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Bachelor thesis

Improving perceived performance of loading screens through animation



Author: Samantha Persson
Supervisor: Romain Herault
Examiner: Susanna Nordmark
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Abstract

This study investigates the impact that loading animations have on perceived performance. Two sets of usability tests were conducted to obtain the data for this study. In the first set of usability tests, 15 participants were observed. The second set was performed online with 45 participants who answered a questionnaire after using the prototype. Five different loading animations were tested: Spinner, Loading bar, a detailed animation, an animation with a quote and a skeleton loading screen. The participants were asked at the end of the usability tests to rate which one of the loading screens were the fastest and the slowest. Results suggested the kind of animation used in a loading screen does have an effect on perceived performance. The loading screen with no animation received a generally lower rating compared to the one with animations. Loading animations intended to entertain and distract the user received a higher rate compared to common loading animations such as Spinners and Loading bars.

Keywords

Animation, Perceived Performance, User experience, Loading Animation, Loading Screens, Loading indicators, Loading time, User Satisfaction, Interaction Design

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1. Introduction

Animation has been around for a century and is most commonly connected with companies such as Disney and Pixar, which are famous for their animated films. According to Wells (2013, p. 10), animation is “the artificial creation of the illusion of movement in inanimate lives and forms”, whereas modern animation is commonly created using various digital tools to manipulate shapes and elements over time. In classical animation there are well established guidelines such as *Disney’s 12 principles of animation* (Johnston & Thomas, 1981, p. 47). Animation today is not limited to only animated series and movies. It is often used in applications, websites and other various digital services and tools in order to improve the appeal, usability, or to indicate a change. However, there is currently a lack of well-regarded guidelines for animation in relation to user interfaces (UI) on the different digital platforms (i.e. any type of computers, including smartphones and tablets). This results in a lack of direction on how to animate in a user interface for an optimal user experience. In general the amount of research concerning animation in UIs is limited.

Loading animations are often placed on a loading screen, which have a generally poor reputation. Everyone that have used a digital service have likely at some point experienced frustration, or even anger, related to the process of loading. Loading bars that are stuck at 99% for several minutes or Spinners that either stop or will not stop spinning are examples of this frustrating process. These loading screens are often overlooked in regards to the user experience. While online services are generally fast, there are still circumstances that can not be controlled, such as a process taking longer than usual or a limited internet connection.

User experience (UX) is how the user interacts with a product, and the emotion and experiences this interaction creates (Preece, Rogers & Sharp, 2015, p. 25). This means that a positive user experience is created through the interaction between the user and the product being positive and satisfactory. In recent years, UX designers have become extremely important for companies according to Forbes (Modicum, 2017). Companies are beginning to understand that no matter how much functionality a product can provide, if it is not usable by the intended target audience, then it will fail. This is where a UX designer comes in. Google is probably one of the best examples of UX failure. Google+, Google Buzz and Google Wave are all good examples of products designed and tested by developers. Google Wave was tested by Google employees, then the beta testers joined in (on request, which means it was people who were following Google). The product did not make it out of beta after user testing. The problem was the UI. Google Wave did everything, it was fast, but it did not make anything more simple or easier.

When talking about UX, one important factor is the loading time of the tool. Google published a study in 2017 relating the impact of loading time of websites (Google API, 2017), the results were as follows:



- 1-3 seconds load time increase the bounce rate probability by 32%
- 1-5 seconds load time increase the bounce rate probability by 90%
- 1-6 seconds load time increase the bounce rate probability by 106%
- 1-10 seconds load time increase the bounce rate probability by 123%

In order to retain people on your website or application, it needs to load fast, or the user will go somewhere else. Loading time also affects the user satisfaction (which is subjective), and the SEO rating (algorithm used in search engines). Loading time is therefore a very important factor in user experience. However, there is a big difference between loading time and perceived loading time. It is well known that people perceive time differently while waiting compared to when performing an action (e.g., waiting for something/someone while being idle seems longer than when doing something).

The impact of loading times in digital TV sets using animation was investigated in *Minimizing impact of loading time and presentation to user experience in modern over the top television* (Bjelica, Ilkic & Rikalovic, 2015). According to this study, changing the type of animation used in the loading screens had an impact on the overall user experience when waiting for a new page to load on a digital TV set. Performance of a technological device is usually measured based on its frequency, throughput and response time (Doherty & Sorenson, 2015). However, this definition does not take the user experience into consideration. Perceived performance instead refers to how well a user experiences that a tool or service is performing subjectively (Canfield, Cano, Hohenstein, Khan & Tung, 2016). Very little is known about the perceived loading time on digital products.

Meetod¹ is a digital consulting and product agency from Växjö, Sweden, that focuses on providing an optimal user experience. They are interested in investigating how perceived performance can be influenced with an appropriate use of animation. Meetod believes that by using various loading animations, the company can potentially impact how the user perceives the performance, even if the measurable performance has not improved at all. This could also improve the overall perceived quality of a website or digital service. They are, therefore, interested in establishing potential guidelines for this type of animation, which they would be able to apply to future projects.

The study will be performed in cooperation with Meetod. They will provide feedback both on the user experience and design of the prototype used for the usability tests. Different kinds of 2D loading animations will be created for this study.

1.1 Purpose

The purpose of the study is to investigate the impact of loading animations on perceived performance. This will be explored through creating and comparing five types of animations;

¹ <https://www.meetod.se/>



spinners, Loading bars, Skeleton loading screens, animation with personality and a detailed loading animation. These loading screens will be evaluated with a general target audience.

An additional goal for this study is to create potential guidelines for loading animations that improves the user experience. The aim is to discover how to implement loading screens with the lowest negative impact on the user experience. Based on this, the following research questions are formulated.

1.2 Research Questions

- What effect does loading animations have on how the user perceives the performance of the website?
- How should loading animations be used improve the overall user experience?

1.3 Limitations

The study will focus on investigating the impact that loading animations have on the user experience rather than focusing on animation in user interfaces as a whole.

A limitation of this study is that the data used to gather the initial requirements came from one expert. This was due to the time constraint and a lack of contacts in the industry. Ideally, these initial requirements would have been gathered from more experts.

2. Background

This section describes the results of the literature review. Previous studies and related work on the subjects of perceived performance, user experience, waiting and animation have been surveyed to find information, definitions and direction for the study. Details on the methods used for this literature review can be found under the methodology section (see 3.1 Literature Review). The aim of this section is to create an understanding of the topic of perceived performance and animation.

2.1 Perceived Performance

The thought of improving perceived performance through animation is not something new. As defined in section 1, perceived performance refers to how fast and well the user perceived that a tool or service is performing (Canfield, et al., 2016). However, according to Bjelica, Ilkic and Rikalovic (2015), some of the current research does not take the user experience into account when designing varying loading animations and elements. There is currently a lack of research in the user experience of loading animations.

“...flow is commonly described as the natural, fluid state of being productively engaged with a task without being aware of the technology that is driving it.” (Doherty & Sorenson, 2015). However, if this flow is broken, the user will become aware of the system, risking a negative



user experience and a negative perception of the tool. Loading screens risk breaking the flow if it is perceived as taking too long. This can, in turn, result in frustration and stress. If the wait is too long, it might even make the user permanently leave or stop using the tool. Therefore it is of importance to discover an effective way to decrease the potential negative impact loading screens can have on the overall perceived performance.

Humans are sensitive to predictivity. A predictive delay is when a wait can be estimated based on previous events (Haering & Tomaschke, 2014). Using predictive delays can speed up user response time and improve the overall user experience. This means that some parts of a digital tool or service may benefit more from having a loading screen as compared to having a page or event load instantly. In fact, this is the reason some payment services will load longer than needed, since it has been suggested to induce trust (ibid.). Therefore, the aim should not be to remove all loading screens, but to ensure that when a loading screen is present, it is designed to be as effective as possible and suitable for the situation.

Time is of the essence when talking about users visiting a website or an application (Google API, 2017). An experience will be regarded as more positive if the waiting time passed faster than expected or if no wait was perceived (Converse, Meyvis, Nelson, Sackett & Sackett, 2010). Through finding a loading screen that has a lower perceived waiting time than the actual progressed time, the overall user experience will in turn improve. A potential way to lower the perceived waiting time is by using a loading animations that diverts the attention of the user.

2.2 Diverting the Users Attention

Loading screens cannot only be used to communicate a waiting time to the user, but they can potentially also be used to divert the users attention away from this waiting period. Certain loading animations such as loading bars can generate stress, since humans do not experience time linearly (Moraveji & Soesanto, 2012). This can potentially be avoided by using loading animations that do not communicate a linear time progression. According to Vierordt's law, a shorter duration will be overestimated while a longer duration will be underestimated (Ge, Qu, Sun, Zhang & Zhao, 2017). When it is brought to a person's attention that a process is taking time, it increases their awareness of that time passing. (Gómez & Liikkanen, 2013). However, the more occupied a person is with another task, the less they notice that time is actually passing.

Humans experience time slower the longer the wait, which can, in turn, create stress from feeling a lack of control over the system (Moraveji & Soesanto, 2012). This can potentially be resolved by diverting the users attention during waiting periods. By turning waiting time into occupied time, a positive impact can be experienced subjectively about time (Gómez & Liikkanen, 2013). This can be done by providing an alternative task or passive entertainment to distract the user from the wait. An example of this is a study where an interactive animated



loading screen in a web-based interface was perceived as faster and had a higher enjoyment (Canfield, et al., 2016). This interactive loading screen was preferred over both a passive animation and a loading bar. What these studies suggest is that if a loading screen brings some kind of entertainment, distraction or joy to the user, it can improve the perceived progressed time and improve the overall user experience. This could also mean that this decreases the risk of a loading screen breaking the overall flow.

Participants in a study that took part in the conditions designed to be entertaining and to make “time fly” experienced a faster time progression than other participants (Converse, et al., 2010). These participants also rated the overall task as more enjoyable in comparison. The result of the study shows that an experience will be regarded as more positive if the waiting time passed faster than expected or if no wait was perceived. Overall, this shows the potential a detailed and entertaining loading animation could have to the overall user experience. However, it is still important to adhere to the users mental models and not create a loading screen that will be confusing or be a negative surprise.

2.3 Mental Models

A mental model is according to Costanza, García, Nowacka, Ramchurn and Verame (2018) how a user expects a system or tool to work and behave. If an animation matches the mental model of the users, it can change and improve the overall perceived performance of a system.

When an animation meet the expectations and mental model of a user, the effect of this will hold despite a minimal performance drop (Costanza, et al., 2018). There is however a risk that certain animations in a UI or loading screen could make a system appear to be working better than what it actually is, risking a negative user experience when it does not meet the expectations. Therefore it is important that the type of animation and detail does not conflict with the mental model of the users.

2.4 Types of Animations

There are different kinds of loading animations that can be used on a loading screen, some more common than others. The most common being spinners and loading bars, but more complex animations can also be used for different outcomes.

2.4.1 Spinners

A common animation used for loading screens and other types of loading animations are spinners (see Figure 1), a circle spinning either forward or backward continuously (Bååth, Mejtoft & Söderström, 2018). A faster spinner was perceived to have a lower loading time.

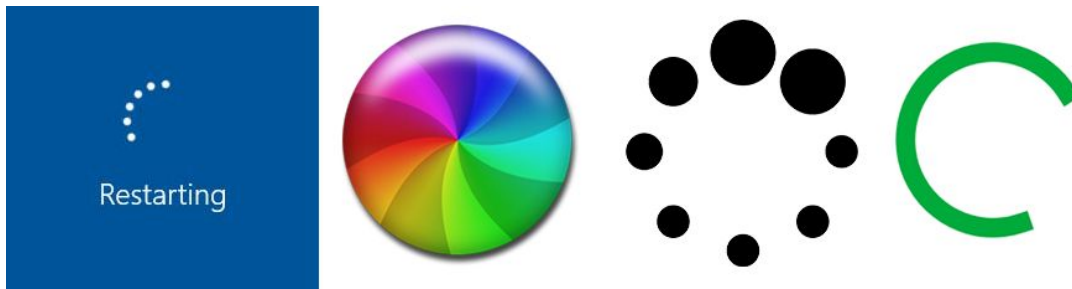


Figure 1: Example of spinners

2.4.2 Loading Bars

Another common loading animation are loading bars (see Figure 2), usually depicted with an empty bar that progressively gets filled with from left to right to communicate the progress of the loading to the user. According to Branaghan and Sanchez (2009), when loading time cannot be estimated, the loading bar should instead overestimate it. It can then speed up towards the end once the process is complete, which can improve the perceived progressed time. A shorter loading bar has a decreased perceived waiting time as compared to a longer loading bar (Kurusathianpong & Tangmanee, 2017).

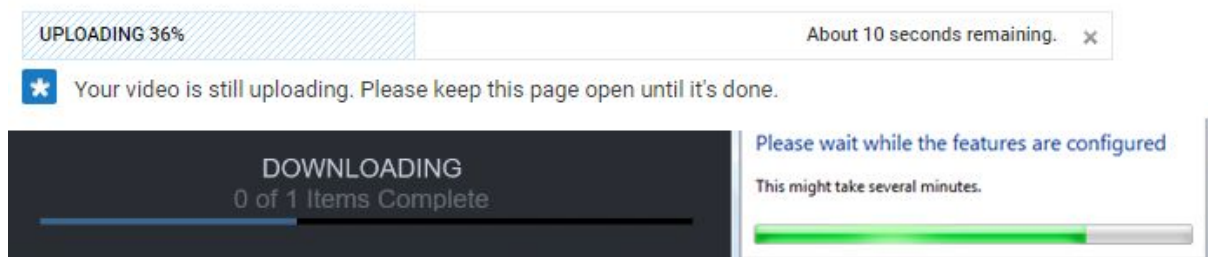


Figure 2: Example of loading bars

2.4.3 Skeleton Loading Animations

A less common loading animation is skeleton loading screens (see Figure 3), which are designed to create the illusion of elements loading in on the actual page while the actual content is loading. In a study by Bjelica, Ilkic and Rikalovic (2015), a spinner was still preferred for loading times less than one second (ibid.). This does however not mean that this kind of loading screen would not be beneficial for slower tools.

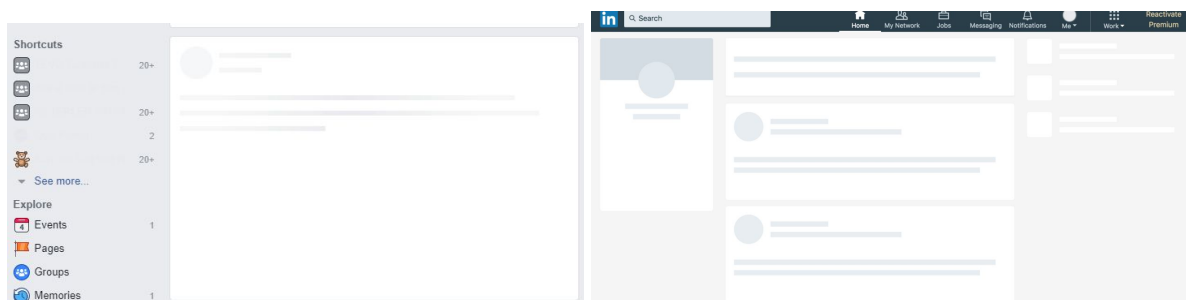


Figure 3, Example of skeleton loading screens

2.4.4 Loading Screens with Personality

One of the design heuristics to decrease stress in user interfaces described how social stressors can be created when a user is communicating with an interface that responds inappropriately (Moraveji & Soesanto, 2012). By taking humans social behaviors and emotion into account it can contribute to decreasing this kind of stress. This can be done through using a human tone, emotion and humor (see Figure 4). A loading screen using this would not only decrease potential stress but could also provide a form of entertainment or distraction.

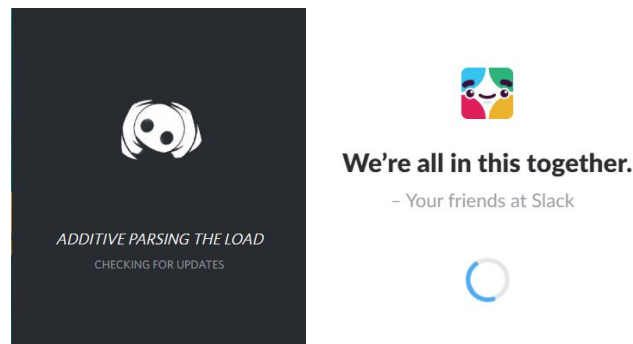


Figure 4, Example of loading screens with personality and quotes

2.4.5 Entertaining and Detailed Loading Animations

Loading symbols that are not repetitive were generally perceived as shorter compared to repetitive animations such as spinners (Kim, Liang & Xiong, 2017). As mentioned previously, by diverting the users attention it is possible to decrease perceived progressed time and improve the overall user experience. This could be applied by creating a loading animation that is designed to be entertaining and bring joy to the user.

Different tools introduced different type of loading screens since the birth of computers, from the percentage changing on text based operating system, passing by the first graphical user interface turning wheel, to more complex personality and skeleton loading screens. These tools were looked at and a few discussions about perceived loading time were conducted. This literature review suggests a need for a deeper analysis of the perceived loading time different loading screens can have. This study will analyse the previously described tools and their impact.

3. Methodology

This section introduces the methods used to gather data and information for this study. The overall work process can be seen in Figure 5. Both qualitative and quantitative methods were used. The methods used were a literature review, observations, questionnaires and interviews, which led to the creation of a prototype that was evaluated with 15 and 45 users respectively.



The results of the literature study and early usability tests were used to create the initial requirements.

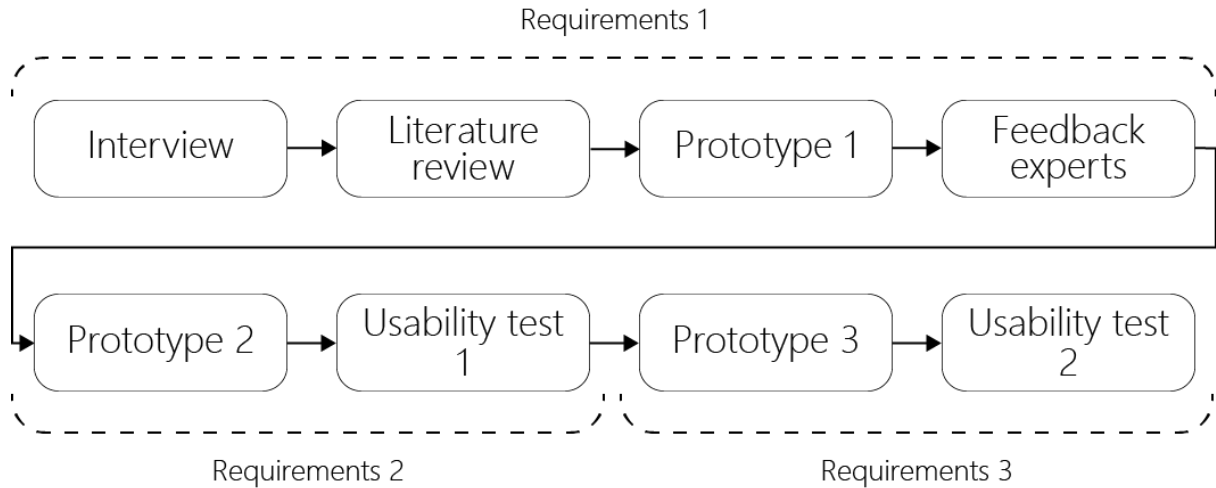


Figure 5: A visualisation of the overall work process, and the set of requirements they resulted in

3.1 Literature Review

	Keywords	Database	Search result	Abstract	Introduction + Conclusion	Entirety
Search 1	"animation" "user experience" "loading"	Google Scholar	4420	6	5	4
Search 2	"perceived performance" "animation" "loading"	Google Scholar	190	6	5	3
Search 3	"response time" "user experience"	Google Scholar	16000	15	8	3

Table 1: An overview of keywords and the elimination process for the literature review

To allow a deeper understanding of animation and user interfaces, a literature review was conducted, as seen in the previous section. A literature review is, according to McCartan and Robson (2016, p. 52), the process of “systematically identifying, locating, and analyzing documents containing information related to the research problem”. A selection of keywords such as “animation” and “user experience” were central to the search, to ensure that the resources are relevant to the study. These resources were located mainly using electronic databases.



The literature review was conducted using Google Scholar. The process of this literature review can be seen in Table 1. Articles were chosen based on their relevance to the study. The intention was to expand on the topic and to give direction to design and execution of the usability tests. All articles had to be peer reviewed. The search was limited to the past ten years, meaning 2009 and forward. This was to ensure that the articles would be up to date with current research. Results older than this would likely no longer be relevant to the study since the field of UX design is one of the first to consider the implications of animation in perceived time.

After an initial search in databases, 12 articles were selected out of the references from the articles from search. After reading these 12 articles in their entirety, four were included in this study. These articles met the inclusion criteria, meaning they are peer reviewed and published within the past ten years. Table 1 shows a summary of the search. The reading strategy was as followed:

- Read the abstract and evaluate if the study is tackling the topic;
- If it is, read the introduction and conclusion for more details;
- If the introduction and conclusion report interesting and valid input about the current work, read the full paper.

Originally, a total of 20 articles were included in the study, but eight of them were removed due to not contributing to the final result of the literature review. The intention was to ensure that only sources directly related to the subject were used. If an article did not add new knowledge or expand further on topics that had already been brought up, it was removed. This is the reason for there being only 12 articles in the final literature review. However, the extensive reading during that time brought valuable insight into the field of animation, UX design and user experience.

3.2 Interview

Semi-structured interviews were performed with the main stakeholder and with users in the first set of usability tests. According to McCartan and Robson (2016, p. 285), semi-structured interviews are when the interviewer has a predefined set of topics and questions, but may rephrase them, change the order or add new questions if suitable. At the end of the user interviews, they were able to speak openly about the prototype and give feedback.

An interview was performed with Gabriel Svennerberg, CEO and UX-strategist of a UX consulting company, in order to understand the problems faced by his team about the perceived loading time online and in applications (transcript available upon request). The intention of this interview was to create a foundation for the rest of the study and create the first set of requirements, combined with the literature review. These requirements were used when designing and implementing the first version of the prototype, and can be found in section 4.3 Requirements.



According to Svennerberg, an enhanced perceived performance of loading screens would be mainly interesting in projects where there are certain processes that may take a longer time. Previously they have experienced that users will get impatient if they wait longer than a few seconds. This is especially true if the user has gotten into a flow, which, when broken, may create frustration. Therefore, these processes should be handled in an appropriate manner so the negative impact on the user experience is decreased. With online services, there is always a risk that the user could lose their connection to the Internet. There is also a risk that a server might be slower than usual or that something is slowing down a service temporarily. If the perceived performance can be better than the actual performance, then a slow process could potentially be seen as faster than it is.

Svennerberg suggests that the prototype should be developed by continuously testing and improving it. The users should be able to rate the experience, by for example estimating the perceived passed time on a scale. Meetod is interested in a target audience with various ages and backgrounds. Demographic questions, such as age and gender, helped to provide a better understanding of the participating audience.

3.3 Observation

Observations were used to gain an understanding of how the user behaved during the usability tests. This was since a user may describe their behavior differently than what they actually do in practice. Observation is when the actions and behaviour of a user is documented and analysed (McCartan & Robson, 2016, p. 319). The observations were performed as non-participatory. This was intended to minimize the risk of influencing the participant's behavior, which could in turn create a bias and impact the results. It was voluntary to participate, and the participants received no compensation.

Usability testing is according to Chisnell and Rubin (2008, p. 21), when a user tests a product to evaluate its functions and design. All the loading screens were randomly assigned different loading times. For the second set of usability tests these times were changed to be more balanced, while remaining different. This was intended to minimize the risk of it being clear which animation was actually faster and slower.

The sessions were short, lasting for around 5-10 minutes. The usability tests were performed on a smartphone through Protopie's application. The users were given the task to visit all pages with recipes in the prototype, and through this process they would also visit all the loading screens. When the user pressed a button linking to a recipe page, it would first display one of the loading screens. After viewing this screen for its set duration, the user would be transferred to the page with the recipe. During this time they were unable to interact with the prototype. Once the users had viewed all loading screens, they were asked which animation was the fastest and slowest. The participants were only able to vote for one animation they considered the fastest, and one animation they considered the slowest. Initial usability tests were performed with both participants and experts. The prototype and



animations were improved based on the observations and feedback from these usability tests. Another set of usability tests were then performed after implementing the improvements. A visualisation of this progress is seen in Figure 6.

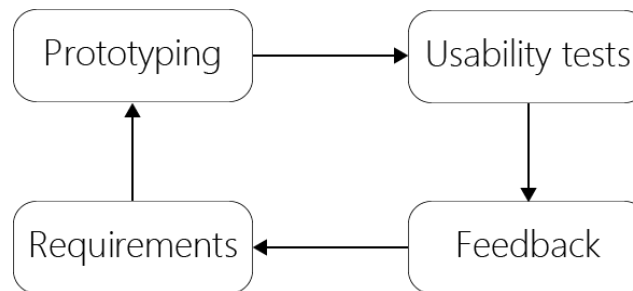


Figure 6: The process of improving the prototype through observation and feedback

3.4 Questionnaire

A questionnaire was used to create an understanding of how participants experience the loading animations. Questionnaires, or surveys, are used to ask multiple questions either in person, or by filling out a form (McCartan & Robson 2016, p. 243). This method was combined with the online usability tests to record the results and demographics of the participants. The questionnaires were distributed through Google Forms, which allows recipients to fill it out in their own time. This service also facilitated the process of compiling the result. The questionnaire can be found in Appendix A.

The questionnaire was created and distributed using Google Forms, so that the participants could fill them out after using the prototype. This questionnaire was used together with the second set of usability tests, which were performed online. The usability tests were performed on a general target audience, based on the stakeholder's interview in section 3.2. Demographic questions, such as age and gender, helped to provide a better understanding of the participating audience.

3.5 Prototype Implementation

A prototype is according to Chisnell and Rubin (2008, p. 299) “an early version of a product that may not be completely operable”. The purpose of the prototype was to evaluate the various loading screens through the usability tests. It was created and improved using a user centered design process. User centered design is when users are involved in the design process through testing and feedback (Preece, Rogers & Sharp, 2015, p. 27). This was done by observing the users throughout this process, the results from which were evaluated, see Figure 7.

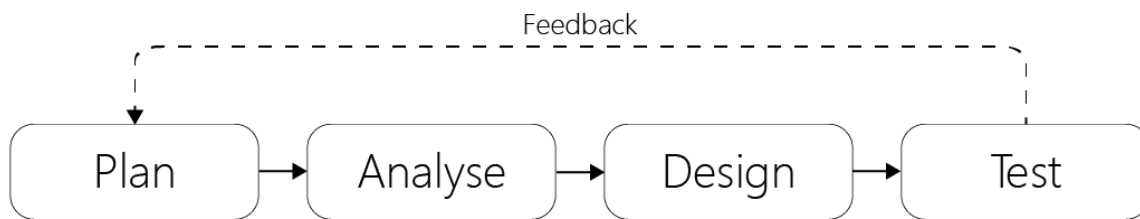


Figure 7: Visualising the User Centered Design process

The prototype was created and improved based on feedback from experts and professionals in user experience and usability. These experts were employees at the company Meetod, which this study was performed in cooperation with. They work as User Experience Designers and User Interface Designers. Requirements were developed and specified according to the Agile method. This is when requirements are expanded and adjusted through the process of implementation, testing and changes in priorities (Preece, Rogers & Sharp, 2015, p. 351). Requirements and the design of the prototype are introduced in the implementation section (see section 4).

4. Implementation

This section presents the design and the various animations created for this study. It also lists the requirements from which the prototype was built.

The designs for the prototype were created in Adobe XD. The designs were then imported into the prototyping tool ProtoPie. This tool allowed the usability test to be performed using a mobile device.

4.1 The Design

The prototype was designed as a mobile application for recipes, as seen in Figure 8. The overall design was intended to be simple. Bright colours and a detailed design may distract the user from the task at hand. Therefore it was of importance to ensure the design would match the users mental model and expectations of a recipe application. Various recipe applications were surveyed to discover common patterns. Generally, the design was intended to follow a light and modern theme.

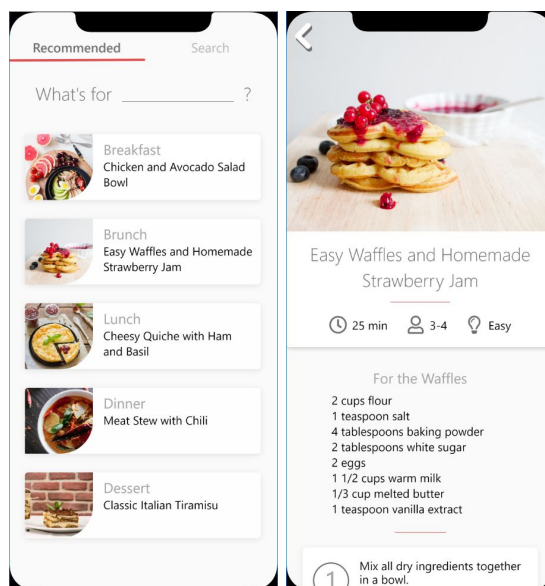


Figure 8: The main page and recipe pages in the version of the prototype used for the first set of usability tests

The colours in the prototype followed a light theme. The accent colour was a desaturated red, which was the only colour used in the prototype other than the images. According to Samara (2007 p. 86), a saturated colour is “very intense and vibrant”. A desaturated colour was more suitable since the design was not intended to stand out.

A sans-serif typeface was used for all text elements. The light colour scheme allowed for a clear contrast between the black text and the light background. This increased readability, which is especially important when reaching out to general target audience. The header text on the landing page was intended to have a playful tone.

The amount of information and elements were limited, as to avoid overwhelming the user. Negative space was used due to its ability to bring attention to the content. According to Samara (2007, p. 18), if a design lacks negative space it “overwhelms and confuses the audience”.

4.1.1 Landing Page and Recipe Page

The prototype had two pages in total, a landing page and a recipe page. The landing page was the first page presented to the user once they enter the prototype. The elements for the recipes were designed to appear clickable. These were the only elements on the page that the user could interact with. Other elements, such as the “Recommended” and “Search” tabs at the top of the page, were intended to make the prototype resemble a complete application.

The user enters the recipe page after clicking one of the recipes and going through a loading screen. At the top of the recipe page it shows a large version of the image for the recipe. The only interactable element on this page was an arrow in the top left-hand corner which the user



could use to return to the landing page. Other elements described the ingredients needed and a step-by-step guide to making the recipe.

4.2 Animation

Animations for the prototype were created both using Adobe After Effects and the built-in animation tools for ProtoPie. ProtoPie ² is a tool for prototyping with a focus on animation. The animations used in the prototype has been changed and improved based on feedback and results. Animations used in the study can be found in the following link³. A total of five animations was used; a spinner, a loading bar, an animation with a quote, a detailed animation and a skeleton loading screen, as seen in Figure 9. An additional loading screen with no animation was added. It was compared with the other loading screens that contained animation. The participants in the usability test were able to vote for the loading screen with no animation just as with the other screens.

The animations used in the prototype were designed with the intention to reduce the perceived loading time. This was done through applying the results that were gathered in the literature review. By applying what has been previously researched about these animations, it allowed the study to continue on what had already been discovered. Initially, the skeleton loading screen was not intended to be a part of the prototype. This was partly due to a decision to limit the total amount of animations to four. Through setting a limit it was intended to prevent adding an excessive amount of loading screens. The skeleton loading screen was therefore not present in the first set of usability tests. However, it was added before the second usability tests after the main stakeholder expressed curiosity regarding the impact it could have on perceived performance and wished for it to be added. The following animations were the ones used in the prototype.

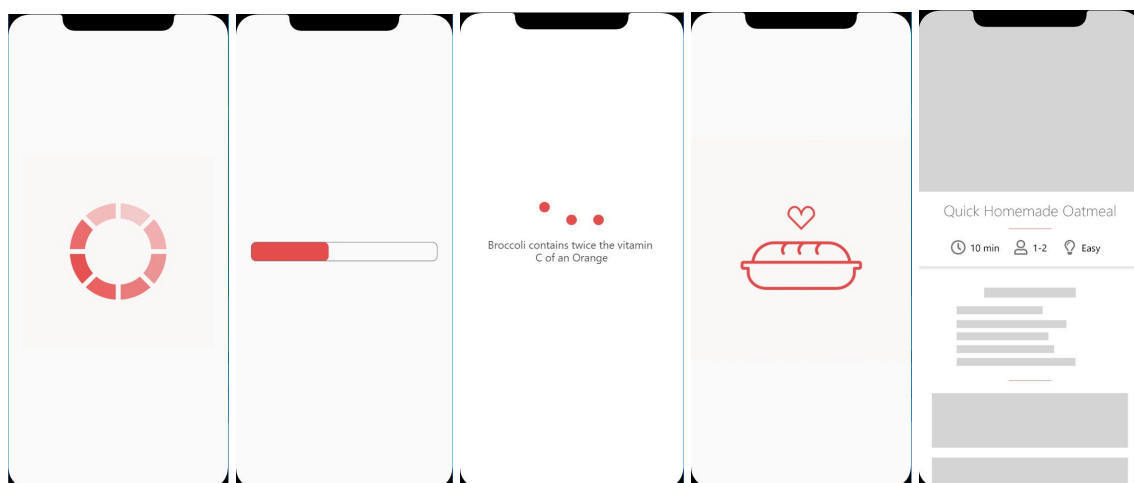


Figure 9: The loading screens with the spinner, loading bar, the quote animation, the detailed animation and the skeleton loading screen

² <https://www.protopie.io/>

³ <http://bit.ly/2X2ZUtW>



4.2.1 Spinner

The spinner was designed to spin 360 degrees in one second, since this was suggested to have the best perceived performance (Bååth, Mejtoft & Söderström, 2018). Considering that the spinner is a common loading animation, it was of interest to see how it would perform when compared to less common loading animations. Users may already have negative connections with common loading animations due to past experiences. Therefore it was designed based on previous research to decrease the potential negative impact this could have on the user experience. It was created using Adobe After effects.

The spinner was not a full circle as it was instead divided up into eight different sections. This design was decided upon after researching spinners from other services. To try and remove any negative connections the users may already have due to past experiences, the design was made to be playful. The spinning animation was created by having the accent colour move throughout the eight sections in the circle.

4.2.2 Loading Bar

The loading bar started off by slowly filling up the empty bar. After reaching about half way the speed of the animation increased progressively at a high rate. This was intended to create the effect of a system overestimating how long the process will take, before speeding up to catch up with the system process when complete or near completion. This was suggested to be an efficient way of displaying loading bars with the least impact on user experience, according to Branagan and Sanchez (2009). This animation was included due to it being a common type of loading animation.

4.2.3 Animation with a Quote

One of the loading screens contained a loading animation with a quote of some kind. This animation was intended to entertain and distract the user from the waiting time (Converse, et al., 2010), while also giving the application some personality through text (Moraveji & Soesanto, 2012). This animation was created in ProtoPie.

The loading screen with a quote had a small animation above the quote itself. It was intended to, through its continuous movement, give the user feedback that the service was not frozen and was in fact still loading. This animation was accompanied by a quote, which was a general “fun fact” about food. Since the prototype was designed as a recipe application, it followed the general theme of the content. This was also partially intended to keep the user in the flow, by providing them with some information related to the kind of service they are in. It, in turn, also provided them with the feeling of learning something new.



4.2.4 Detailed Animation

To complement the animation with a quote, a more detailed and complex animation was created. This was intended to entertain and distract the user through a playful animation (Converse, et al., 2010). Due to being more complex, this animation was created using Adobe After Effects.

The detailed animation illustrated the process of baking bread, from mixing the dough to the bread being taken out of the oven. This animation loops around continuously. By not breaking the flow and movement in the animation, the motive was that it would bring the user some joy and satisfaction from seeing how each part of the “story” in the animation connects in a seamless way.

4.2.5 Skeleton Loading Screen

A skeleton loading screen was added before the second set of usability tests, as suggested by the main stakeholder. The animation created the illusion the elements on the page loading in progressively. Elements containing text load in from top to bottom. The last thing to load in on the page was an image.

The skeleton loading screen displayed boxes as placeholders for the various elements in the user interface. The colour of these elements kept shifting between a light and dark gray continuously. It was intended to signal to the user that the content was loading in, and allowed a distinguishment between what elements had loaded in and not.

4.3 Requirements

The following requirements were revised based on the information gathered from both the literature review, and the interview with Gabriel Svennerberg (see section 3.2). They have been improved, changed and expanded upon based on feedback and results from the different usability tests as shown in Figure 5. These requirements were used when designing and creating the prototype, to ensure that it followed the results and included what was needed to perform the study in the best possible way.

4.3.1 Version 1: Before Design and Implementation

This initial set of requirements were based on the literature review and the interview with Gabriel Svennerberg.

Functional

The loading screens must:

- Include four different types of loading animations
- Have common loading animations
- Have less common loading animations
- Include a screen with no animation



The animations must:

- Be designed to reduce the perceived time
- Include animations designed to entertain and distract the user

Non-Functional

The prototype must:

- Be tested on a general target audience
- Be developed and improved according to a user centered design process
- Have a design that does not distract the user from the task
- Have a design that's easy to understand and read
- Support several types of loading screens

The usability test must:

- Involve asking the user after each loading screen to estimate the loading time

4.3.2 Version 2: First Set of Usability Tests

These requirements were revised after testing and consulting with experts and professionals from Meetod. This version was used for the first set of usability tests.

Functional

The loading screens must:

- Include four different types of loading animations
- Have common loading animations
- Have less common loading animations
- Include a screen with no animation
- Have varied loading times for all animations

The animations must:

- Be designed to reduce the perceived time
- Include animations designed to entertain and distract the user

Non-Functional

The prototype must:

- Be tested on a general target audience
- Be developed and improved according to a user centered design process
- Have a design that does not distract the user from the task
- Have a design that's easy to understand and read
- Support several types of loading screens

The usability test must:

- Avoid breaking the users flow while using the prototype by ex. Asking questions
- Avoid encouraging the user to keep track of time
- Involve asking the user which animation they considered the fastest and slowest



4.3.3 Version 3: Second Set of Usability Tests

These requirements were revised based on the result of the first set of usability tests and feedback. This version was used for the second set of usability tests.

Functional

The loading screens must:

- Include five different types of loading animations
- Have common loading animations
- Have less common loading animations
- Include a screen with no animation
- Have varied loading times for all animations

The animations must:

- Be designed to reduce the perceived time
- Include animations designed to entertain and distract the user
- Include a skeleton loading screen

Non-Functional

The prototype must:

- Be tested on a general target audience
- Be developed and improved according to a user centered design process
- Have a design that does not distract the user from the task
- Have a design that's easy to understand and read
- Support several types of loading screens

The usability test must:

- Avoid breaking the users flow while using the prototype by ex. Asking questions
- Avoid encouraging the user to keep track of time
- Involve asking the user which animation they considered the fastest and slowest

5. Results

This section presents the data gathered from two sets of usability test. The first set of usability tests provided feedback and data which allowed improvements to the prototype for the second set of usability tests.

5.1 First Set of Usability Tests

The purpose of the first set of usability tests were to obtain feedback, gain initial results and improve the prototype by refining the requirements. A total of 15 usability tests were performed. The sessions were short, lasting about 5-10 minutes. Each session opened by providing the participant with information from the script (see Appendix E) to ensure that all of them received the same information.



Some issues with the design and animations were discovered through the usability tests. The elements at the bottom of the recipe pages appeared clickable to some participants, which created some confusion. While some participants enjoyed the animation with “fun facts”, they expressed that the second quote disappeared too quickly. A participant suggested using one quote instead of two, which was implemented in the next version of the prototype used in the second set of usability tests. Some participants stated that the detailed animation felt unnecessarily long, especially when they saw the animation loop back at the end of the sequence. This animation was shortened for the next version of the prototype.

The votes for the slowest and fastest animations can be seen in Figure 10. Rated as the fastest animation was the spinner, which also received no votes for being the slowest. The loading bar was rated as the slowest with one vote for being the fastest.

The detailed animation and the quote were rated by some participants as being the slowest, despite expressing that they found it enjoyable. A participant expressed that “[The detailed] animation felt like it was the longest, but it does not feel like you are waiting in the same way”. Both the detailed animation and the quote received an equal amount of votes for being the fastest and slowest (see Figure 10).

While the loading screen with no animation received the second to most votes for being the slowest, it received one less vote for being the fastest. Some participants expressed frustration over this loading screen. It had the lowest loading time out of the five loading screens. Once these users would reach this loading screen they would attempt to interact with the prototype, tapping and swiping in confusion. Upon reaching the recipe page, they expressed their confusion and dismay over the loading screen, thinking it had frozen or broken based on previous experiences.

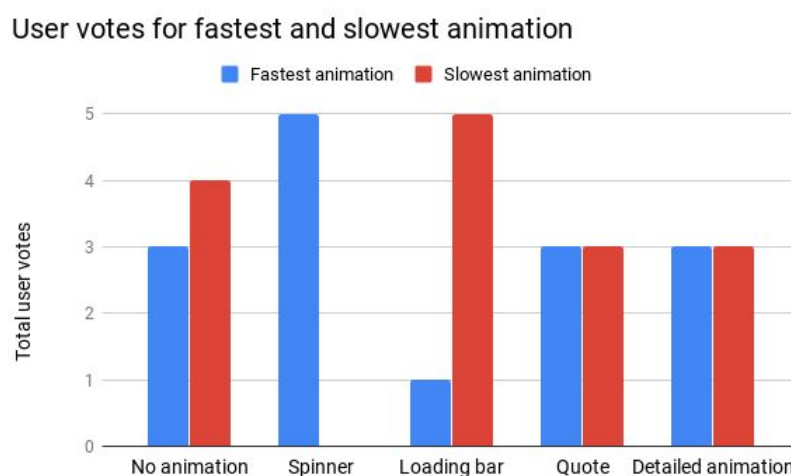


Figure 10: The results of the user votes for which animation they perceived as the slowest and the fastest



There was a four seconds difference between the fastest and slowest loading times, as seen in Figure 11. These loading times were more balanced for the second set of usability tests. However, they remained having different times. The screen with no animation had the lowest time of 5 seconds. The spinner had the second shortest loading time of 6 seconds, followed by the loading bar and the detailed animation respectively. Lastly, the screen with the quote had the longest loading time of 9 seconds.

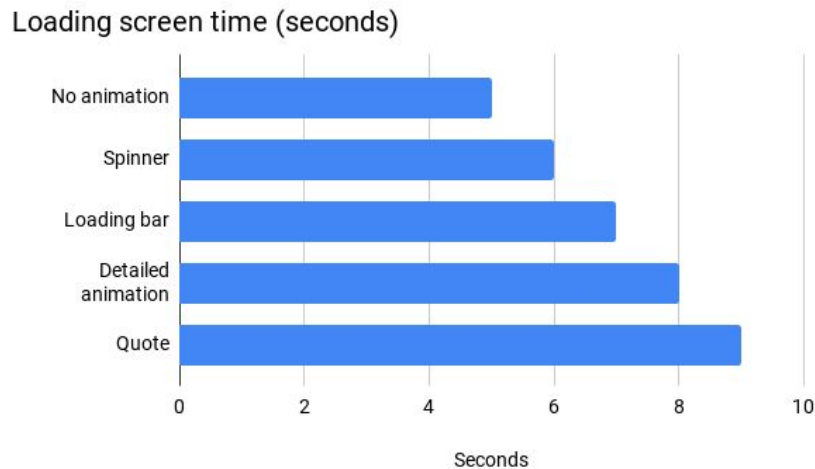


Figure 11: The loading time the various loading screens were set to

5.2 Second Set of Usability Tests

This set of usability tests were performed online. A total of 45 people participated. The prototype was sent out with instructions and a questionnaire to complete once the test was done. Improvements were made to the prototype before this set of usability tests. After a follow-up discussion with the main stakeholder, a skeleton loading animation was added to the prototype.

The loading screen with no animation received the most votes for being the slowest, as seen in Figure 12. While the loading bar received the second most votes for being the slowest, it got no votes for being the fastest. Quote was voted as the fastest and received one vote as the slowest.

The more common types of loading screen generally received a lower rating. These common loading screens included no animation, spinner and the loading bar (see Figure 12). Quote, the detailed animation and the skeleton loading screen on the other hand received the most votes for being the fastest.

User votes for fastest and slowest animation

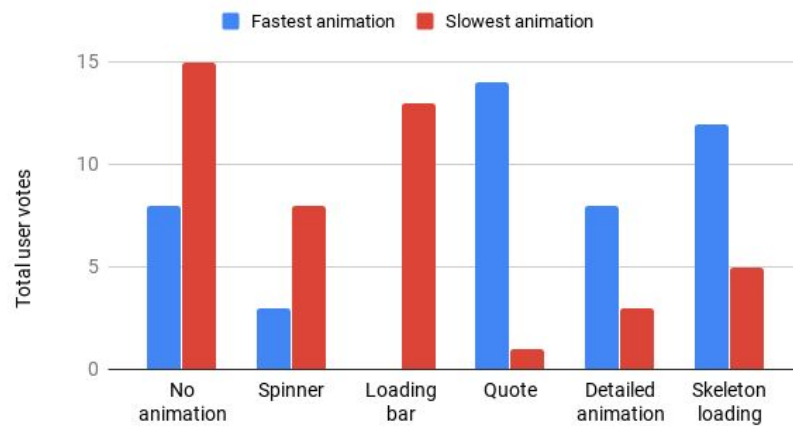


Figure 12: The results of the user votes for which animation they perceived as the slowest and the fastest in the second set of usability tests

For this set of usability tests the loading screen times were set move evenly, as seen in Figure 13. This was based on the result of the previous set of usability tests. The loading screen with no animation had a loading time of 5 seconds, the same as in the first set of usability tests. This meant that the screen with no animation was still the shortest one in the second set of usability tests. The spinner, skeleton loading screen, the detailed animation and the quote were closer to each other timewise. Lastly, the longest loading screen of 7 seconds was the loading bar.

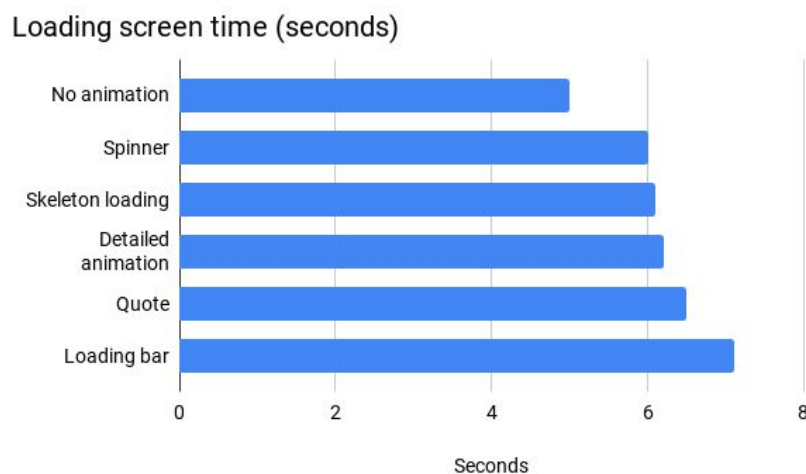


Figure 13: The loading time the various loading screens were set to for the second set of usability tests

6. Discussion

In this section the data from the results will be analysed and discussed. The aim is to investigate and answer the research questions for this study.



6.1 Using No Animation

The loading screen with no animation received several votes for being the slowest, despite having the shortest loading time in both sets of usability tests. This suggests that not using animation can have a negative impact on the perceived performance. When there is no loading animation, the user is unable to tell if the service is loading or not.

The loading screen with no animation also received votes for being the fastest in both sets of usability tests. This may suggest that not using loading animations could be a plausible option. However, a few participants expressed frustrations over there being no animation since they believed the application had ceased to work. Even if some participants considered this loading screen to be faster, it does not negate the risk that it could create a negative user experience among other users. Overall, this suggests the importance of having some kind of animation on a loading screen, so it clearly communicates a period of wait to the user. If the user believes the application is not functioning as intended, it risks breaking their flow since the wait will be brought to their attention.

The loading screen with no animation was generally considered slower and received negative feedback from some users. It gained several votes for being the slowest despite having the shortest loading time. What this suggests is that a loading screen with no animation may not generally be the best approach.

To ensure a positive user experience, it is important to consider all parts of the journey the user goes through while using the service. It is often assumed that the best wait is a short or non-existent one. However, that can not be guaranteed to always be the case. The results show that loading screens with animation was preferred over the one with no animation, despite that loading screen technically being the fastest one. If something loads in or changes too quickly it might instead confuse the users. They might not be able to tell what changed immediately despite noticing that something did happen on the page. Also, there is a risk that if something happens too suddenly it could potentially break their flow, since their focused attention would be brought elsewhere.

6.2 Common Loading Animations

The second set of usability tests showed an overall lower rating for the common loading animations; the spinner and the loading bar. The loading bar received among the most votes for being the slowest in both sets of usability tests.

The spinner received the most votes for being the fastest animation in the first usability tests, and no votes for being the slowest. In the second usability tests it was instead rated as the third slowest. This shift could be the result of balancing out the loading times, so it was no longer as apparent which animation was the fastest. It could also be the result of improving the loading animations based on feedback. As mentioned previously, non-repetitive loading



symbols were generally perceived as shorter (Kim, Liang & Xiong, 2017). Once the issues with certain animations had been improved, they received more votes. This can be due to the repetitive nature of the spinner being brought to the users attention, which in turn resulted in it no longer being as highly regarded.

In the first set of usability tests, the loading bar was rated as the slowest, while in the second usability tests it was the second slowest. Generally, this suggests that the loading bar had a worse perceived performance. This kind of loading animations are commonly used in user interfaces to display progress to the user. A loading bar can bring attention to the period of wait, which may negatively affect the user experience (Converse, et al., 2010). It can be useful when, for example, downloading a file. However, this suggests that a loading bar should be used with caution.

6.3 Entertaining and Less Common Animations

The entertaining and less common loading animations received an overall higher rating in the second set of usability tests. These animations include the skeleton loading screen, the detailed animation and the quote.

The loading screen with a quote received the same amount of votes for being the fastest and slowest in the first set of usability tests. Despite having the second longest loading time, it was still rated as the fastest animation in the second set of usability tests. It only received one vote for being the slowest. This suggests that this animation had the best perceived performance out of all of the loading screens in the second set of usability tests. This loading screen displays a simple animation, accompanied by a quote. Through the time the user spent reading this quote, it may have provided them with enough of a distraction to lower their perceived passed time.

The detailed animation received an equal amount of votes for being the fastest and slowest, while in the second usability test it was rated the third fastest. Some participants in the first set of usability tests expressed that while they found the detailed animation to be longer than the others, it provided them with enjoyment. Even if the perceived loading time would be higher than a different kind of animation, it can be suggested that an entertaining loading animation generally performed better, especially in comparison to common loading animations such as a spinner. The user is distracted from the wait if they are preoccupied with something designed to entertain them, which in turn decreases the risk of breaking the users' flow (Doherty & Sorenson, 2015).

The skeleton loading screen was added to the second set of usability tests. It received the second highest amount of votes for being the fastest. This suggests that a skeleton loading screen could be a fully viable option for a loading screen. Out of the three less common loading animations, it received the most votes for being the slowest. Due to being added in the second set of usability tests, it could not be improved in the same way as the loading



screens from the first usability tests. With improvements based on feedback from the participants, it might have performed even better in the usability tests. This kind of animation may be ideal in settings where there are several elements that has to load in. It would allow the user to start interacting with the content sooner, rather than having to wait for the whole page to load.

The loading screens intended to entertain and distract the user received the most votes in total for being the fastest. What this suggests is that if a loading animation manages to distract the user from the period of wait, it can improve the perceived performance. Two types of entertaining loading animations were used in this study, the detailed animation and the quote. Combining these two animations could potentially use the benefits of both animations. However, there are several other ways to create loading screens intended to entertain and distract the user from a period of wait. They can be inspired by the content provided by the service in which its used. It can display a logo or a mascot, or display a creative twist on common loading animations. This could be of interest to investigate further.

In general, what the results suggest is that the potential impact that entertaining and distracting loading animation can have on the user experience compared to the common loading animations should not be ignored. Users will often have a negative connection to loading screens and waiting, since they are used to their interactions with services and tools being instant. If a service uses a playful and entertaining loading animation that reflect the intended personality of this service, a period of wait could potentially become memorable in a positive sense rather than just purely being a frustration. Designing and creating an entertaining loading animation intended to distract the user requires the designer to be creative and think outside of the box. Since most websites and services overlook loading screens and animations, what would normally be a negative wait can instead become a positive surprise.

6.4 Applying Loading Animations

It can be suggested that the ideal loading animation depends on the context in which it will be used. Despite the fact that the loading bar was generally rated as the slowest, it can still be the ideal loading animation in certain situations. This could, for example, be when a file is downloading. Then the user may prefer to be able to estimate how long the download will take, even if it had a worse perceived performance.

The loading animations intended to entertain and distract the user were generally considered faster in the second set of usability tests. This could in turn suggest that an entertaining animation would be the ideal kind of loading screen. However, it is also important to take the users emotional state into consideration when applying an entertaining loading animation. A cheerful animation with an entertaining quote could create a negative user experience if the user is frustrated or sad while using the service. It is therefore important to consider in what



contexts the service will be used. If this kind of animation is suitable in the given context, it can give the service some personality since it is more memorable.

The overall results changed significantly between the first and second sets usability tests. This could be due to improving the animations based on feedback and observations. While the loading times were more balanced for the second set of usability tests, the time for the loading screen with no animation remained the same. What the result of these improvements suggest is that it is beneficial to test and improve the loading screens to achieve the desired result. Also, a good way to discover which animation is ideal for a specific service or tool is to test it with the target audience. Since the loading animations in this study were only tested in one context and on one kind of platform, the results may differ in a different context. Improving the loading screen with the quote had an overall positive impact on the result for this animation in the second usability tests. This adds to the importance of testing and improving the loading animations.

This study applied previous research to create loading animations intended to have the ideal impact on perceived performance. In the same way, the result of this study can be used to further investigate various loading animations. Most previous studies focus on common loading animations such as spinners and loading bars, which generally performed worse in this study compared to the other animations. It could in turn encourage further research into loading animations intended to entertain and distract the user. The results point to the potential impact that these entertaining loading animations can have on perceived performance.

This section of the discussion does not present any more specific guidelines, such as the ultimate way to design a loading screen that will always give the best possible result. However, it does give direction of how through working together with the users a designer can find what works best for a specific service or tool. The findings of this study can also give direction to future research in this area.

7. Conclusion and Future Work

This thesis goal was to investigate the impact that loading animation has on perceived performance. A literature review and two sets of usability tests were performed to obtain the results. A total of 15 participants participated in the first set of usability tests, where the users provided feedback to improve the loading animations. The second set of usability tests were performed online, with 45 participants.

The result of this study suggests that the kind of animation used in a loading screen does have an effect on perceived performance. After improving the animations through feedback, the loading screen with no animation was rated as the slowest in the second set of usability tests. This was despite the fact that it had the fastest loading time in both sets of usability tests. The



animations designed to entertain and distract the user were generally rated the fastest together with the skeleton loading screen. More common loading screens received an overall lower rating. In general, the overall results indicate that animation had a positive effect on the perceived performance.

Future work could involve investigating more animations in a different context. An example of this could be the skeleton loading screen. It can be suitable in situations where several elements will be loaded onto a page. If loaded from top to bottom, the user would be able to start reading or interacting with the content even if the whole page has not yet loaded in. Testing the animations with other kinds of services or platforms could also be of interest.

It could involve investigating other types of animations designed to entertain and distract the user. There are several different ways these could be designed, some of which are mentioned in the discussion. An example of this would be combining a detailed animation with some kind of quote. These animations had a generally higher rating in the second set of usability tests, so the impact of combining them could be investigated further.

Lastly, focusing on either a specific demographic or on a larger target audience would also be of interest. Over half of the participants in the second of the usability tests were between 18-35 years old. Certain loading animations may be preferred for certain demographics compared to others, which would need to be studied further through testing and research.



References

- Bjelica, M., Ilkic, V. & Rikalovic, D. (2015). Minimizing impact of loading time and presentation to user experience in modern over the top television. In *2015 IEEE 5th International Conference on Consumer Electronics - Berlin (ICCE-Berlin)*. Berlin, Germany. 6-9 September 2015, pp. 228-231. doi: 10.1109/ICCE-Berlin.2015.7391242.
- Branaghan, R. & Sanchez, C. (2009). Feedback Preferences and Impressions of Waiting. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 51(4), pp. 528-538. doi: 10.1177/0018720809345684
- Bååth, M., Mejtoft, T. & Söderström, U. (2018). The Users' Time Perception: The effect of various animation speeds on loading screens. In *36th European Conference on Cognitive Ergonomics*. Utrecht, Netherlands. 5-7 September 2018, Article No. 21. doi: 10.1145/3232078.3232092
- Canfield, K., Cano, R., Hohenstein, J., Khan, H. & Tung, S. (2016). Shorter Wait Times: The Effects of Various Loading Screens on Perceived Performance. In *2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems*. San Jose, USA. 7-12 May 2016, pp. 3084-3090. doi: 10.1145/2851581.2892308
- Chisnell, B. & Rubin, J. (2008). *Handbook of Usability Testing*. 2nd edn, Indianapolis: Wiley Publishing, Inc.
- Converse, B., Meyvis, T., Nelson, L., Sackett, A. & Sackett, A. (2010). You're Having Fun When Time Flies: The Hedonic Consequences of Subjective Time Progression. In *Psychological Science*, 21(1), pp. 111-117. doi: 10.1177/0956797609354832
- Costanza, E., García, P., Nowacka, D., Ramchurn, S. & Verame, J. (2018). Seeing (Movement) is Believing: The Effect of Motion on Perception of Automatic Systems Performance. *Human-Computer Interaction*, pp. 1-51. doi: 10.1080/07370024.2018.1453815
- Doherty, R. & Sorenson, P. (2015). Keeping users in the flow: Mapping system responsiveness with user experience. In *6th International Conference on Applied Human Factors and Ergonomics and the Affiliated Conferences*. Las Vegas, USA. 26-30 July 2015. pp. 4384-4391. doi: 10.1016/j.promfg.2015.07.436
- Ge, Y., Qu, W., Sun, X., Zhang K. & Zhao, W. (2017). The duration perception of loading applications in smartphone: Effects of different loading types. *Applied Ergonomics: Human factors in Technology and Society*, 65, pp. 223-232. doi: 10.1016/j.apergo.2017.06.015



Gómez, P. & Liikkanen, L. (2013). Designing Interactive Systems for the Experience of Time. In *6th International Conference on Designing Pleasurable Products and Interfaces*. Newcastle upon Tyne, United Kingdom. 3-5 September 2013, pp. 146-155. doi: 10.1145/2513506.2513522

Haering, C. & Tomaschke, R. (2014). Predictivity of system delays shortens human response time. *International Journal of Human-Computer Studies*, 70(3), pp. 358-365. doi: 10.1016/j.ijhcs.2013.12.004

Johnston, O. & Thomas, F. (1981). *The Illusion of Life: Disney Animation*. 1st edn, New York: Disney Editions.

Kim W., Liang, Z. & Xiong, S. (2017). Effect of Loading Symbol of Online Video on Perception of Waiting Time. *International Journal of Human-Computer Interaction*, 33(12), pp. 1001-1009. doi: 10.1080/10447318.2017.1305051

Kurusathianpong, P. & Tangmanee, C. (2018). Comparison of perceived waiting time between two lengths of progress indicator and two styles of graphics animation with perceived uncertainty as a covariate. In *2018 Seventh ICT International Student Project Conference (ICT-ISPC)*. Nakhonpathom, Thailand. 11-13 July 2018. doi: 10.1109/ICT-ISPC.2018.8523993

McCartan, K. & Robson, C. (2016). *Real world research*. 4th edn, Chichester: John Wiley & Sons Ltd.

Moraveji, N. & Soesanto, C. (2012). Towards Stress-less User Interfaces: 10 Design Heuristics Based on the Psychophysiology of Stress. In *CHI '12 Extended Abstracts on Human Factors in Computing Systems*. Austin, USA. 5-10 May 2012, pp. 1643-1648. doi: 10.1145/2212776.2223686

Preece, J., Rogers, Y. & Sharp, H. (2015). *Interaction Design: Beyond human-computer interaction*. 4th edn, Chichester: John Wiley & Sons Ltd.

Samara, T. (2007). *Design Elements : A Graphic Style Manual*. Rockport Publishers. E-book.

Wells, P. (2013). *Understanding animation*. London: Routledge. E-book.

Modicum (2017). The Rise of the UX Gold Rush. [online] Forbes.com. Available at: <https://www.forbes.com/sites/propointgraphics/2017/07/15/the-rise-of-the-ux-goldrush/> [Accessed 21 May 2019].



Google API (2017). Find Out How You Stack Up to New Industry Benchmarks for Mobile Page Speed. [online] Think.storage.googleapis.com. Available at: <https://think.storage.googleapis.com/docs/mobile-page-speed-new-industry-benchmarks.pdf> [Accessed 21 May 2019].



Appendix

A. Questionnaire for Second Set of Usability Tests

What recipe did you feel loaded the fastest?

*

- ☐ Breakfast: No loading animation
- ☐ Brunch: Rotating circle (Spinner)
- ☐ Lunch: Quote with facts
- ☐ Dinner: The animation showing the making of bread
- ☐ Dessert: Progress bar
- ☐ Snack: Text and image loading in progressively

What recipe did you feel loaded the slowest?

*

- ☐ Breakfast: No loading animation
- ☐ Brunch: Rotating circle (Spinner)
- ☐ Lunch: Quote with facts
- ☐ Dinner: The animation showing the making of bread
- ☐ Dessert: Progress bar
- ☐ Snack: Text and image loading in progressively

Gender *

- ☐ Woman
- ☐ Man
- ☐ Prefer not to say
- ☐ Other...



Age

*

- ☐ Below 12
- ☐ 12-17 years
- ☐ 18-24 years
- ☐ 25-34 years
- ☐ 35-44 years
- ☐ 45-54 years
- ☐ 55-64 years
- ☐ 65-74 years
- ☐ 75 years and above

What do you most often use the internet for?

*

- ☐ Work/Studies
- ☐ Social Media
- ☐ Gaming
- ☐ Searching for information
- ☐ Streaming (Movies, Series and video)

Have you visited all recipes in the prototype? (linked above)

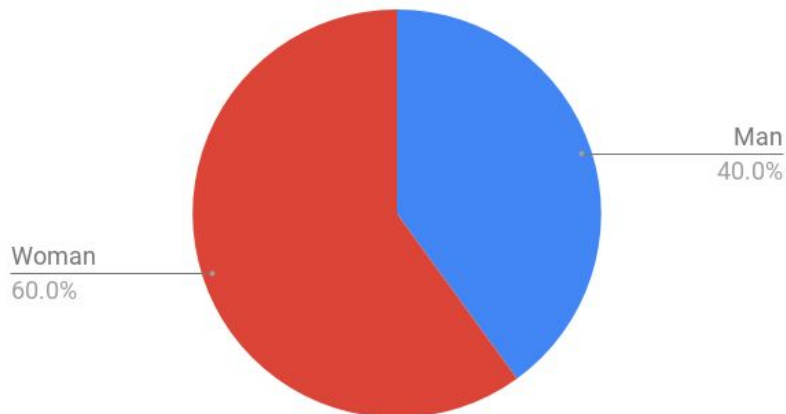
*

- ☐ Yes
- ☐ No



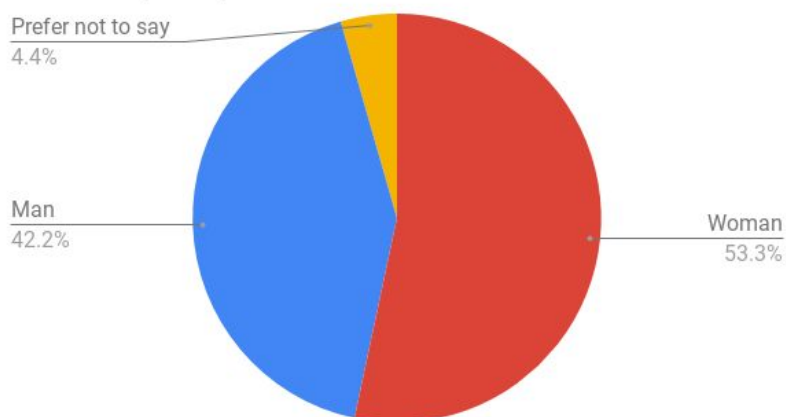
B. First Usability Tests: Gender Distribution Among Participants

Genders of participants



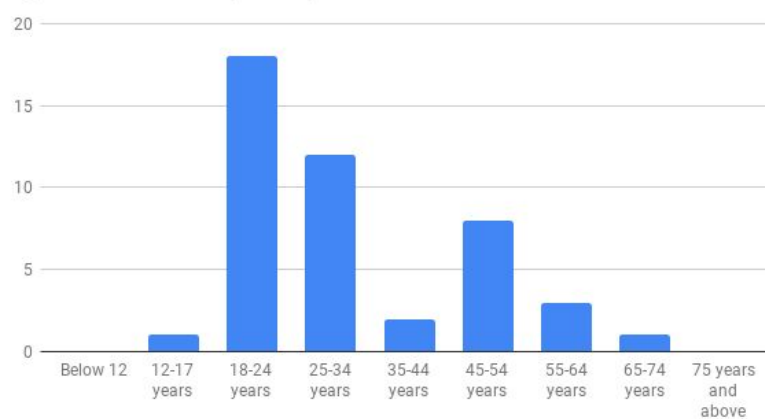
C. Second Usability Tests: Gender Distribution Among Participants

Gender of participants



D. Second Usability Tests: Age Distribution Among Participants

Age distribution of participants





E. Script for Usability Tests

Introduce yourself to the participant, with your name and what you study. Explain that this usability test is for a bachelor thesis.

Main script:

- You will be testing a prototype.
- The whole session will take around 10 minutes total.
- First and foremost, it's the prototype that we'll be testing, not you. You can't do anything wrong or make any mistakes.
- The test will be anonymous.
- If you have any questions during the test feel free to ask them. If you need to take a break or leave during the test that is no problem.

- It's a small prototype. Your task will be to visit the various recipes. I will ask some short questions after the usability test.
- Make sure you use the buttons provided inside the prototype, otherwise you may end up leaving the prototype.

- Once the usability test is complete, thank the participant for their time.