (62)
Oppgave 1	01:02	06:06	5 m 4 sek (304)
Oppgave 2	06:06	10:56	4 m 50 sek (290)
Oppgave 3	10:56	15:36	4 m 40 sek (280)
Diskusjon	15:36	35:41	20 m 5 sek (1205)

Oppsummering

Testen ble gjennomført uten store problemer. Brukeren var flink til å tenke høyt, og fikk til alle oppgavene. Litt forvirring rundt lik fram/bakside.

- Oppgave 1
  - Forsto først ikke at hun allerede var på Design selv siden
  - Liker feedback i visualisering når valg endres
  - Legger først til struktur ved klikk
  - Litt forvirret først om lik fram/bakside. Prøver seg fram og forstår det ganske raskt.
- Oppgave 2
  - Skulle ønsker et preview av garn som er strikket. "En liten bit glattstrikk".
  - Vil ha rosa garn, men kan ikke endre farge.
  - Fjernet flette på framside med uhell, hadde lik fram og bak og ville bare fjerne baksiden.
  - Nå drar hun for å legge til strukturer.
- Oppgave 3
  - Vil plassere strukturer helt inntil hverandre, litt problemer med dette.
  - Forvirret over at strukturer bare vises når struktur-fane er åpen. Strukturer vises heller ikke i oppsummering. "Ikke sant, her har vi en genser uten tvist, og da hadde jeg kommet til å blitt litt usikker, og sikkert sendt en mail til nettsiden og spurt før jeg hadde bestilt noe"
  - Klarte ikke å plassere strukturer helt symmetrisk.
- Diskusjon
  - Vil velge farge samtidig som garn
  - Kunne tenkt seg tydeligere markering av Design selv siden, kanskje knapp i navbar skulle vært markert. Overskriften på siden er "01 Garntype", som er forvirrende fordi siden heter Design selv.
  - Logisk å velge garn først. "Det kan jo ha en betydning for hvilke valg man tar senere".
  - Lik struktur foran og bak: Hun tenkte først at det var snakk om lengde. Også ingen feedback når man velger.
  - Manglet enklere strukturer, rader med annenhver rett og vrang. Vrangbord, patentstrikk. Tenker på vanskelighetsgrad for strikking, derfor kan fletter og tvister være litt "skummelt til å begynne med".
  - Ønsker mer realistisk visualisering. Fotografi.
  - Foretrekker å dra fremfor å klikke for å legge til strukturer.
  - Liker guidelines for å aligne strukturer.
  - Ville brukt PC for å besøkt nettsiden. Men hvis hun ikke hadde visst hvordan nettsiden så ut, kunne det hende at hun hadde brukt mobil.
  - Ting som manglet: Cardigan, korte armer/t-skjorte, enklere strukturer, velge hvordan vrangborden ser ut.
  - Ikke helt logisk at "vest" er plassert under Ermer.

Transkript

T = Testperson
H = Hans

Kalibrering

Eye-tracker blir kalibrert.

Oppgave 1

H: Her har du den første oppgaven, så kan du bare lese den og sette i gang.

T: Okei, da skal jeg lage et design for en genser. Nå har jo jeg vært borti den her nettsiden før, så jeg vet at jeg kan sette sammen ermer og sånt med en kropp, så det skal jeg prøve å finne. Her ser jeg at det står design selv oppe i menyen, så jeg klikker der. Da skjedde det ikke så mye. Okei, så da scroller jeg ned, og ser om jeg kan finne noe her som jeg kan bruke for å komme dit. Velg garntype, da antar jeg at jeg allerede er inne på design selv. skal vi se, populære garn. Jeg har lyst til å strikke i børstet alpakka, det har jeg gjort før, så jeg velger den, og der har vi en genser. Garnvalg, det har jeg allerede gjort. Her ser det ut som at den har valgt, skal vi se, her ser det ut som at den har valgt ut en pinnestørrelse og strikkefasthet for meg. Jeg så at det var noen slidere på den forrige siden, så jeg går tilbake. Skal vi se om det er noe jeg kan stille inn på egenhånd. Da vil jeg kanskje tro at garnvalg forsvinner når jeg stiller inn på det her, så jeg gjør det først. Da sier jeg at jeg vil ha mellom pinnestørrelse 4 og 7. Ja, 6.5, 7. Ja okei. Strikkefasthet, det kan være det samme. Da velger jeg børstet alpakka. Der er garnvalget mitt og strikkefasthet, løpelengde greit.

T: Passform. Jeg velger størrelse, medium ser bra ut. Vanlig passform, ja. Her har vi et par knapper, vanlig eller oversized. Ser at det har litt å si for hvordan denne tegningen blir. Jeg velger vanlig, og jeg velger også vanlig lengde, på de to neste valgene.

T: Hals, her får jeg opp flere hals valg, rund, v, halvhøy og høy. Jeg velger v-hals.

T: Ermer. Vanlig, vest, ballong, vide. Jeg velger vide ermer.

T: Struktur. Lik foran og bak, jeg antar kanskje at det er lengde. Skal vi se om jeg kan få opp noe bilde. Nei. Struktur. Oja sånn ja. Struktur som på en måte mønsteret i garnet, da velger jeg at jeg vil ha lik foran og bak. Nå ser ikke jeg noe bilde av hvordan struktur jeg kan velge mellom, men det er kanskje. Jo, her har vi det kanskje. Legg til tvist og flette, okei. Legg til bortover sånn og så flytt plass på de. Skal vi se, dra for å endre bredde. Endre bredde. Og jeg kan flytte på dem, kan jeg flytte på dem tro? Jeg kan ikke flytte på dem, okei. Slett da i så fall og legg til på nytt. Tilbake til struktur foran og bak. Nå har jeg forskjellig foran og bak, hvis jeg først legger til et par sånne, blir dem da og på baksiden? Nei, okei. Og hvis jeg velger den lik foran og bak, da vil de være, okei. Da forstår jeg, lik foran og bak handler om strukturen jeg velger på toppen der. Jeg vil ikke ha noen struktur, vil bare ha glatt, så jeg tar bort dem. Og ermene vil jeg også skal være lik. Så okei, da er jeg fornøyd med genseren.

T: Skal vi se nå kom jeg på at jeg ikke har fått noe spørsmål om farge på garnet. Men det kan kanskje være noe jeg kan stille inn på forrige side. Jeg går tilbake, så her har vi en lys børstet alpakka. Finnes det andre farger, kanskje hvis jeg søker på børstet. Okei da får jeg fremdeles bare den hvite. Litt usikker på hvor jeg kan velge farge hen. Jeg går videre med børstet alpakka. Og der var den genseren ja, lagret fra sist. Da er jeg fornøyd med designet, jeg trenger ikke fullføre kjøpet står det, så da sier jeg meg ferdig her.

H: Ja, kjempebra.

Oppgave 2

H: Da kan du få neste oppgave her.

T: Thank you. Yes okei, så nå skal jeg designe en genser som det er bilde av her. Da går jeg først tilbake til startsiden inne på Design selv, og velger et garn. Da må jeg jo prøve å velge noe som ligner her da. Hvis man er nybegynner så er det kanskje litt vanskelig å se det, så det gir jo ikke nettsiden noe støtte for sånn sett. Det hadde kanskje vært litt fint, om man kunne sett en liten bit med glattstrikk eller noe sånt, for å se hvordan den vil se ut. Eventuelt om man kan trykke her, jeg kan jo se om man kan komme inn på en sånn side. Nei, du kan bare

velge bilde av garnet. Så for å finne ut hvilket garn som kunne sett ut som den, så ligger det ikke noe funksjonalitet inne, så der er det opp til brukeren hva de vet om strikking fra før. Jeg tror at børstet alpakka kan være fint for denne, så jeg velger den. Den skal jo være rosa, det får jeg ikke noe spørsmål om her, det er bare masse lyse garn. Men det kan jo være noe jeg for spørsmål om senere, litt usikker. Etter den siden her, hvis man går videre står det bare til betaling. Så da virker det som at det her er siste steget før man skal betale. Så den fargen er jeg litt usikker på. Men hva er egentlig dette? Garnkombinasjon eller annet garn. Okei, det ser ut som et slags filter, ja. Velger børstet alpakka, den blir ikke rosa, den blir lys. Garnvalget, yes, det ligger inne der. Passformen, da antar jeg at venninnen min har størrelse medium så jeg tar den igjen. Vanlig passform ser bra ut, skal vi se. Ja. Vanlig passform ser bra ut i forhold til den genseren her. Vanlig lengde, ser også riktig ut. Halsen, det ser ut som en rund hals. Ja. Jeg går for en rund hals her. Ermene, de er litt ballong-aktig. Jeg tror kanskje, hvis ikke de er vide. Hmm, ja jeg velger ballong også tenker jeg heller at når jeg skal strikke den så kan jeg lage en mindre ballong her for å få den til å ligne mer på genseren som det er bilde av, så jeg velger ballong. Selv om det kanskje ikke er helt optimalt, men jeg tenker at det er det nærmeste. Struktur, nå ser jeg ikke baksiden av genseren, men jeg antar at det er samme som foran, så skal det være noen fletter her. Den der ser riktig ut, ja okei fint, jeg kan plassere den midt på genseren på egen hånd. Da gjør jeg bare det sånn, da var den plassert der. Også skal jeg ha på hver arm. Da putter jeg en flette der på armen, også ser jeg at her så har jeg valgt like armer, og da vet jeg at det vil være den samme armen på andre siden. Ja, jeg tror kanskje at jeg tar en kunstnerisk frihet her og dropper fletten på baksiden. Jeg ser jo ikke hvordan den skulle vært her på genseren uansett. På framsiden, der forsvann den fletta, da sier jeg forskjellig foran og bak, og så putter jeg på fletten midt på. Sånn. Baksiden skal ikke ha den. Framsiden med flette på, baksiden har ikke det, og armen her har det, og siden de skal være lik så har også den andre armen det. Yes. Da er jeg også ferdig med oppgaven her.

H: Kjempebra.

Oppgave 3

H: Her er siste oppgaven, som er en liten fortsettelse.

T: Ja okei. Ja. Da skal jeg legge til, fortsette med den genseren her, og legge til en tvist på hver siden av fletten på bolen, så da gjør jeg det. Jeg har oppdaget at jeg bare kan dra også her til genseren, så da gjør jeg det. Tvist på hver siden av fletten, og det der var vel en tvist ja. Tar en tvist, så da har vi en tvist der. Oi, og den vil jeg skal være nærmere, men det vil den ikke. Joda. Den vil så nærme men ikke lengre ser det ut som. Da flytter jeg den dit, også har vi en på andre siden der. Ja, nå er den så nærme som den kan komme. Da har vi en flette i midten og en tvist på hver side, greit. Og vet at venninnen ikke liker å ha struktur på baksiden. Og den er plain fra sist, så nå tror jeg at venninnen min vil bli fornøyd med bursdagsgaven. Men jeg har jo ikke riktig farge da. Det, som sagt er jeg litt usikker på hvordan det endrer seg, jeg har ikke funnet ut av det. Jeg ser heller ikke noen opplagte steder hvor det kan gjøres. Jeg kan jo prøve å finne det nå da, skal vi se, for den genseren der vet jeg, oi. Ja, nei. Nå var den bare helt plain, okei. Men hvis jeg trykker på den så ser jeg at strukturen kommer tilbake. Så i en kjøpsprosess hadde jeg kanskje vært litt usikker her. okei er egentlig flettene og tvistene lagret på genseren, hvis jeg nå trykker på til betaling, har jeg da en genser med eller uten struktur, litt usikker. Det kan jo være at man får et betalings sammendrag helt på slutten her, som sier noe om det. Så jeg kan jo gå til betaling å se. Ikke sant, her har vi en genser uten tvist, og da hadde jeg kommet til å blitt litt usikker, og sikkert sendt en mail til nettsiden og spurt før jeg hadde bestilt noe. For det står jo ingenting her om at det skal være struktur. Men kanskje hvis jeg har struktur-fanen åpen, nei. Okei, så det hadde jo vært fint å fått en bekreftelse på slutten i oppsummeringen, at strukturen er med. Det står jo heller ikke noe om farge her. Bare børstet alpakka og forhandler. Og det er jo litt synd, det hadde vært fint å fått med. Garntype, for der er det jo type, hmm. Okei, pinnestørrelse, strikkefasthet, kan det være noe på informasjon, nei. Men det kan jo kanskje være noe som man tenker å legge inn etter hvert da. Og da tenker jeg at det hadde vært en fin løsning, for eksempel at man kan søke på børstet alpakka, også får man masse fargevalg, jeg tenker kanskje at det er den beste løsningen, så slipper man å gå inn på en garn for å se fargene, for det kan jo være at et garn har en ganske fin farge som hadde vært fint å fått vist allerede her, før man klikker seg videre inn på garnet. Jeg antar at dette her ikke er lagt inn enda, altså den funksjonaliteten med å endre farge. Så jeg velger børstet alpakka, der har vi genseren min, og som sagt er jeg litt usikker på om strukturen her er med, men jeg kan ikke forstå at jeg skal gjøre noe annet, jeg antar også at det er en svakhet med testen her at det ikke er lagt til funksjonalitet for det, så jeg tenker nå at genserne er ferdig designet, og at venninnen min blir fornøyd så da går jeg videre til betalingssiden og da skal det være greit. Ferdig.

H: Ja, kjempebra.

Diskusjon

H: Du antok riktig forresten.

T: Ja okei bra.

H: Okei, jeg skal bare dobbeltsjekke at lyden er på der. Ja. Har du noen umiddelbare tanker om hvordan det gikk? Du var jo kjempe flink til å tenke høyt, så det var veldig bra.

T: Okei bra. Nei jeg synes det gikk bra. Synes det var, altså jeg synes det var en fin nettside. Enkelt å geleide seg rundt omkring. Jeg har laget en brukertest selv en gang, og vet at det er ikke alt man legger inn allerede i testen, så det kan jo være en svakhet, men ja. Det med fargene og sånt er jo sikkert på vei inn som du sa, så det ser bra ut. Fin nettside.

H: Ja. Så du kunne tenkt deg å velge farge samtidig som du velger garn da?

T: Ja. Jeg tenker at det er bedre at fargene vises allerede her, fordi la oss si at vi går inn på børstet alpakka her, nå trykker jeg på velg, også får jeg opp et vindu, også er det masse farger du kan velge. Så tenker jeg at, la oss si at du går heller etter farge når du skal bestille garn, ikke type. Så det hadde vært fint å fått allerede de her kanskje, også kanskje filtrer på farge. At jeg har lyst å ha garn som er rosa. For det kan jo være at det er noen garn som har en veldig fin farge du har lyst å strikke etter, at det er fargen som bestemmer hva du strikker ikke type garn. Så jeg tenker at det hadde vært den beste løsningen ja.

H: Mhm. Enn i starten så prøvde du å trykke på Design selv.

T: Design selv ja, så. Fordi på siden her er det kanskje ikke opplagt at man er inne på den siden. Hvis det hadde stått for eksempel her, design selv, og så steg 1 garntype. Så hadde det kanskje vært enklere å forstå at nå er det her vi er. Eller at kanskje denne hadde vært markert på et vis.

H: Ja.

T: Som gjør det tydelig at nå er vi her, men hvis jeg trykker på der nå så kommer jeg kanskje på startsiden, og det er jo der man vil komme inn når man er ny på nettsiden. Så, hvis jeg hadde vært sånn som i oppgave 1 her da. Du havner på Dreamknit sin nettside, så er jo jeg her, og da ser jeg design selv, også er jeg inne her.

H: Mhm.

T: Så det var kanskje bare at jeg var forvirret fordi jeg allerede var inne på siden.

H: Ja, enn sånn, synes du det gir mening å velge garn først, før du

T: Før genseren? Ja egentlig. Det synes jeg, jeg synes det er mest logisk. Det kan jo ha betydning for hvilke valg man tar senere, tenker jeg. Så absolutt, jeg tenker at det er en logisk rekkefølge.

H: Okei, enn dette struktur-steget.

T: Ja, nå bare klikker jeg meg videre her. Da var vi, oi.

H: Ja, du kan, hvis du åpner den andre fanen der, du havnet på den produksjonsnettsiden.

T: Oja sånn ja, så her altså.

H: Ja nå er du på den prototypen.

T: Okei, velg. Der er det struktur. Hva jeg synes om den, ja struktur. Sånn når jeg leser i ettertid så hadde jeg heller tenkt at hvordan genseren er i stoffet hvis man kan kalle det det. Men lik foran og bak, jeg tenkte først lengde da. Det kunne også vært noe man kunne stilt inn her, på passform kanskje. Ja det har man jo her, kort og vanlig lengde. Det er fint. Nei jeg tenker egentlig at det er greit, men det som er er at det er ingen reaksjon her på bildet. Hvis jeg trykker forskjellig foran og bak, så ser jeg ikke hva det betyr før jeg eventuelt drar ned sånne fletter. Det er først da man forstår det. For det er litt fint med alt det andre her, at man får en respons på bildet, så det er veldig lett å forstå hva som skjer med genseren. Så det hadde vært fint å fått et eller annet bilde her kanskje, som viser hva dette betyr. Kanskje man får, la oss si at du får opp to gensere her da, du får opp en forside og en bakside. Ja, du må jo kanskje ha inn en struktur, men kanskje et eller annet som indikerer hva som skjer, uten at man må dra ned disse her. Det hadde vært fint, uten at jeg kan si helt umiddelbart om hvordan jeg synes det burde vært gjort. For har du to gensere her, så får du egentlig samme problemet hvis du trykker på forskjellig foran og bak, det skjer jo ikke noe på hver av dem før du trykker på det her.

H: Ja. Men et eller annet.

Notat i ettertid: Kanskje struktur kunne hete dekorasjoner?

T: Ja, en tanke. Det kunne vært fint. For nå måtte jeg lete litt før jeg forsto hva det betydde.

H: Okei. Men pleier du å strikke sånne fletter og tvister og sånne ting?

T: Nei, jeg gjør egentlig ikke det.

H: Nei.

T: Men ja, noen gjør jo det. Så det er en fin funksjonalitet å ha med.

H: Ja.

T: Jeg tenker også at det kunne vært, kanskje det som jeg synes er mer aktuelt er sånn rett- og vrangbord, patentstrikk, sånne ting. At du kan få det med i oppskriften. For nå tipper jeg kanskje bare at det som er her, det er rettstrikk, også er det her vrang, eller rett og vrang.

H: Ja, det stemmer nok.

T: Så jeg tenker kanskje at det er mer aktuelt, for eksempel sånn legg inn at du vil ha én rad som er rett og så én rad som er annenhver rett og vrang, også får du struktur sånn da.

H: Ja.

T: Og kanskje særlig tenker jeg at denne nettsiden er også aktuell for nybegynnere da. Og at da er kanskje fletter og tvister litt skummelt til å begynne med, og at enkle ting sånn som rett og vrang, da er det lettere og faktisk velge seg noe på struktur da. Og hvis det skal legges inn hadde det også vært fint med et bilde som viser hva de ulike strukturene gjør. Hvis man skal få inn en sånn patent her på det bildet. Hvis du kan få et bilde ved siden av da som kanskje viser et faktisk bilde med en genser med den strukturen.

H: Ja.

T: Jeg vet ikke.

H: Et fotografi liksom?

T: Kanskje, jeg tenker at det viser mer hvordan det ville vært enn en tegning.

H: Ja.

T: Når det kommer til struktur så synes jeg at her på flette og tvist og sånt, så er ikke det noe problem. Da skjønner man hva det er, men når det blir såpass lite, så kan det kanskje være litt vanskelig å forstå hvordan det faktisk vil se ut.

H: Enn begrepet struktur da, ville du kalt det for…

T: Ja, egentlig. Jeg synes det er et bra begrep egentlig. Det indikerer jo at det er hvordan stoffet, eller hvordan den strikken da. Hvilken form den har på en måte. Så ja jeg synes det er et bra begrep, absolutt ja. Jeg kommer ikke på noe annet som også kunne, skal vi se, struktur. Overflate, jeg vet ikke. Nei, struktur er nok det beste.

H: Mhm. Enn sånn foran og bak, jeg la merke til at du endret baksiden en gang, også ble liksom fletten tatt bort fra fremsiden.

T: Yes ja.

H: Men du fant ut ganske fort etterpå at det var forskjellig.

T: Nei jeg tenker egentlig at det. Jeg synes egentlig det var greit nok, det plaget meg ikke. Ja, det er vel kanskje litt vanskelig, du må jo ha noen regler for hvordan genseren skal oppføre seg, ut i fra hva som er stilt inn og hvilken flette du har valgt og så trykker du på den, at da, jeg vet ikke, det å finne noe regler som alltid passer det du har tenkt som kunde er kanskje ikke helt enkelt, så jeg synes det var helt greit. Det er jo ikke værre enn å legge til på nytt. Eller slett eller den som var lagt til feil, sant her var jo den, det går fint.

H: Når du la dem til, så tror jeg først

T: Først trykket jeg bare sånn, også fikk jeg dem der. Men så oppdaget jeg etter hvert at man kan dra da.

H: Ja.

T: Nå man skulle plassere den på midten. Men ja, det er jo egentlig, jeg fant jo ut av det, det var kanskje andre oppgave jeg fant ut av det. Det er jo litt kjedelig hvis man er ny, også klikker du sånn, den var ikke helt på stedet som jeg ville, men det er greit nok også bestiller du, også kunne du egentlig ha fått dem mer optimalt da. For sant de her er jo ikke midtstilt en gang.

H: Nei.

T: Så, ja. Jeg vet ikke, jeg tenker sånn at det er viktig at brukeren vet at man kan dra dem, på den måten man vil. Ja.

H: Synes du det var bedre å dra enn å klikke på den?

T: Ja, særlig fordi du fikk sånne streker som sier at okei nå er den midtstilt. Da er det bedre å dra. Også hvis du legger til en ved siden av sånn, så kan du på en måte dra den helt oppi, også spretter den tilbake til dit da, så vet jeg at jeg kan gjøre det på andre siden og at det blir symmetrisk. Okei de ser ikke helt symmetrisk ut her nå, men det er sikkert det som er tenkt, at det skal være like lang avstand dersom det er der.

H: Ja, for sånn som det er nå, hvis du prøver å dra den over den andre, så hopper den bare tilbake til der den var.

T: Ja, ikke sant. Eller hvis du dro en ny en her nå, som er oppå, så bare spretter den bort. Hvis jeg plasserer den helt her, så bare forsvinner den. Men, jeg tenker at dra-funksjonalitet er det beste. Og kanskje hadde det vært bedre om hvis man trykker her, så skjer det ingenting. For da skjønner du at okei nå har jeg ikke brukt den riktig, eller så tenker jeg at hvis du klikker her så havner de sånn, så tenker man kanskje at det er sånn man plasserer flettene. Men hvis de ikke dukker opp, så skjønner du at okei her må det være noe mer, og at du da prøver å dra, jeg vet ikke, kanskje.

H: Mhm.

T: Men jeg tenker det at man burde legge opp til at man som bruker faktisk drar. Og at det er riktig.

H: Ja. Enn for å aligne de helt sånn perfekt.

T: Ja.

H: Ville du ha vært, eller hvor på en måte perfekt måtte du ha alignet dem for at du skulle ha kjøpt denne oppskriften?

T: Det må være på maska ja, at det må være like stor avstand, altså det må like mange masker mellom hver flette da, hvis det gir mening. Hvis jeg tegner de inn sånn her nå, og den er der, også setter jeg den så nærme den kan komme. Så forventer jeg egentlig at maske-antallet mellom her er det samme på begge sidene. Og hvis det ikke hadde vært det, så hadde jeg vært litt skuffet. Det synes jeg burde vært med. Så jeg vet ikke om man kunne fått en bekreftelse på det. Nå ser jeg også at dette er ikke helt symmetrisk, men det er kanskje noe som skal rettes på i den faktiske nettsiden, la oss si at det hadde vært helt symmetrisk her også hadde jeg gått videre, så hadde jeg stolt på at det var like mange masker i mellom. Men hvis dette skal auto-genereres, eller sånn, hvis det er ingen som kontrollerer at det her, hvis man bare drar så regner systemet ut en avstand her, på hvor mange masker det vil bli. Så er jo det litt kjedelig hvis det blir forskjellig masker her, hvis det er ingen som kontrollerer det at det faktisk blir det samme. Det kan jo også være at noen har lyst til å ha forskjellig avstand kanskje, og da bør jo de også gå an. Så jeg vet ikke om man for eksempel kunne stilt inn at du har lyst at for eksempel hvis du stiller inn at du vil ha en symmetrisk framside om den aksen der. Så vil det stilles inn på egenhånd, hvis jeg klikket her nå symmetrisk, så plasserer jeg den her sånn, så kommer det på ny her som er akkurat symmetrisk om midten. Det kunne kanskje vært noe, men ja det må være symmetrisk. Eller at man kunne fått en liten beskjed her, som gir en indikator om hvordan oppskriften faktisk vil bli, som kan fortelle, okei har du likt antall masker, så ser du nei du har ikke det, så flytter du på den til du får det samme maskeantallet for eksempel.

Notat: Kanskje "Lag symmetrisk"-knapp?

H: Mhm.

T: Ja.

H: Alright. Okei så har jeg et siste spørsmål, hvis du skulle besøkt Dreamknit sin nettside, tror du at du hadde gjort det på en PC eller på telefonen?

T: PC ja.

H: PC

T: Absolutt. Særlig siden det er design inne i bildet, så klart hvis man ikke vet hva nettsiden er så kan man jo, da vet man ikke, men skulle jeg faktisk ha brukt den, og jeg visste at det her kom, så hadde jeg brukt PC uten tvil.

H: Ja. Okei, er det ellers noen flere ting som du tenker på? Noe som du føler mangler?

T: Nei det er kanskje litt dette med strukturen, det jeg nevnte med andre strukturer enn bare fletter og tvist, jeg synes de er kanskje litt for avansert. Det skal litt til for at man faktisk velger å legge til det her. Jeg synes det hadde vært fint med noen enklere strukturer.

H: Ja.

T: Ellers synes jeg det er et godt utvalg. Kanskje at du også kunne velge lang lengde, og kanskje at du kan velge en cardigan, altså at den er åpen midt på. Det hadde vært fint. Også per nå så er det jo genser og vest som er, som tas høyde for. Men det kan jo være sånn, jeg vet ikke hvis man kan lage en t-skjorte eller noe sånt. Eller andre plagg da. Men det vanligste er kanskje å strikke gensere. De fleste gjør jo det hvis de skal strikke et stort prosjekt, så er det genser som er mest aktuelt. Så jeg synes at det er fint sånn. Men kanskje litt flere valg, kanskje særlig en lang lengde, og en cardigan. At man kan velge her da, på ermer, ja. Fordi det heter ermer, også er det vest her. Jeg synes ikke det gir helt mening. Men kanskje du kan velge type genser, så en vanlig genser, også vest eller cardigan for eksempel. Halsene synes jeg er bra. Halsene er fin. Vanlig, ballong og vide, ja det er egentlig dem ermene jeg kunne ønsket meg. Jeg tenker kanskje det er mer logisk at vest plasseres et annet sted, type genser. Med kanskje en cardigan, også har man vanlig, ballong og vide. Eller kanskje du kan ha korte ermer, tre kvart eller noe sånt. Ja, og enklere strukturer.

H: Ja. Hvordan type strukturer var det du tenkte på da?

T: Litt sånn patentstrikk hadde vært kult, og ulike varianter av det. Jeg nevnte jo litt for eksempel at du har en rett runde, og så har du en rett og vrang, altså annen hver maske rett og vrang runde. Kanskje bare helt små enkle ting, som gjør at maskene blir litt annerledes, så du får litt annen struktur.

H: Ja.

T: Og kanskje at du også på vrangborden kan velge om du har lyst å ha en vrang, eller to rette to vrange. At du kan velge det da, og det vil jeg tro er ganske enkelt å legge til også, eller sånn, for en bruker også så er det jo enkelt å utføre. Jeg tror det er viktig. Særlig hvis man er ny så gidder man ikke å legge til masse fancy greier, men at det er fint med helt enkle steg da.

H: Men de her rett og vrang greiene, tenker du at man skal legge det på hele genseren, eller er det en liten seksjon da?

T: Jeg tenker kanskje at hvis du velger den strukturen så er det logisk at sånn som her at, hals og den nederste biten på genseren og her på armene der det er vrangbord. Rett og vrang, to rette to vrange. Kanskje det kan være et eget valg, struktur på vrangbord. At du kan ha en rett en vrang, to rette to vrange. Eller andre varianter. Også velger du en struktur på, egentlig på hele genseren. Eventuelt at du kan skille på foran og bak, selv om jeg ikke ville brukt den funksjonen, jeg synes det er fint at hele genseren har en struktur. Og at du da velger struktur på vrangbord. Her nede på ermene altså, og på halsen. Og at du kan velge en struktur på hele genseren, som da vil være alt annet, så ermene og bolen og sånt.

H: Mhm. Nei da har ikke jeg noen flere spørsmål.

T3U5

Dato: 25. mars 2022
Tid: 08:00-08:30
Sted: UX-laben NTNU Gløshaugen

Navn: ██████████
Alder: 18-26 år
Kjønn: Kvinne
Strikkekompetanse: Viderekommen
Gensere strikket: Mer enn 8

Oppgave	Fra	Til	Varighet
Kalibrering	00:00	00:53	53 sek (53)
Oppgave 1	00:53	03:23	2 m 30 sek (150)
Oppgave 2	03:23	06:58	3 m 35 sek (215)
Oppgave 3	06:58	08:16	1 m 18 sek (78)
Diskusjon	08:16	20:56	12 m 40 sek (760)

Oppsummering

Testen ble gjennomført uten store problemer, og brukeren klarte alle oppgavene. Hun synes det var unaturlig å velge garn først, og ville også velge passform til slutt.

- Oppgave 1
  - Synes det var realistisk oppgave
  - "Vanskelig å begynne med å velge garn"
  - Har en idé om hvordan armene og halsen skal se ut, vil velge passform til slutt.
- Oppgave 2
  - Synes det er lettere å designe genseren enn å velge garn.
  - Drar for å legge til flette.
  - Prøver å dra struktur direkte på armene når framsiden vises.
  - Knapper under visualisering legger hun lite merke til, men finner de etter hvert.
  - Drar for å legge til tvist på armen.
- Oppgave 3
  - Nå trykker hun for å legge til tvister på framsiden.
  - "Jeg skulle ønske at de bare plasserte seg likt"
- Diskusjon
  - Ønsker å endre på rekkefølgen.
  - "Også synes jeg det er litt rart at det er, fordi du velger ikke struktur på samme måte som du velger fasongen på ermer, det er noe du putter på etterpå"
  - Synes det var vanskelig å bruke knapper under visualisering. Knapper i venstre-meny er mer tydelig, men mindre viktig: "Jeg er mer interessert i å velge hvor jeg har struktur enn om den er lik". Også vant til å bruke menyen fra tidligere steg.
  - Ser at strukturer er "skeiv", altså ikke likt distribuert.
  - Kunne blitt plassert på midten som standard når man legger til struktur.
  - Vil ha det symmetrisk
  - Legger ikke merke til resize-knapper, tenkte kanskje det var for å flytte på fletten.
  - Vil at midten på struktur skal forbli på samme plass etter resize
  - La ikke merke til align-knapper. Synes det var langt mellom venstre og høyre delen av toolbaren. Tror hun ville brukt align-knapper hvis hun visste om de.
  - Vil ha eksempler på garnvalg, gensere som er strikket med garn.
  - Vil ha "finishen" til slutt, om man vil ha store eller små masker. Virker ikke som hun liker å bruke begrepet strikkefasthet.
  - Rart at størrelse er under passform. Forventer at passform handler om hvordan skuldrene skal gå.
  - Hadde besøkt Dreamknit på telefon. Leter ofte etter strikkeoppskrifter på farten. Bruker Instagram.

Transkript

T = Testperson
H = Hans

Kalibrering

Eye-tracker blir kalibrert.

Oppgave 1

H: Så skal du få første oppgave her, så kan du bare lese den og sette i gang.

T: Vil du at jeg skal lese den høyt?

H: Det kan du bestemme selv.

T: Ja jeg leter etter et nytt strikkeprosjekt akkurat nå.

H: Ja, så det er kanskje realistisk.

T: Mhm. Lag et design for en genser som du kunne tenke deg å strikke. Oppgaven er ferdig når du er fornøyd, du trenger ikke fullføre kjøpet. Nei det er helt i orden.

T: Jeg synes det er vanskelig å begynne med å velge garn. Fordi jeg skulle gjerne begynt med design, og så kunne jeg velge garn etterpå. Så nå velger jeg noe jeg er kjent med. Jeg vil ha en genser som, jeg har en idé om hvordan armene på genseren skal se ut. Og halsen. Jeg synes det er lett å finne frem til det. Og velger passform egentlig helt til slutt, for jeg synes det kommer an på resten av genseren.

T: Okei, da trykker jeg meg egentlig videre til betaling tror jeg. Og fyller inn betalingsinformasjon. Og det synes jeg var ganske lett å gjøre, og… siden jeg ikke trenger å fullføre kjøper sier jeg meg egentlig fornøyd med denne oppgaven. Ferdig.

Oppgave 2

H: Alright. Da får du oppgave 2 her.

T: Okei, skal jeg bare gå tilbake?

H: Du kan egentlig bare gå tilbake ja. Så nå ble du faktisk tatt til Dreamknit.no.

T: Da må jeg en liten tur tilbake her da.

H: Ja, hvis du trykker på den design selv kanskje, der ja.

T: Bra. En god venninne av meg har bursdag og du tenker å strikke en genser til henne. Hun har snakket om en genser hun synes var veldig fin. Det er den på bildet her. Design en genser som ligner på denne genseren som du tror venninnen din vil like. Okei. Det jeg ser her er en genser som er strikket i ganske tykt garn. Og igjen skulle jeg ønske at jeg kunne velge garn til slutt. Fordi, jeg synes det er lettere å designe genseren enn å velge garnet. Men jeg velger Drops Air. Også lager jeg strukturen først. Jeg tror den er forskjellig foran og bak, og foran så legger jeg på en flette. Og fikser halsen, så den er rund og armene så de er vanlige? Jeg tror de er vanlig. Så går jeg tilbake til å velge struktur. Jeg ser at det er noen tvister på armen, det får jeg ikke lagt på, det er sikkert fordi jeg har feil passform på genseren, at den må være vanlig. Så bytter jeg til det og prøver å legge på… Jeg må velge armer ja, skjønner. Da velger jeg at jeg skal ha struktur på armene. Jeg vil ha den plassert på midten, det skulle jeg ønske at den bare gjorde av seg selv. Og jeg har valgt at armene er like. På baksiden har jeg ingen mønster, foran har jeg en flette. Ja, nå ser det ut som at det skal legges til noen vrangmasker ved siden av fletten, men det tror jeg ikke jeg får lagt inn. Så da sier jeg meg… Kanskje fornøyd, jeg er litt usikker om det er rund hals eller halvhøy hals, men jeg går for rund hals. Og trykker meg videre til betaling, og da er jeg vel egentlig ferdig med oppgaven.

H: Ja.

Oppgave 3

H: Så er det siste oppgave, det er en liten fortsettelse på den oppgaven.

T: Oj, jeg kom på at venninnen min er veldig glad i struktur, derfor lurer jeg på hvordan genseren vil se ut med flere strukturer. Prøv å legg til en tvist på hver side av fletten på bolen. Da må jeg først tilbake til den jeg lagde da. Nei jeg lager ny jeg.

T: Her er den ja. Okei da prøver jeg legge til en tvist, på hver side av fletten. Jeg skulle ønske de bare plasserte seg likt, sånn at jeg ikke måtte dra de for at de var plassert likt. Jeg kjenner venninnen min godt, og vet at hun ikke liker å ha struktur på baksiden, nei det har jeg ikke lagt til heller. Endre designet slik at venninnen din blir fornøyd med bursdagsgaven.

T: Ja da har vi tvist, flette, tvist. Ingenting på baksiden, og tvist på armen. Da er jeg fornøyd med genseren og klikker meg til betaling og er ferdig.

Diskusjon

H: Kjempebra. Det var alle oppgavene.

T: Så bra.

H: Du var jo veldig flink til å tenke høyt, så det var bra.

T: Bra.

H: Har du noen sånne umiddelbare tanker om hvordan det gikk?

T: Hmm, altså hva jeg synes om nettsiden eller hva jeg synes om min egen innsats eller situasjonen?

H: Bare generelt.

T: Nei jeg synes det er ganske morsomt å få teste strikkenettsiden. Og jeg synes det er greit å finne frem, jeg synes av og til rekkefølgen er litt ulogisk på ting jeg velger.

H: Ja. Du nevnte det at du synes det var litt rart å velge garn først.

T: Ja. Men også sånn, her vil jeg heller velge passform til slutt.

H: Ja.

T: For jeg er gira på å gå i gang med designet med en gang, og så passform litt lengre ned da.

H: Ja. Hvordan steg ville du hatt først da?

T: Hmm, nei kanskje man må ha passform først, jeg bare hadde en så tydelig idé om hvordan halsen og ermene skal se ut når jeg skal designe en genser, og da vil jeg velge det først, men det var lett å finne frem til det. Også synes jeg det er litt rart at det er, fordi du velger ikke struktur på samme måte som du velger fasongen på ermer, det er noe du putter på etterpå. Så det er kanskje ikke helt i samme kategori, men jeg skjønner jo at det, eventuelt måtte du hatt en for glattstrikk og en for struktur da. Sånn at du fikk delt den opp.

T: Men jeg synes hovedproblemet mitt er at jeg velger garn først, fordi hvis ikke jeg vet hvilket garn jeg vil ha, så stopper jeg litt opp i prosessen her.

H: Ja. Enn sånn for eksempel, kunne du tenke deg å ha struktur på ermene, under det ermet steget for eksempel?

T: Det kunne også fungert, men jeg liker godt, når jeg først skal legge på struktur at jeg kan velge alt. Jeg synes det var vanskelig å bytte her (knapper under visualisering).

H: Ja.

T: Den kunne kanskje poppet litt mer, for den fikk jeg ikke helt med meg at var der. Jeg ville heller kanskje hatt disse valgene her, og disse valgene her.

Vil bytte plass mellom View-knapper og valg i venstre-meny under struktur.

T: For jeg er mer interessert i å velge hvor jeg har strukturen enn om den er lik, på de forskjellige stedene.

H: Okei. Ja.

T: Men det kan hende at det bare er meg.

H: Så du ville egentlig ha byttet plass på de to?

T: Mhm.

H: Fordi du legger merke til det på venstre-siden mer enn under der?

T: Mhm. Dette er jo en større skrift, og det er sikkert samme farge, men når jeg er vant til å jobbe nedover her, så tok det litt tid før jeg oppdaget at dette var de valgene jeg lette etter. Ja.

H: Jeg så at når du skulle legge en flette på armen, så prøvde du først å dra den på armen her da (Framside).

T: Mhm. Jeg så ikke at jeg måtte velge den.

H: Ja. Kunne du tenke deg at det…

T: At det var mulig?

H: At det var mulig ja, å plassere dem på den måten?

T: Ja, det kunne jo vært nice det også, og ikke måtte bytte. Her ser jeg at den er skeiv også. Så her skulle jeg ønske at den bare ble plassert rett da. (Struktur på arm)

H: Ja. Så når du la den til da, så skulle du ønske at den bare var på midten som default da?

T: Ja.

H: Ja.

T: Og samme på her når jeg har plassert den og den, eller kanskje den da. Så er jeg keen på at den neste jeg trekker inn skal plasseres på samme sted. Sånn at det ikke blir mitt øyemål som avgjør om det er symmetrisk.

H: Ja, skjønner. Enn når du la dem til, så kan du jo både klikke der oppe i toolbaren, eller dra den.

T: Okei, jeg bare dro jeg.

H: Ja. Nå som du vet at man kan gjøre begge deler, hvordan tror du at du hadde brukt selv?

T: Jeg tror jeg ville dratt den.

H: Ja.

T: Også ser det ut som at det ikke går an å velge, jo jeg kan endre bredde, nice.

H: Tenkte du noe på de der blå knappene i stad?

T: Nei. Det burde kanskje, eller jeg tror jeg hadde satt pris på om det kom opp en sånn popup eller et eller annet, som er sånn her kan du justere bredden på fletten eller tvisten.

H: Ja.

T: Sånn at jeg blir…

H: Du for en slags tutorial?

T: En liten reminder på at det går an. Okei her kan jeg midtstille den (knapper i toolbar). Det er jo nice. De her også blir veldig små og uten, eller når det ikke står hva det er de gjør, så tenkte jeg at det her er sikkert ikke noe

beskjeder til meg, det er sikkert til noe sånn innstillinger eller noe annet som jeg ikke trenger å bry meg om. Men jeg hadde jo hatt nytte av å bruke de her.

H: Ja.

T: Så det ble langt mellom de flettene som er her, og de verktøyene som er her som jeg trenger for å justere fletten. Også kan jeg dra, eller endre størrelsen på den her. Jeg ville kanskje samlet, jeg vet ikke helt hvordan da. Men samlet det.

H: Ja hatt dem litt nærmere hverandre?

T: Ja, eller kanskje gjort det her litt større eller sånn at det poppet litt mer da. For det er jo mye luft her.

H: Ja.

T: I hvert fall de her da (høyre knapper i toolbar), for de gikk meg helt hus forbi. Og de blå her var jeg sånn (Resize-knapper), jeg kan sikkert flytte på den tenkte jeg. At det var det som var saken, og ikke at jeg kunne gjøre den større og mindre.

H: Men du ville kanskje brukt de der knappene for å justere dem hvis du hadde visst om det?

T: Ja. Det ville jeg nok gjort. Også ville jeg egentlig her, hvis jeg kunne valgt, så ville jeg valgt å, eller da ville jeg justert den sånn at den ble større begge veier.

Vil at midten på struktur skal forbli på samme plass etter resize.

H: Okei.

T: Ikke sånn at jeg drar den bare, okei nå drar jeg den ene veien, men jeg vil fortsatt at den skal være symmetrisk, så da drar jeg den litt den andre veien. Eller trykke på den her igjen da (align-knapp).

H: Ja.

T: Jeg vil bare at fletten skal bli større.

H: Ja, at den er på samme plassen på en måte.

T: At den er sentrert fortsatt da.

H: Ja.

T: Det ville jeg kanskje gjort.

H: Mhm. Okei er det ellers noen ting i grensesnittet som du føler mangler?

T: Hmm. Jeg synes at sånn som her (Garnvalg) får jeg jo ingenting informasjon om hvordan, eller når jeg skal strikke den her da (Oppgave 2 genser), så vet ikke jeg, jeg ser jo at den er strikket på store pinner, så jeg kan jo på en måte flytte opp pinnestørrelsen, men jeg synes det hadde vært fint med noen eksempler på disse genserne er strikket i dette garnet.

H: Ja.

T: Fordi jeg synes ofte det å velge garn og strikkefasthet, det… Jeg kunne jo strikket den genseren her med en annen strikkefasthet og, så det har på en måte ikke så mye å si, jeg tenker kanskje at man kunne valgt finishen til slutt da, mhm. Om du ville hatt store masker eller små.

H: Mhm. Med noen eksempler også?

T: Ja, kanskje litt mer eksempler. Andre strikkere har også strikket dette på en måte.

H: Mhm.

T: Ellers synes jeg dette er, jeg synes det er litt rart å velge størrelse sammen med lengde og passform. Fordi jeg forventer egentlig, det jeg forventer er hvordan skuldrene skal gå. Også er det fint å kunne velge lengde og, jeg tenkte oja smart. Men, størrelse, overrasket meg litt at det havnet her da.

H: Ja.

T: Hals synes jeg er tydelig hvordan denne menyen fungerer. Helt greit med å finne betalingsknappen. Jeg ville kanskje hatt den her (oppe til høyre). Men det er kanskje vanlig å ha den nede. Men siden den er farget så ser jeg den jo.

T: Ja, er det noe annet du vil at jeg skal kommentere på?

H: Jeg har et sprøsmål til, hvis du skulle besøkt Dreamknit sin nettside, tror du at du hadde brukt PC eller telefon for å gjøre det?

T: Telefon.

H: Telefon? Ja. Er det det du bruker mest for å browse?

T: Mhm. Og ofte så leter jeg etter nye strikkeoppskrifter når jeg er litt på farten, på toget eller på flyet eller et eller annet. Og, da sjekker jeg ofte instagram eller, nå vet jo jeg om Dreamknit da, så da ville jeg sjekket det på telefonen.

H: Ja.

T: Men det hadde ikke hatt noe å si for meg om det var en app eller nettside.

H: Nei okei. Så lenge det er på telefonen?

T: Mhm.

H: Nei da har ikke jeg noen flere spørsmål, så hvis ikke du har noe mer, så er vi egentlig ferdig.

T: Ja men så bra da.

T3U6

Dato: 27. mars 2022
Tid: 12:00-12:30
Sted: UX-laben NTNU Gløshaugen

Navn: ███████████
Alder: 18-26 år
Kjønn: Kvinne
Strikkekompetanse: Viderekommen
Gensere strikket: 4-8

Oppgave	Fra	Til	Varighet
Kalibrering	00:00	01:17	1 m 17 sek (77)
Oppgave 1	01:17	06:17	5 m (300)
Oppgave 2	06:17	10:09	3 m 52 sek (232)
Oppgave 3	10:09	11:37	1 m 28 sek (88)
Diskusjon	11:37	20:12	8 m 35 sek (515)

Oppsummering

- Oppgave 1
    - Leter etter design siden, litt unaturlig for henne å velge garn først
    - Velger et garn hun er kjent med.
    - Liker guidelines for å aligne struktur
    - Usikker på hvordan farge garnet har
    - Ser ikke valg under struktur-meny. Forstår ikke hvordan man har ulike struktur på fram og bakside.
    - Drar for å legge til strukturer
- Oppgave 2
    - Går etter farge når hun skal velge garn
    - Nå ser ut valgene i struktur-meny, og forstår hvordan hun kan ha forskjellig framside og bakside.
    - Vil ha struktur-meny-knapper i toolbaren i stedet.
- Oppgave 3
    - Savner hjelp for å distribuere lik avstand mellom strukturer.
- Diskusjon
    - Liker å dra direkte fremfor å bruke align-knapper.
    - La ikke merke til align-knapper.
    - Veldig forvirret over fargevalg. Bilde av Drops Air har 3 forskjellige farger av garnet.
    - Når man har mye fletter er det fint med garn som ikke loer. Bedre med "et litt basic garn".
    - Logisk å ha design først sånn at man ser hvordan den blir før man velger garn.
    - Foretrekker dra fremfor klikk for å legge til strukturer. Da får man strukturen der man vil ha den plassert.
    - Venstre-meny tar mye plass og havner av skjermen noen ganger.
    - PC fremfor telefon

Transkript

T = Testperson
H = Hans

Kalibrering

Eye-tracker blir kalibrert.

Oppgave 1

H: Da er første oppgaven her, så kan du bare lese den og sette i gang.

T: Filmer den lyd og sånt og nå?

H: Ja, den tar opp med kamera der, også er mikrofonene her.

T: Mhm. Skal jeg lese høyt?

H: Det kan du bestemme selv.

T: Okei. Jeg skal lage et design for en jumper som jeg kunne tenke meg å strikke i påsken. Så har jeg kommet inn på Dreamknit sin nettside, og nå skal jeg lage et design for en jumper. Det første jeg tenker da er at ja, her er jeg på nettsiden. Hvor går jeg til der jeg velger å designe en jumper? Hvis vi bare ser her på liksom hvilke garn der er, for å se kanskje de har et garn jeg har vært borti før. Hvis jeg har noen favorittgarn og sånt. Så tipper jeg at jeg kanskje må begynne å velge garntype med en gang. Da velger jeg Drops Air.

T: Her får jeg opp en jumper, så hvis jeg trykker her så kan jeg bare velge garn ja. For her legger de inn litt info om garnet. Okei, så kan jeg sikkert velge passform. Størrelse og sånt. Vanlig eller oversized, ja så kan jeg se hvordan det ser ut. Kort eller vanlig lengde. Og med hals. Ja, godt med litt hals i påsken. Vest har jeg strikket før, så det skal vi strikke nå.

T: Struktur, her kan jeg legge til fletter og sånt, eller tvist. Oj den ble litt skeiv, der fikk jeg hjelp til å legge den på midten, ja. Så kan jeg velge om jeg skal ha bare på framsiden eller på baksiden. Det var litt rart, for jeg har jo valgt vest, men jeg får armer, men vi skal jo ikke ha armer. Også skal jeg bare sjekke om jeg kunne ha, ja, hvis jeg tar på framsiden så må jeg ha på baksiden også, okei. Jeg kan ikke velge kun å ha det på framsiden eller kun på baksiden. Jeg likte det at du fikk hjelp til å ha den på midten, det er jo litt fint. Sånn. Jeg skulle bare lage et design som jeg kunne tenkt meg å strikke, ja. Det som jeg reagerte litt på var at jeg skulle gå rett på garnvalg, før jeg hadde valgt passform og sånt. Jeg tror kanskje at jeg hadde tenkt at det var logisk at jeg valgte litt hvordan type jumper jeg ville strikket, før jeg velger hvordan garn jeg vil ha. Det er sånn jeg gjerne gjør i butikken, at jeg bare finner hvilken type jeg vil strikke først, og så finner jeg hvordan garn jeg kan ha. Men nå er jeg fornøyd med designet på denne. Eneste er med garnvalg, jeg tok Drops Air, men hvordan fikk jeg velge farge? Det vil jeg gå tilbake å se på. Jeg valgte bare denne, Så går det ikke an å sortere her, eller kanskje hvis jeg søker i søkefeltet, så kan jeg få opp bare Drops Air. Ja da får jeg opp denne samme, men nå vet jeg jo ikke hvilken farge jeg har valgt, siden det var 3 farger på bildet. Kanskje jeg må velge denne garnkombinasjon eller annet garn. Ja, nei. Hvis jeg velger den Drops Air. Ja. Så det lurte jeg litt på, hvordan farge jeg har valgt. Jeg satser på at det blir en bra farge, og trykker på til betaling. Det står at jeg ikke trenger å fullføre kjøpet, så er dette godt nok eller skal jeg gå videre?

H: Du trenger ikke fylle ut de der.

T: Nei, ja. Okei. Ja. Snakket jeg for fort?

H: Neida det var helt bra.

T: Okei.

Oppgave 2

H: Så er neste oppgave her.

T: Okei, jeg skal designe en jumper som ligner på den jumperen som hun har på seg. Ja, da trykker jeg på design selv. Ja, den er rosa, så da må jeg jo velge et rosa garn da. Det var ikke så mange sjokk-rosa, men denne her virket litt rosa farge. Det var mulig, det var rosa på Drops Alpaca så da valgte jeg det, ja.

T: Venninnen min er sikkert en medium, også skal jeg designe en som ligner på den her. Det var litt rart, nå klikket jeg på passform også endret den ikke passform. Kanskje jeg må ta å velge at jeg ikke har vest men vanlig jumper først. Ja, nå fikk hun velge passform. Jeg tror kanskje den er litt oversized, men ikke kort, vanlig lengde. Rund hals ja. Armene, det er litt sånn ballongarmer, ja, vi kan si det er ballongermer. Kanskje den ikke er oversized, kanskje den bare er vanlig passform. Sånn.

Notat: Sekvens under redigering kan være interessant. Går litt fram og tilbake mellom steg.

T: Struktur, hva var det? Oja okei nå skjønner jeg, fordi struktur, da går det sikkert an at du kan fjerne fletten på baksiden også. Ja, okei. Jeg trodde den knappen der gjerne hadde vært et valgalternativ her (toolbar). At man kunne ta den på framsiden og baksiden, ja, der. Men hun skal ha noe på armene, en sånn flette. Cirka midt på. Jeg tror det er flette og ikke tvist. Eller er det tvist på armene ja, mhm. Sånn. Like armer, da skal det være på begge armene. Baksiden den kan jeg ikke se. Tipper den er uten da. Framsiden skal ikke ha tvist, den har flette ja, sånn. Da sier jeg at dette er jumperen hun vil like. Så går jeg til betaling.

H: Ja.

Oppgave 3

H: Så er siste oppgaven her.

T: Ja.

H: Det er en fortsettelse av den her oppgaven.

T: Mhm. Ja jeg skal legge til en tvist på hver side av fletten på bolen. Okei. Hvis jeg først legger til en tvist på siden av fletten. Hvor skal vi ha den da. Kanskje sånn. Her så skulle jeg ønske at det kom opp slik at det var helt lik avstand, at det var en senter-linje som viste at de to var helt lik avstand fra den linjen, nei fra den fletten. Men jeg synes det ser ganske likt ut nå.

T: Ja, også skal hun ikke ha struktur på baksiden. Den er grei, det har den ikke. Ja, legge til en tvist på hver side av fletten på bolen, og ikke struktur på baksiden. Da er det vel det hun er ute etter. Og den er på armene, ja.

H: Ja, kjempebra.

Diskusjon

H: Det var alle oppgavene.

T: Det var det?

H: Ja. Har du noen, du var jo flink til å tenke høyt, så det var jo bra.

T: Ja.

H: Har du noen umiddelbare tanker om hvordan det gikk?

T: Hmm, det irriterte meg at jeg klarte å skippe den struktur-leddet. At jeg ikke, for det reagerte jeg jo på den første oppgaven.

H: Ja, du nevnte det ja.

T: Ja.

H: Så du ville kanskje hatt den der oppe i den toolbaren i stedet for?

T: Ja. Eller bare rett under her (under toolbar). Ja, eller et eller annet oppi der. Også lurte jeg litt på hva alt dette her er til. Oja ja okei. Nei skal det skje, må jeg klikke på en sånn. Er det det at man skal på en måte, ja man kan flytte på den. Ja okei, ja.

H: Tror du at du hadde brukt dem hvis du hadde visst om det?

T: Nei.

H: Du hadde bare dratt den?

T: Ja. Det eneste var med de her, da hadde jeg kanskje brukt de for å få dem akkurat like, men jeg hadde ikke lyst til å ha de så langt ute, jeg ville ha den litt mer inni. Men sånn ja, okei. Nå får jeg ikke lov til å flytte den lenger. Fordi det var der jeg mente med at nå, så er jo den her mye nærmere her enn den.

H: Ja.

T: At jeg ville hatt at det kom opp på skjermen og at nå har jeg tatt lik avstand. Sånn som nå ser det jo ut til å være lik avstand.

H: Ja.

T: Ja.

H: Men tror du at du ville foretrukket en sånn, litt på samme måte som den her når du plasserer den på midten og sånt, en sånn type?

T: Ja. En sånn type funksjon. Men jeg vet ikke helt hvor lett det er å standardisere.

H: Neida, det trenger ikke du å tenke på.

T: Nei. Ja, også er det dette med fargevalg, det lurer jeg veldig på.

H: Ja.

T: Fordi når jeg bytter garn, og her er det jo litt farger, men for eksempel dette Drops Air som jeg valgte, her er det jo 3 farger, hvordan vet jeg hvilken farge jeg har tatt?

H: Ja, det ser jeg at kan være litt forvirrende.

T: Også prøvde jeg å gå på den garnkombinasjon eller annet garn for å prøve å søke.

H: Er det det som vanligvis er det viktigste når du velger garn? Altså fargen.

T: Ja. For meg er det egentlig viktigere enn hvordan type garn det er.

H: Okei.

T: Ja, men det er jo litt forskjell på folk, noen har jo sånne merker og sånt, at de bare strikker i Drops Air for eksempel. Jeg kan strikke med mange forskjellige typer garn, men jeg vil helst ha fargen som jeg har lyst å ha på jumperen.

H: Ja, det er en viktig faktor ja.

T: Ja, jeg synes det. Også, men jeg pleier å være sånn at når jeg skal strikke en jumper så finner jeg gjerne mønsteret først, og så velger jeg garnet etterpå.

H: Så kanskje bytte litt om på rekkefølgen her da?

T: Ja, kanskje det.

H: For da er garnet liksom det siste du velger eller?

T: Ja, da er det på en måte å designe den først, også i hvert fall om du skal ha med mye fletter og sånt, så er det jo ikke så kjekt å ha et garn som loer mye hvor det er styr å strikke med.

H: Okei.

T: Da synes jeg det er lettere å ha et litt basic garn, hvis jeg skal gjøre mye med det.

H: Ja.

T: Mhm. Sånn at da er det på en måte gjerne greiest å velge strukturen først, eller designe først, og så kan du tilpasse det til et garn som du velger.

H: Så det er på en måte, struktur og garn henger litt sammen?

T: Ja.

H: Hvis du har mye strukturer så er det noen garn som er bedre enn andre da?

T: Ja, det kommer like så mye an på hvordan du designer jumperen, for eksempel hvis jeg strikke en jumper å ha på sommeren, så vil jeg ha den litt tynn og lett.

H: Ja.

T: Men da tenker jeg at det er mest logisk å ha designet på plass først, sånn at du ser for deg hvordan den blir.

H: Mhm.

T: Ja.

H: Okei.

T: Men det er jo bare litt sånn smakssak, sikkert.

H: Ja, det, neida det er ikke dumt å gå rett på designet.

T: Ja.

H: Mhm. Okei, enn når du la til de her strukturene, så tok du å dro de fra den der toolbaren.

T: Her ja?

H: Ja. Du kan også klikke på den for å legge den til.

T: Oja, det er ikke plass. Okei, så jeg kunne bare klikket?

H: Hvordan av de to tror du at du hadde, liker du best?

T: Om å dra og klikke?

H: Ja.

T: Ja fordi jeg flyttet den sånn. Nei for meg var det logisk at man skulle dra.

H: Ja.

T: Mhm, jeg kom ikke på at man kunne klikke.

H: Nei.

T: Men ja, det er kanskje mest logisk at man bare skal klikke, eller, jeg vet ikke. Nei jeg synes egentlig at det er mest logisk at man skal dra, fordi da drar du den til hvor du vil ha den.

H: Ja.

T: Ja. Mhm. Ja.

H: Alright, er det ellers noen ting som du følte manglet her da?

T: Det var nok bare jeg som ikke sjekket hva som sto under struktur, for å finne ut av det her med at du kunne ha forskjellig foran og bak.

H: Ja.

T: Ja, mhm. Men er det kanskje ja, fordi når du begynner å åpne de her, så blir det litt fullt på siden, du må bla fordi det er så stor skrift. Så du må bla langt den for å komme til de nederste til menyene.

H: Ja. De går utenfor skjermen liksom.

T: Ja. At den bare stoppet sånn, ja kanskje etter armer da. Ja, så kanskje gjøre litt om på det, sånn at, det er jo kanskje fint for folk å ha stor skrift sånn at de ser det, men enten om det går ut til en sånn sidekategori her på siden. Fordi det er jo masse plass.

H: Ja.

T: Ja. Kanskje. Ja.

H: Alright, da er det et siste spørsmål. Hvis du hadde besøkt Dreamknit sin nettside, sånn på egenhånd, tror du at du hadde brukt telefon eller PC for å gjøre det?

T: PC.

H: PC? Okei.

T: Det er mest fordi at når du skal designe med alle de flettene og tvistene og sånt.

H: Mhm.

T: Så tror jeg det er lettere på PC.

H: Ja.

T: Med mindre man da bruker de knappene som du har lagt til. De der, ja du skjønner, der du kunne justere.

H: Ja.

T: Mhm. Ja.

H: Alright, nei men hvis du ikke har noe mere da, så er vi egentlig ferdig.

T: Jeg tror ikke jeg har noe mer.

H: Nei.

Appendix C

User Test 4

C.1 Tasks

C.1.1 Task 1

Du trenger en ny genser til sommeren og vurderer å strikke en selv. Du havner på Dreamknit sin nettside, og vil undersøke hva som finnes der. Siden du har ganske god tid, vil du ha fletter eller tvister på genseren. Lag et design for en genser med strukturer som du kunne tenke deg å bruke i sommer. Oppgaven er ferdig når du er fornøyd med designet. Du trenger ikke fullføre kjøpet.

C.1.2 Task 2

Du så et bilde (Figure C.1) av en genser med en stor flette på midten og tvister på begge sidene, og lurer på hvordan det vil se ut på ditt design. Sørg for at strukturene er symmetrisk.
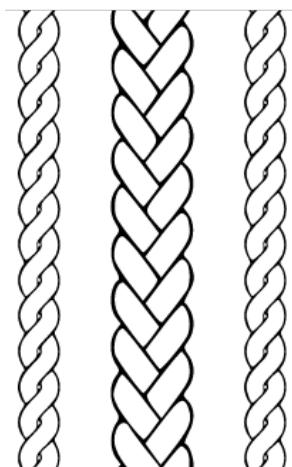
Figure C.1: Image of pattern in Task 2

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C.1.3 Task 3

Du lurer på hvordan det vil se ut med enda flere strukturer. Prøv å legg til tvister på hver side av fletten, slik at det er 3 tvister på hver side. Sørg for at framsiden og baksiden er lik.
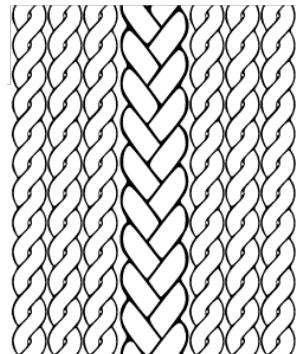
Figure C.2: Image of pattern in Task 3

C.1.4 Distribution Images
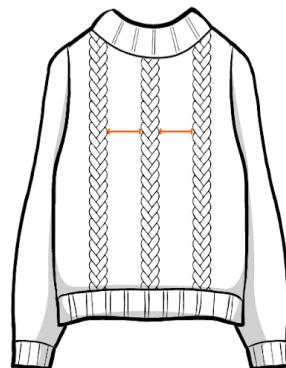
Figure C.3: Illustration of distribution with equal spacing only between structures.

C.1.5 Mobile Mockups
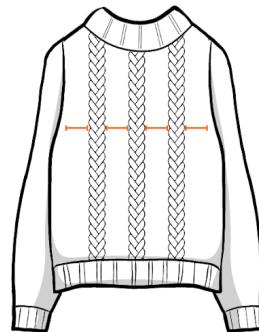
Figure C.4: Illustration of distribution with equal spacing between structures and the edges.

(a) Mobile mockup 1.
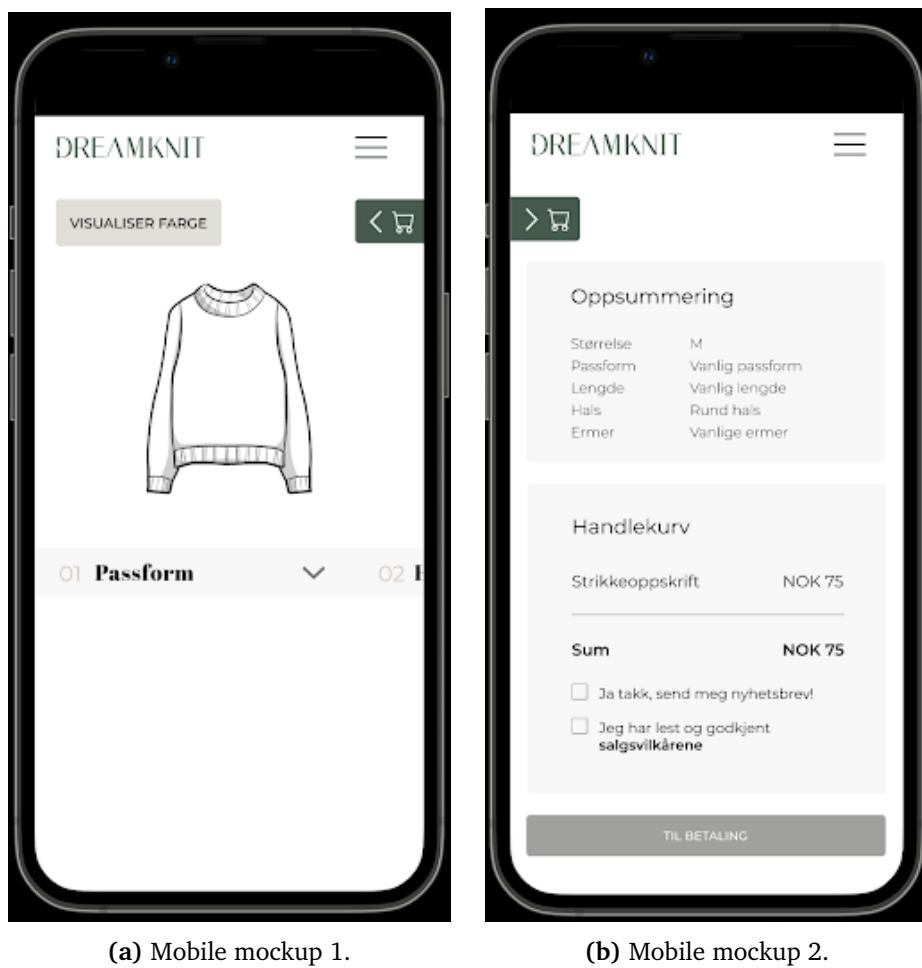
(b) Mobile mockup 2.

Figure C.5: Mobile mockups created by Dreamknit.

C.2 Heatmaps

Heatmaps for each individual participant in User Test 4 is presented in this section.
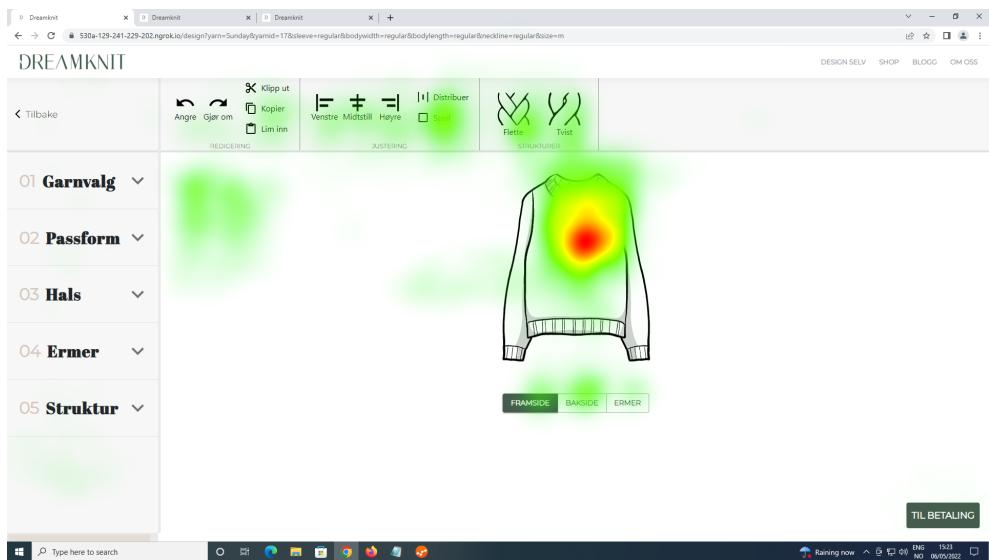
Figure C.6: Design page T4U1-T4U6
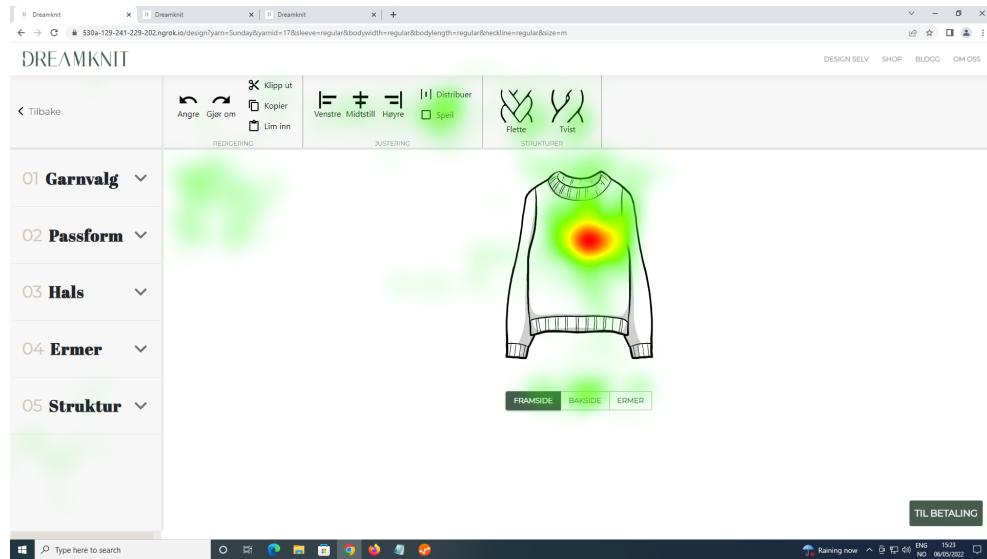
Figure C.7: Design page T4U1
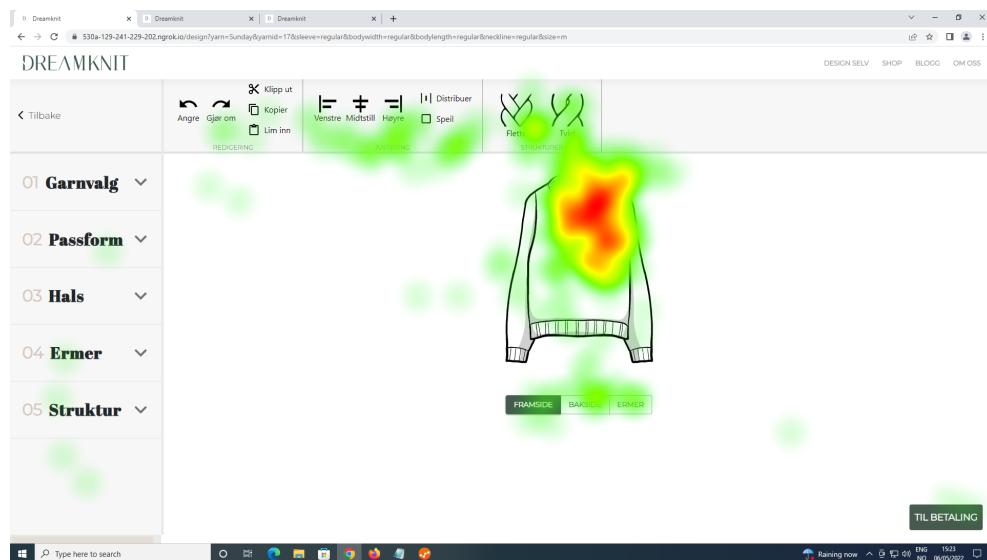
Figure C.8: Design page T4U2
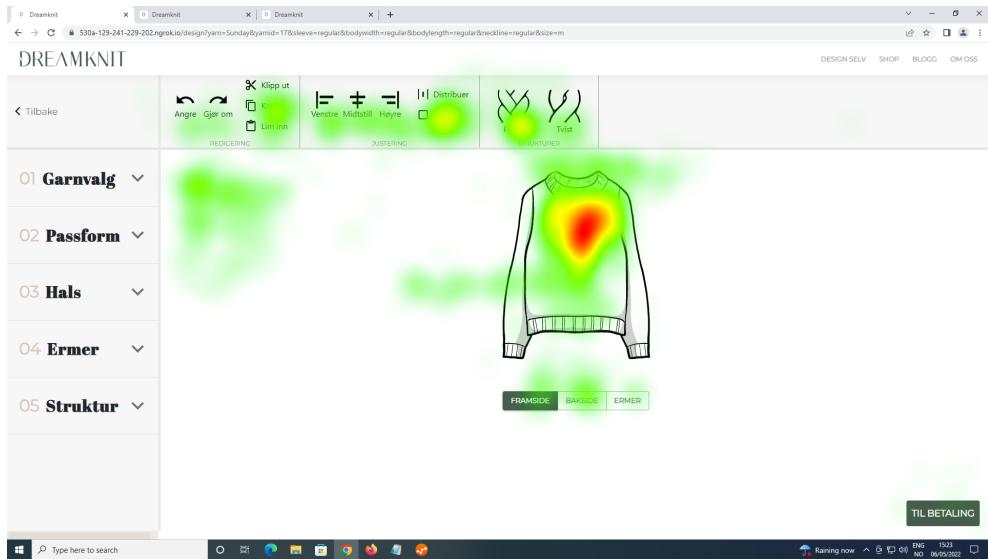
Figure C.9: Design page T4U3
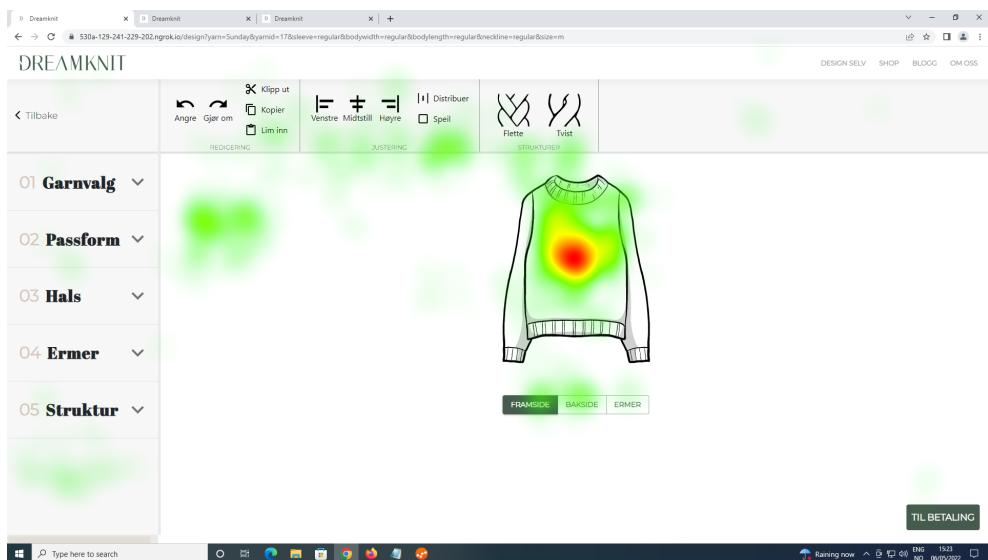
Figure C.10: Design page T4U4
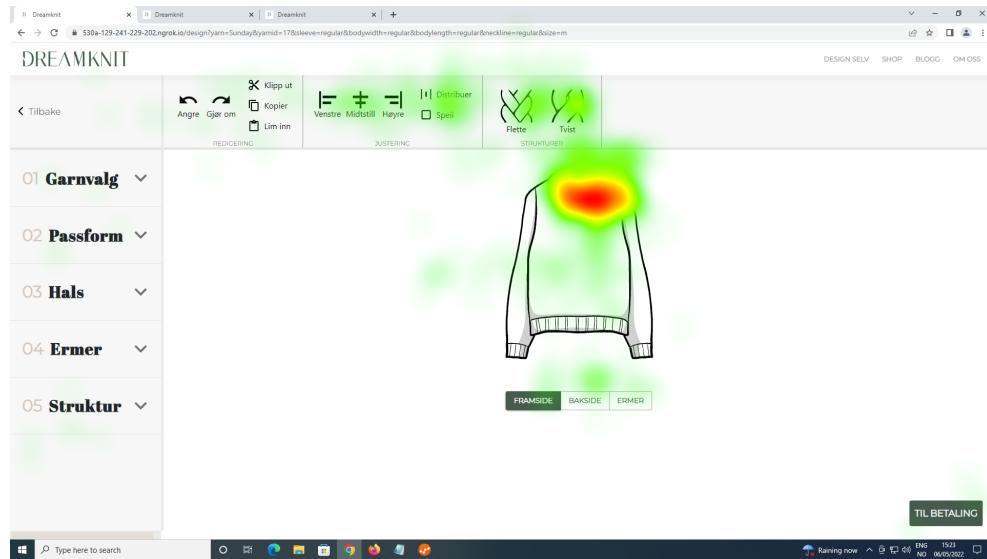
Figure C.11: Design page T4U5
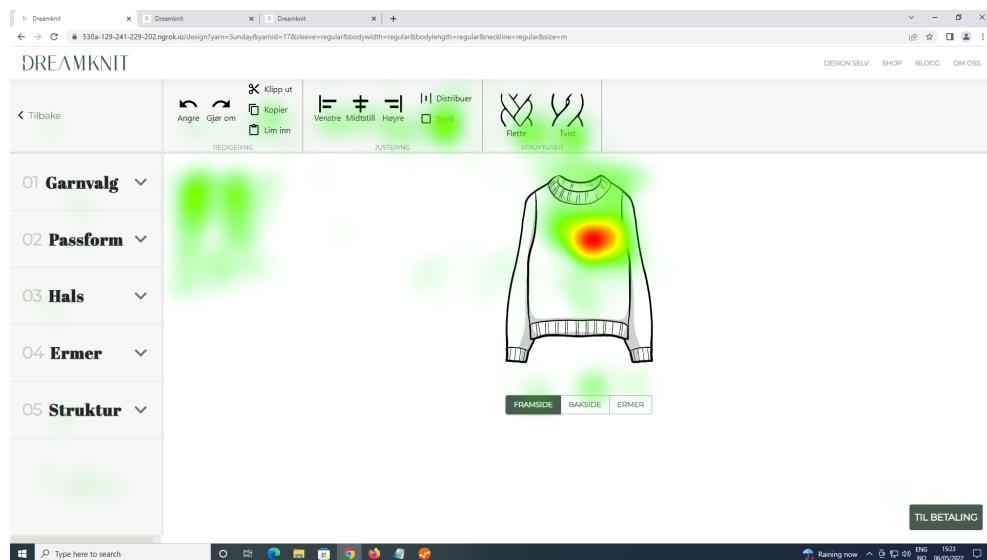
Figure C.12: Design page T4U6

C.3 Transcripts

Summaries of each session in User Test 4 is presented in this section. Note than, unlike the transcripts for User Test 3, only summaries are presented here. In order to save time and resources, full transcripts were not written down.

T4U1

Dato: 3. mai 2022
Tid: 12:30
Sted: UX-laben NTNU Gløshaugen

Navn: █████████
Alder: 18-26 år
Kjønn: Kvinne
Strikkekompetanse: Viderekommen
Gensere strikket: 4-8

Oppsummering

Strukturer

Legg til struktur	Drar for å legge til. Ikke plass til å legge til, hadde hatt plass hvis strukturen var S. Resizer ofte rett etter lagt til strukturer i oppgave 3.
Ermer struktur	Skjønner at det kommer på begge ermene.
Flytt	
Guidelines	Hadde vært den beste løsningen med guidelines for å få symmetrisk.
Resize	Skjønte resize-knapper med en gang.
Selection	Prøvde først å holde shift mens klikk, fungerte ikke pga en bug. Både dra og shift+klikk er naturlig, men hun bruker vanligvis mer shift+klikk. Logisk at alt blir markert som default, hvis man ikke har noen selection.
Slett	Sletter én og én struktur i stedet for å markere alle og slette gruppen.

Redigering

Undo Redo	Synes ikke redigering-seksjon hadde nyttige verktøy. Bruker ikke undo etter hun speilet feil side. Mens vi snakket om speil med uhell: "Tar ikke så lang tid å lage det på nytt, fordi du har ikke så mange valg. " Bruker heller slett enn undo, mer naturlig.
Copy Paste Cut	

Justering

Align	Leser forklaring. Kaller det for "faktabokser".
Distribuering	"Den var veldig fin". Bruker denne for å prøve. Aligner ikke etterpå. (Første gang aligner hun faktisk med å dra gruppen på midten, tror derimot ikke hun er klar over at hun trenger å gjøre det. Hun sier etter hun distribuerer: "Men hvis du trykker på den så vil alle midtstilles sånn.). Bruker for å lage genseren symmetrisk.

	Trykker flere ganger, strukturer flytter seg litt hver gang hun trykker, sannsynligvis en bug.
	"Jeg antar at knappene gjør at alle blir distribuert, jeg må kanskje ikke velge dem". Prøver likevel å markere dem først.
	Mest aktuelt at alt skal være symmetrisk, men kan tenkes at "noen" vil distribuere bare deler av designet.
	Foretrekker A (bare lik avstand mellom strukturene, ikke ta hensyn til kantene).
	Guidelines hadde egentlig vært best for å sette lik avstand mellom. Mer allsidig. "Lettere å få akkurat det designet som du vil".
	Dumt hvis det ikke blir symmetrisk. "Da fungerer det ikke slik som jeg vil at det skal fungere".
	Distribuer er et bedre navn enn symmetrisk. Hvis det hadde stått symmetri, hadde hun tenkt at da "speiles" for eks. venstre side over til høyre side. Kan bli trøbbel med midten da.
	Designer grovt først, også er det etterpå hun tenker at hun vil ha lik avstand. Å designe halve genseren og så kopiere den virker unaturlig.
Speil	Bruker denne. Nysgjerrig på speiling på armene, "Der kan jeg ikke speile, men det er kanskje logisk". Speilet motsatt med uhell, brukte ikke undo etterpå.
	Vil ha speiling motsatt. Var forvirret over hva som speiles hvor.
	Likte bedre å bruke knappen eksplisitt, enn å få prompt om speiling.
	Kunne tenkt seg å speile bare én struktur. Hvis en flette skal treffe flettene på baksiden, men kanskje man ikke vil speile den på midten.
Symmetri	Bruker distribuer for å lage symmetrisk. "Da trykker jeg på distribuer, og da er det tatt hånd om".

Layout

Toolbar	
Accordion	
View buttons	
Tutorial Tooltips	Bruker ikke opplæring. Synes det var greit å ikke ha opplæring.

	Foretrekker at den ikke vises automatisk, men hadde ikke vært krise. Hadde vært litt irriterende. Likte tooltips/forklaring på verktøy i toolbar. Var gode forklaringer. For eks. på forklaring på speil at det er framsiden som kopieres til baksiden, var bra. Litt som å velge å lese bruksanvisningen eller ikke. Man kan gjøre det hvis man vil, det går fint å ha den der. La ikke merke til opplæring før jeg nevnte det.
Mobil	"Jeg foretrekker å gjøre slike ting på PC, så har man litt mer plass." Hun hadde nok ikke brukt en slik app, hun hadde brukt nettsiden på PC. Foretrekker å gjøre nettkjøp på PC. Bestiller alltid på PC, og ikke mobil.

Andre steg

Garn	
Passform	
Hals	
Ermer	
Forslag	Vanskelighetsgrad på designet. Vanlig å skrive på oppskriften. Andre strukturer: Kast for å få hull i genseren. Patentstrikk. Vil kunne endre vrangborden. Vil heller ha det enn flette og tvist. Fane med "bord". Hvor stor skal de være. Kan sette innstillingen på hele genseren, og trenger ikke velge akkurat hvordan struktur man skal ha på hver vrangbord.
Annet	Hadde ikke trengt å vite bredden i cm på flettene, så lenge man har bildet.

T4U2

Dato: 3. mai 2022
Tid: 13:30
Sted: UX-laben NTNU Gløshaugen

Navn: █████████████
Alder: 18-26 år
Kjønn: Kvinne
Strikkekompetanse: Viderekommen
Gensere strikket: Mer enn 8

Oppsummering

Strukturer

Legg til struktur	Drar for å legge til. Bruker guidelines. Hun bruker klikk for å legge til én gang på oppgave 3. Her er det lite plass på genseren når hun bruker klikk.
Ermer struktur	
Flytt	
Guidelines	Intuitivt med guidelines, skjønner at de er justert riktig når man plasserer de.
Resize	Forstår resize-knapper med en gang. Like greit å ha knapper når det er bestemte størrelser. Ideelt sett vil hun kunne dra de akkurat til den bredden hun vil ha.
Selection	Marker alt som default: Hadde ikke tenkt over det, men det er en god funksjon. "Jeg ville ikke tenkt at, jeg har lyst å midtstille alle, jeg bare trykker på midtstill".
Slett	

Redigering

Undo Redo	
Copy Paste Cut	

Justering

Align	Bruker align-knapper etter hun har dratt strukturene helt til kanten, for å forsikre seg om at de faktisk er plassert helt ut. Sier senere at hun synes guidelines var intuitivt, kanskje justerte hun etterpå for å være sikker, siden oppgaven spurte om symmetri. Hvordan ville du midtstilt alle? "Jeg hadde tatt den midterste". Hun hadde justert én og én struktur.
Distribuering	Bruker ikke. Foretrekker A (lik avstand mellom flettene og ikke ta hensyn til kanten). Legger ikke så mye merke til avstanden til kanten, men avstanden mellom strukturene er viktigst.

	Hvis man har 3 fletter, så vil man mest sannsynlig ha den ene plassert på midten. Fordel at den blir sentrert.
Speil	Vil ikke speile med prompt på oppgave 1.
	Bruker speil-prompt i oppgave 3. Synes det var veldig greit. "Da vet man jo at det blir likt".
	Bruker ikke speil-knapp.
	Antar at hvis man markerer en struktur og trykker speil, så ville den havnet på andre siden.
	Vil ha motsatt. "Mer naturlig at når du trykker speil på fremsiden, så speiler du fremsiden til baksiden". Når man er fornøyd med framsiden, vil man speile den til andre siden.
	Vil ha automatisk lik fram- og bakside. Hvis du gjør en endring også glemmer du å endre den andre siden.
Symmetri	Plasserer tvistene helt ut på siden for å få de symmetrisk i oppgave 2.
	Etter hun har plassert de, bruker hun align-knapper for å justere hver enkelt struktur. Bruker ikke distribuer for å få de symmetrisk.
	Lurte på om det var noen funksjon for dette, hun endte derfor opp med å bare justere dem.

Layout

Toolbar	
Accordion	
View buttons	
Tutorial Tooltips	Savnet ikke opplæring. "Jeg synes dette er veldig lett å skjønne".
	Hadde blitt litt irritert hvis den hadde kommet automatisk. Bedre at den ligger sånn som den er.
Mobil	Mobil eller PC? "Det er litt begge deler kanskje".
	Lettest å gjøre dette på PC, men det er praktisk å gjøre det på telefonen.
	Hadde foretrukket accordion nedover som en liste, men er litt usikker. Er praktisk at man hele tiden ser visualisering.

Andre steg

Garn	
Passform	
Hals	
Ermer	
Forslag	
Annet	Lås: Kanskje greit hvis det er veldig mange. Men kanskje også "litt ork" med enda flere funksjoner å forholde seg til. Hadde ikke brukt lås hvis det hadde vært der. Størrelse på visualisering? "Det synes jeg er veldig greit". Tenker du på vanskelighetsgrad når du skal finne en oppskrift? "Vet ikke helt. Når jeg begynte å strikke sjekket jeg ofte vanskelighetsgraden". Hun hadde ikke begynt med dette, hadde skjønt at strukturene krever noe. Men er kan være praktisk med vanskelighetsgrad.

T4U3

Dato: 5. mai 2022
Tid: 09:00
Sted: UX-laben NTNU Gløshaugen

Navn: ████████████
Alder: 18-26 år
Kjønn: Kvinne
Strikkekompetanse: Viderekommen
Gensere strikket: Mer enn 8

Oppsummering

Strukturer

Legg til struktur	Ser at man kan både dra og trykke for å legge til (ut ifra tooltips), men velger å dra. "Jeg er veldig glad i å dra og flytte på ting". Har mer kontroll med å dra. Likte at man har valget mellom å trykke eller å dra. "Kanskje noen trenger at valget blir tatt for dem".
Ermer struktur	Prøver å sette XL struktur, men: "Begrenset med plass på ermet". Hun skjønte at ermene blir like.
Flytt	Finner ut med et uhell etter testen at man kan dra en gruppe med strukturer.
Guidelines	
Resize	Forstår med en gang.
Selection	Markerer ikke flere strukturer. Foretrekker å dra for å markere fremfor ctrl+klikk. Men visste ikke at det var en funksjon å markere flere. Følte ikke behovet for å markere flere. Marker alle som default var litt unaturlig. Tenker at ingenting ville skje hvis man ikke har noe markert. Men det var veldig kjekt at de flytter seg sammen, men var ikke egentlig det hun forventet.
Slett	

Redigering

Undo Redo	Bruker undo. "Det er veldig kjekt å ha en angreknapp" Undo gjør om struktur-plassering på ermene, men hun er på Framsiden. Tror ikke hun legger merke til det, men en stund etterpå når hun ser på ermene, må hun sette fletten på midten igjen slik den var før undo. Melding etter operasjoner (speil, distribuer, align) med mulighet for å angre synes hun virket som en god ide. Trengte ikke en slik melding etter man flytter, da hadde det fort blitt irriterende hvis det hele tiden kommer opp en melding. "Da blir det mer sånn, slutt å mas".

Copy Paste Cut	Bruker Klipp ut, men er nok bare for å teste det. "Kanskje ikke alle ser at søppelbøtta betyr å slette, så da kan man heller bruke klipp ut". Hun hadde nok ikke brukt disse funksjonene selv. Hun hadde brukt knappene rundt struktur og dratt den direkte. Har mer kontroll selv da. Prøver etter testen å markere en struktur å trykke lim inn. Hun har da kopiert en annen struktur fra før, og tror at den markerte strukturen skal dupliseres.

Justering

Align	Trodde først at dette brukes for å flytte strukturen mot en side. Etter litt kjapp utprøving fant hun ut hva de gjorde. Leser ikke tooltips her. Dette gjaldt bare venstre og høyre, hun forstod midtstill. Bruker align-knapp for å midtstille struktur på ermet.
Distribuering	Bruker distribuering, men forstår det ikke riktig. "Oja da plasserer man det jevnt slik at det blir symmetrisk". Leser også tooltips, men misforstår. Tror det blir symmetrisk. Prøver å distribuere på ermet, men 2 strukturer. Får ikke til å fjerner heller den ene og midtstiller den som er igjen. Bruker da align-knapp. "Distribuer er jo kanskje et ord som ikke så mange er kjent med fra før av". "Den var veldig kjekk, fordi man vil jo som regel ha det symmetrisk på genseren". Foretrekker A (Lik avstand mellom strukturene, ikke ta hensyn til kantene"). "Finere at det er mer luft midt på genseren, fordi det vil mest sannsynlig gå litt under sånn uansett (fletten vil gå under armhulen) ". Vil kunne flytte to fletter på sidene mer mot midten samtidig, slik at de har samme avstand til midten.
Speil	Leser tooltips her. Prøver å velge én flette og vil da trykke på speil. Vil speile markert struktur til andre side. Prøver ut hvordan det fungerer, og plasserer kun en flette på framsiden, og flytter til baksiden og bruker speil-prompt for å speile. Ønsker motsatt speiling. Forvirret over retningen. Etter å lese tekst på speil-prompt forstår hun. "Det som hadde vært naturlig for meg er at, okei nå har jeg den siden her, nå vil jeg speile det på andre siden".

	Trodde først speil tok strukturen fra venstre side og plasserte den på samme plass på høyre side av genseren.
Symmetri	Hadde vært greit med en funksjon der du markerer en struktur å får den på samme plass på andre siden (høyre/venstre) av genseren.

Layout

Toolbar	
Accordion	
View buttons	
Tutorial Tooltips	Leser tooltips fra starten av.
	Liker tooltips. "Her står det faktisk hva som skjer hvis du trykker på knappen".
	La ikke merke til tutorial. Blendet litt inn i bakgrunnen. Trengte ikke den fordi hun var såpass datakyndig. Prøver seg heller litt frem.
	Hadde nok gått gjennom kjapt hvis den hadde vist automatisk. Kunne tenkt seg en prompt som spør om man vil gå gjennom opplæring eller ikke.
Mobil	Hadde først gått inn på mobilen, men så funnet ut at "her blir det mye flytting og tastetrykk, og mobilen er liten. Så hadde jeg tenkt at jeg gjør det på PCen når jeg kommer hjem, hvis jeg sitter på bussen på mobilen og kommer over det."
	Dra på mobilen hadde kanskje ikke blitt det samme. Men det er det første hun hadde prøvd.
	Hadde byttet til PC hvis det var vanskelig å bruke mobilen. Men hadde ikke gitt opp, fordi hun liker konseptet.
	Vil kunne zoome inn på mobilen for å få nøyaktig plassert. Vil kunne zoome inn bare på genseren, mens andre elementer blir på samme plass.
	Hvordan skal forklaringene/tooltips vises når man ikke har hover?
	Hadde kanskje prøvd å trykke på tilbakeknappen i mobil-browser for å angre.
	Ville brukt så mye rom som er mulig. Visualisering kunne godt vært større hvis det er plass til det.
	Bedre at man kan scrolle sidelengs enn at man må dra seg opp og ned. Visualisering burde alltid være synlig.

Andre steg

Garn	Synes det var mange garn å velge mellom, ble litt overveldet: "Oi det var mange". Vil ha tynt garn fordi det er sommer. Velger mindre pinnestørrelse. Velger et garn hun kjenner fra før.
Passform	
Hals	
Ermer	
Forslag	
Annet	Sjekker ut bloggen for å finne eksempler på gensere og velger garn ut ifra det. Liker best å trykke rett på visualisering, fremfor å først trykke på visualisering og så bruke knapper i toolbar. "Du har mer kontroll selv, føler jeg ihvertfall". Lås strukturer: "Jeg vet ikke helt hva som skal være poenget med det". Hadde ikke brukt dette. Enda en ting som folk må sette seg inn i.

T4U4

Dato: 5. mai 2022
Tid: 15:00
Sted: UX-laben NTNU Gløshaugen

Navn: ███████████
Alder: 18-26 år
Kjønn: Kvinne
Strikkekompetanse: Nybegynner
Gensere strikket: 0

Oppsummering

Strukturer

Legg til struktur	Drar for å legge til. Likte at det var drag and drop. Bra å jobbe med det "hands on". Struktur er betydelig mer komplisert enn de andre 4 stegene.
Ermer struktur	
Flytt	
Guidelines	
Resize	Forstår resize-knapper med en gang.
Selection	Prøver å markere med Ctrl+klikk. Er derimot en bug som gjør at det ikke fungerer å markere mer enn 2 strukturer. Marker alle som default: "Det gir mening. Det synes jeg er smart".
Slett	

Redigering

Undo Redo	Bruker ikke undo, selv ikke etter hun speilet feil side.
Copy Paste Cut	Har lyst til å bruke Ctrl+C, men prøver det ikke. "Jeg tør ikke å gjøre det". Programmet krasjet tidligere når hun prøvde å markere 3 strukturer med Ctrl+klikk. Kanskje derfor hun ikke ville prøve. Etterpå ser hun kopier i toolbar og leser tooltips. "Oja, så jeg kan ta kontroll copy". Kopierer alle strukturene fra framsiden og skal prøve å legge de på baksiden. Men bruker speil-prompt i stedet når den vises.

Justering

Align	Prøver align knapper. Tenker først at den skal justere alle sammen, men forstår fort at det kun er den som er markert som blir justert. Skjønte ikke helt align. Finner ut av det under diskusjon. Var det hun mente tidligere med at hun kunne distribuere og så midtstille. Prøvde først å midtstille med å dra derimot.
Distribuering	Ser ut til å skjønne hva den gjør etter å ha lest tooltip, men synes "distribuer" er et ukjent ord, og ville heller brukt "fordel".

	Har lyst å markere to fletter, og dra for å øke avstanden mellom dem. "Kan som regel gjøre sånne ting i lignende verktøy som jeg jobber med". Nevner Figma. Studerer interaksjonsdesign.
	Skjønte du egentlig hva distribuer gjør? "Nei". "Kan hende at jeg tenkte den også skulle sentrert seg".
	Forstår at hun kan distribuere og så justere for å gjøre den symmetrisk. Dette fungerer derimot ikke når man har forskjellig bredde på strukturene.
	Guidelines for distribuering slik som i Figma? "Ja kanskje det". "Trenger ikke være så komplisert som Figma". De andre stegene er veldig enkel, må beholde simplisiteten i struktur-steget også.
Speil	Brukte prompt for å speile, likte den. "Ja, nice. Den likte jeg. Det vil man jo ofte".
	Speiler motsatt når hun bruker speil knapp. "Det var ikke det jeg trodde speiling betydde, men det gir jo mening. Jeg tenkte det betydde på andre siden".
	Gi feedback på hvilken side som blir speilet, og hvordan det vil se ut etter speil. Står i prompt, men det leste hun ikke.
	Når man står på en side og tenker "Oj dette mønsteret har jeg lyst å ha på forsiden".
	Speile bare én? Er kanskje et poeng for noen. Gir mening hvis det framsiden og baksiden skal møtes oppå skulderen. Ikke noe hun savnet derimot.
Symmetri	

Layout

Toolbar	
Accordion	
View buttons	
Tutorial Tooltips	Legger merke til opplæring, men ser ikke gjennom den. Hun synes det var forståelig uten opplæring.
	Starter med å lese gjennom alle tooltips.
	Bruker 14 sek (03:12-03:26) på å lese tooltip til distribuer.
	Vise opplæring automatisk? "Jeg tror jeg ofte bare krysser ut sånne ting som popper opp".
	Kryss i opplæring skipper ikke, men går bare til neste steg. "Der tror jeg

	at jeg hadde blitt irritert".
	Tooltips likte hun.
Mobil	"Man er jo mest på mobilen da, men akkurat sånn som denne hadde jeg sikkert brukt en PC da".
	Skulle vise Dreamknit til bestemoren sin, var litt vanskeligere å bruke på mobilen. Det var også uten struktur-steget.
	Hvis mobilversjonen hadde vært veldig brukervennlig, hadde du da foretrukket å bruke mobil? "Jeg tror ikke det, ikke på noe sånt som det her". "Føler at man har litt mer kontroll på PC".
	På bussen kunne man prøvd litt ut på mobilen, men når hun faktisk skulle bestilt, så hadde hun gjort det på PC. Kunne "lekt seg litt" på mobilen.
Visualisering	"Det er litt vanskelig å visualisere seg hvordan dette blir".
	Kunne hatt et bilde av hvordan det vil se ut.
	Ser "veldig mye ut" med strukturer, siden det er svart og hvit. Er ikke sikker det ser så voldsomt ut på ekte.
	Grei størrelse. Følte ikke behov for å zoome. Lente seg derimot fram for å se. Trenger i hvert fall ikke zoom på steg 1-4. Kan være naturlig å zoome når man jobber mer detaljert. Ved nøyaktig finjustering kan zoom være nyttig.

Andre steg

Garn	Har "lite peiling" om Pinnestørrelse og strikkefasthet.
	"Er så mange valg"
	Velger bare en til slutt.
Passform	
Hals	
Ermer	
Forslag	
Annet	Var ikke så farlig om det ikke ble helt nøyaktig, siden hun ikke skulle strikke den. Hun gjorde det bare for å teste. Lås strukturer? Nyttig når man har flere lag oppå hverandre. Da bruker man lås for å få tak i riktig element. Hun synes ikke det er nødvendig.

T4U5

Dato: 6. mai 2022
Tid: 11:00
Sted: UX-laben NTNU Gløshaugen

Navn: ███████████
Alder: 18-26 år
Kjønn: Kvinne
Strikkekompetanse: Viderekommen
Gensere strikket: 4-8

Oppsummering

Strukturer

Legg til struktur	Trykker først for å legge til, men går over til å dra. "Jeg synes begge deler er greit". Tenkte ikke over at det var to forskjellige muligheter. Prøver å dra en M tvist der det kun er plass til en S.
Ermer struktur	Prøver å dra struktur på ermene når hun er på framsiden. Tror først at hun ikke kan legge til struktur på ermene, men finner fort Ermer knapp under visualisering.
Flytt	Finner ut at man kan dra en gruppe med strukturer. Etter distribuering ble alle markert, og da drar hun gruppen.
Guidelines	Likte at "de midtstiller seg selv". Forstår at flette er midtstilt når guideline kommer opp. Kunne vært greit at du får opp guidelines når de er likt fordelt. "Jeg liker å få opp sånne streker".
Resize	Forstår resize med en gang. Synes det var stort hopp mellom S og M. "Small var betydelig mindre enn Medium". Draging hadde vært fint hvis det hadde blitt flere mulige størrelser. Lettvint med knapper. Greit hvis man kan justere det akkurat slik man vil ha det selv (draging).
Selection	Marker alle som default: Ja. "Hvis du ikke har markert noen, da vil du sikkert ha alt". Eventuelt må man få opp feedback på at man må markere. "I utgangspunktet så visste jeg ikke at det gikk an å markere flere i det hele tatt". Trodde hun måtte ta alt sammen når hun gjorde en operasjon. Fordel med Ctrl+klikk (Bruker Ctrl+Alt+klikk) er at man kan markere strukturer på siden uten å markere de i mellom. Følte ikke behovet for å kunne markere kun en del av strukturene.

Slett	Sletter én og én struktur når hun vil fjerne alle (5) på genseren.

Redigering

Undo Redo	Brukte ikke.
Copy Paste Cut	Brukte ikke. Følte ikke behov. Bedre å trykke slett enn å bruke klipp ut.

Justering

Align	Bruker justeringsknapper for å plassere helt til venstre/høyre, men i midten bruker hun guidelines. Har mer tillit til at den blir midtstilt når man bruker knappen, enn når man drar den selv.
Distribuering	Bruker distribuer. Prøver å dra dem slik at de er ca. distribuert. Bruker ikke distribuer i oppgave 2, men plasserer tvistene helt til kanten for å få den symmetrisk. "Jeg skjønte ikke helt hva den gjorde". Foretrekker A (Lik avstand kun mellom flettene, ikke ta hensyn til kanten) Hvis den ikke midtstiller seg, kunne B vært mer naturlig, slik at den blir midtstilt. Tenkte ikke så mye over den. "Jeg trykte jo på den, men visste ikke helt hva den gjorde". Så ikke hva som skjedde i visualisering etter distribuer, fordi det var veldig liten endring. Mangler feedback.
Speil	Bruker speil prompt for å speile til baksiden. Prøver å bruke speil for å få venstre-fletten over på høyre side. Speiler feil side med knapp og mister det hun hadde gjort i oppgave 3. Leser ikke teksten i prompten. Sletter strukturene og begynner på nytt. Andre gang leser hun teksten, og forstår at hun må gjøre motsatt. Ender opp med å slette baksiden, og gå til framsiden, da er speil-knappen disabled, hun forstår ikke hvorfor. Går da til baksiden og får opp prompt som hun bruker for å speile. "Naturlig at du speiler den siden du er på".

	Naturlig at dersom man står på en blank side, så vil man speile den andre siden til denne. Speile bare en kunne vært mulig, men kan også speile alle og så bare fjerne de du ikke vil ha. Hadde kanskje brukt det hvis det var en mulighet, men "hadde ikke vært avgjørende om du kan speile én eller alle".
Symmetri	

Layout

Toolbar	
Accordion	
View buttons	
Tutorial Tooltips	Bruker ikke opplæring. Så ikke at den var der. Greit å ha. Opplæring vist automatisk? "Kan være litt irriterende med opplæringer". Bedre å flytte opplæringsknapp mer mot midten, slik at den blir mer synlig. Bedre med en prompt der det står "Vil du ha opplæring?", så kan man velge selv. Så lenge man ikke må gå gjennom hele opplæringen, hadde det vært greit med en automatisk prompt. Leser ikke tooltips. La ikke merke til dem. Ville hatt dem nærmere knappen. Men likte å ha en forklaring.
Mobil	Ville brukt PC. Mobil-mockup ser enkelt og oversiktlig ut. "Hvis jeg skal gjøre sånne her ting som jeg har lyst å ha bra, så gjør jeg det på PC". "Har mer kontroll når jeg justerer det med datamus, enn når jeg justerer det med fingeren min". Kunne brukt mobilen først, men når hun skulle bestille hadde hun gått tilbake til PCen. (Her er det kanskje et behov for å sende et design fra mobilen sin til PCen?). Pleier å bestille ting på PCen.
Visualisering	Synet blir trekt mot visualiseringen.

Andre steg

Garn	Vil ha et luftig garn. Velger sunday fra populære.
Passform	
Hals	
Ermer	
Forslag	
Annet	Har ikke strikket fletter før, men strikker patentstrikk. Tror det er ganske lett å strikke fletter. Hadde ikke vært bekymret over vanskelighetsgraden med fletter. Hun hadde nok bare bestilt en oppskrift og satset på at hun fikk det til, fremfor å lære seg å strikke fletter før hun bestiller oppskrift. Er litt sånn første gang man strikker en genser, at man hopper ut i det. Kunne prøvd å bare legge til én flette for å gjøre det lett for seg selv. Lås strukturer? Usikker på om hun hadde brukt denne. Ikke de mest avanserte redigeringene man gjør, så usikker på om behovet er der.

T4U6

Dato: 13. mai 2022
Tid: 10:00
Sted: UX-laben NTNU Gløshaugen

Navn: █████████████
Alder: 18-26 år
Kjønn: Kvinne
Strikkekompetanse: Avansert
Gensere strikket: 1-3

Oppsummering

Strukturer

Legg til struktur	Prøver å legge fletter lengre ut på kanten.
Ermer struktur	Ønsker å plassere strukturer rundt hele ermet.
Flytt	Fant ut at man kan flytte på alle når de er markert, det var derimot ved et uhell, og hun kunne tenkt seg noen indikasjon på at man kan dra for å flytte på flere strukturer samtidig. Hun likte at hun kunne flytte på alle samtidig.
Guidelines	Ønsker guidelines for distribuering. Prøver å plassere to tvister på hver sin side, og vil ikke ha de helt ytterst mot kanten.

Vil ha linjer sånn som i PowerPoint. Vertikale linjer langs ytterkanten av fletten som kommer opp på den du drar på og på andre siden for å indikere at de har lik avstand fra kanten. Kunne også vært horisontal, det er ikke det viktigste.

Noen ganger vanskelig å bare ha et lite mellomrom mellom flettene, siden de snapper til hverandre. |
| **Resize** | Forstår resize med en gang. "Så kan man endre størrelse, det er nice".

Resizer 3 strukturer samtidig.

Synes dra hadde vært litt "knotete". Så lenge det er de samme størrelsene, fungerer knapper bra. |
| **Selection** | |
| **Slett** | Etter distribuer ble alle strukturene markert, hun ønsker å slette en av dem men sletter alle ved et uhell. Bruker ikke undo etter dette. |

Redigering

Undo Redo	
Copy Paste Cut	Brukte ikke disse.
"Hva skal man ha det for?"

Kunne kopiert alle over på andre siden, men da kunne man jo bare brukt speil også. Hvis man har noe veldig detaljert som tar tid å lage, kunne man kopiert og limt inn. Lettere å legge til fletter på nytt.

Kunne kanskje brukt dette hvis hun skulle ha 8 små fletter på rad, da kunne hun kopiert en og limt inn 7 ganger. Ville gått litt fortere, men hun måtte i så fall ha visst om denne funksjonen på forhånd. |

Justering

Align	Bruker align. Følte ikke behov for å bruke disse. Vil heller dra dem.
	Kanskje hun hadde brukt dem hvis flettene hadde vært mindre, da kunne det vært vanskeligere å dra dem.
	Trenger ikke å være så nøye når man drar, hvis det hadde vært mer flytende/kontinuerlig så kunne align-knapper vært nyttig.
Distribuering	Leser tooltips nøye for distribuer. Ble forvirret og forstår ikke hva denne gjør.
	"Det her skjønte jeg ikke helt".
	"Er det for å ha de jevnt fordelt liksom?"
	Distribuerer 3 strukturer, forvirret over at bare den i midten flyttet på seg, fordi den skulle jo være på midten av genseren. Mer logisk at de ytterste flytter på seg.
	Bruker til slutt distribuer og drar strukturene for å midtstille alle.
	Foretrekker A (lik avstand bare mellom flettene, men ikke ta hensyn til kanten). Er ikke sikkert hun vil ha flettene så langt ut mot kanten.
	Kunne tenkt seg at det ble symmetrisk. "Det er jo det man er ute etter, man vil jo ikke ha noe som er off-center".
	Guidelines mer intuitivt enn knapp for distribuering. Vil likevel ha begge deler. Hadde nok brukt guidelines, men hvis det er veldig mange hadde hun heller brukt knappen.
Speil	Tror speil speiler om midten av genseren, altså mellom venstre og høyre side. Hun prøver å markere en tvist og vil trykke på speil, men knappen er deaktivert. Hun leser tooltips, men sliter litt med å forstå det.
	"Plasserer fra den andre siden… Jeg bare prøver å skjønne det her. Oja fra andre siden av genseren, foran og bak liksom. "
	Speiler med å bruke speil-prompt.
	Speiler feil side med uhell, og mister det hun hadde. Prøver igjen, og nå leser hun teksten i dialogen. "Hadde jeg lest litt nøyere hadde jeg sett det da".
	Synes det er logisk å ha det den veien som det er under diskusjonen, likevel tok hun feil første gang. "Det er jo logisk sånn som dere har det, tror jeg…Og siden vinduet dukker opp med informasjon, har det ikke så mye å si. "

	Ser ikke behovet for å speile kun én struktur. Hadde bare gått over på andre siden og lagt til selv.
Symmetri	Prøver å ha to tvister på hver side og vil ha det symmetrisk. Er litt usikker men hun tar det på øyemål. "Man klarer å ta det på øyemål, men det er veldig kjipt å bestille, hvis man har litt uflaks da, og ikke klarer å plassere det helt likt".

Layout

Toolbar	
Accordion	
View buttons	
Tutorial Tooltips	Bruker ikke opplæring. Leser tooltips. "Ja, det er nice med litt informasjon om hvordan man gjør det".
Mobil	Ville brukt PC. Liker å ha det stort. Også undersøke med garn, nice å ha flere faner, lese blogger og sånt. Hvis hun hadde visst akkurat hva hun ville ha, kunne hun brukt mobilen. Mobil-mockup "Jeg synes det ser veldig ryddig ut". Litt upraktisk å ha scrolling bortover, vil heller ha det nedover. Men da må visualisering forblitt i bildet. Man må alltid se genseren. Kunne tenkt seg å zoome. I hvert fall hvis man skal plassere små strukturer.
Visualisering	

Andre steg

Garn	Litt vanskelig å velge garn. Nevner instagram-side som inspirasjonskilde for garn. "Jeg klarer ikke helt å bare tenke at det garnet passer perfekt for en sommergenser". Velger "tynt garn som ikke er så pusete" (Sandnes Sunday)
Passform	Ønsker innsvinget bol. Altså smalere over hoftene.

Hals	
Ermer	
Forslag	
Annet	Ønsker å endre retningen på tvister. Altså om de skrår mot venstre eller høyre.
	Prøver å dra strukturene opp/ned for å justere hvordan de treffer halsen.
	Lås hadde ikke gjort noe skade, men hun hadde nok ikke brukt det aktivt. Kanskje hvis hun har to fletter ytterst, og så vil distribuere noe mellom de. Kunne vært nyttig hvis det var mer detaljert. For eks. en linje med vrang.
	Kunne vist advarsel før man betaler hvis designet ikke er symmetrisk, slik at man slipper å kjøpe oppskrift som er litt usymmetrisk.
	Zoome på PC: Ja, hvis det var mindre strukturer. Men hadde ikke behov for det sånn som det er nå.
	Andre strukturer: Hullmønster, perlestrikk, vrange kanter. Går ikke nødvendigvis fra topp til bunn sånn som fletter, kan også være horisontalt eller på skrå. Er ofte i type linjer.

Appendix D

NSD - Form of Consent

Vil du delta i forskningsprosjektet

Web Application for Generating Customized Knitted Clothing Items (Dreamknit)

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å utvikle en brukervennlig nettside for Dreamknit, der man kan tilpasse en strikkeoppskrift. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål
Dreamknit ønsker en brukervennlig nettside som oppfyller brukernes behov. I den anledning har Norges Teknisk-naturvitenskapelige Universitet (NTNU) en masteroppgave i samarbeid med Dreamknit, for å utvikle produktet deres på en måte som prioriterer sluttbrukerne. Prosjektet har to studenter involvert, og vil vare fra høsten 2021 til våren 2022.

Hvem er ansvarlig for forskningsprosjektet?
NTNU er ansvarlig for prosjektet.

Hvorfor får du spørsmål om å delta?
Som teststrikker hos Dreamknit, har du allerede kjennskap til produktet og vil være i målgruppen. Du er interessert i å strikke, og sitter på kunnskap som er relevant for utviklingen av produktet. Dine kontaktopplysninger er hentet fra Dreamknit.

Hva innebærer det for deg å delta?
Hvis du velger å delta i prosjektet, innebærer det at du deltar på brukertester og intervju. I tillegg kan du bli kontaktet for oppfølgingsspørsmål om det skulle være behov for det. Under en brukertest vil du få noen oppgaver du skal løse, som er ment for å teste vårt design. Det er ikke du som blir testet, det er vårt design, og du kan når som helst avbryte brukertesten uten å oppgi noen grunn. Av praktiske årsaker vil ikke alle bli kalt inn til hver runde med brukertesting og intervju. Dette vil bli avtalt god tid i forveien, og du vil bli informert om det er brukertest eller intervju som skal skje.

Av smittevernhensyn kan brukertestene og intervjuene foregå digitalt om nødvendig. Da vil vi sette opp et videomøte, og du vil få veiledning om hvordan det gjennomføres.

For å analysere brukertestene vil vi ta video- og lydopptak. Intervjuene vil kun ha lydopptak. Det er også mulig at noen brukertester blir gjennomført på NTNU sin UX (user experience/brukeropplevelse) lab. Da kan det forekomme sporing av blikket ditt ved bruk av et spesielt kamera (Eye tracking). Dette vil overvåke hvor på skjermen du har blikket ditt, og forteller oss hvilke elementer du fokuserer på. Dersom en brukertest vil involvere slik sporing av blikket ditt, vil du bli informert om dette i forkant av brukertesten.

Det er frivillig å delta
Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykket tilbake uten å oppgi noen grunn. Alle dine personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger
Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

Det er kun personer som er involvert i prosjektet som har tilgang til dine opplysninger:
- Studenter som skriver masteroppgaven
- Veileder av masteroppgaven
- Ansatte i Dreamknit som deltar i prosjektet

Under prosjektet vil datamaterialet bli lagret på en av NTNUs anbefalte lagringstjenester for denne typen informasjon.

Resultatet av prosjektet har mulighet for publisering, men du vil ikke kunne bli gjenkjent i en eventuell publikasjon.

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?
Opplysningene anonymiseres når prosjektet avsluttes/oppgaven er godkjent, noe som etter planen er rundt sommeren 2022. Personopplysninger og eventuelle opptak vil bli slettet når prosjektet avsluttes.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:
- innsyn i hvilke personopplysninger som er registrert om deg, og å få utlevert en kopi av opplysningene,
- å få rettet personopplysninger om deg,
- å få slettet personopplysninger om deg, og
- å sende klage til Datatilsynet om behandlingen av dine personopplysninger.

Hva gir oss rett til å behandle personopplysninger om deg?
Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra NTNU har NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Hvor kan jeg finne ut mer?
Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:
- NTNU ved George Adrian Stoica, Førsteamanuensis, stoica@ntnu.no
- NTNU ved Hans Jørgen Engstad, Student, hjengsta@ntnu.no
- Vårt personvernombud: Thomas Helgesen, thomas.helgesen@ntnu.no

Hvis du har spørsmål knyttet til NSD sin vurdering av prosjektet, kan du ta kontakt med:
- NSD – Norsk senter for forskningsdata AS på epost (personverntjenester@nsd.no) eller på telefon: 55 58 21 17.

Med vennlig hilsen

Georige Adrian Stoica   Hans Jørgen Engstad
(Forsker/veileder)   Rosita Høybakken
                                      (Studenter)

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet *Web Application for Generating Customized Knitted Clothing Items*, og har fått anledning til å stille spørsmål. Jeg samtykker til:

- å delta i intervju
- å delta i brukertest
- å motta eventuelle oppfølgingsspørsmål frem til prosjektet er avsluttet

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet

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(Signert av prosjektdeltaker, dato)

Appendix E

Dreamknit Device Statistics
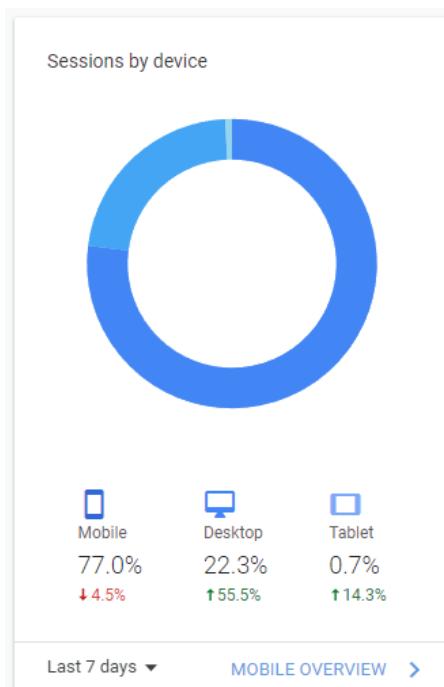
Figure E.1: Devices used to visit Dreamknit's websites between February 15 and March 15 2022.

Table E.1: Key figures for visitors on Dreamknit's website between February 15 and March 15 2022.

Device	Users	Sessions	Bounce Rate	Avg. Session Duration
Mobile	1841	2306	36.08%	01:37
Desktop	450	613	12.07%	02:57
Tablet	28	31	29.03%	01:09
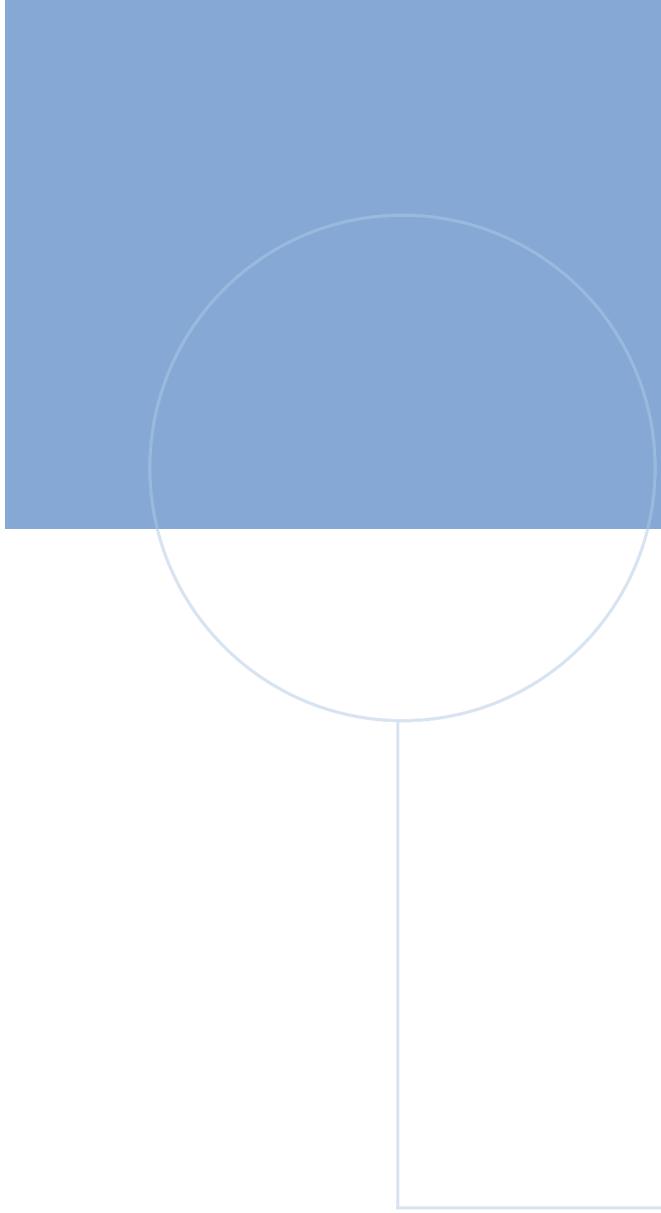
Engstad

NTNU

Norwegian University of
Science and Technology