Animations Effect on Reading Comprehension in Web-based User Interfaces

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Animationers Påverkan på Användares Läsförståelse i Webbaserade Gränssnitt

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Master's thesis in Computer Science and Communication, DA222X
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2016-06-29
ABSTRACT
When it comes to web-based user interfaces and web design, one of today’s trends is to use informative and storytelling animations. They can be used as tools for communication, simplifying the interaction, or guiding the user’s attention. However, those animations used in a web-based user interface can slow down the interaction and the user flow and become a distraction for the user. Three popular informative and storytelling animations that are used in web design are: background video, animated slideshows, and parallax scrolling. In order to understand what effect these informative animations have on the users’ reading comprehension on websites — four prototypes were created in Adobe Muse. A user study in form of an A/B testing followed by a questionnaire were conducted, showing that the three different animations affected the reading comprehension negative. While they at the same time also brought an entertaining feeling to the user experience (UX).

Keywords
User Study; A/B testing; Web Design; Animations; Animated Slideshows; Background Video; Parallax Scrolling; Attention; Reading Comprehension;

SAMMANFATTNING

Nyckelord
Användarstudie; A/B test; Webbdesign; Animationer; Animerade Bildspel; Bakgrundsvideo; Parallax Rullning; Uppmärksamhet; Läsförståelse;
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When it comes to web-based user interfaces and web design, one of today’s trends is to use informative and storytelling animations. They can be used as tools for communication, simplifying the interaction, or guiding the user’s attention. However, those animations used in a web-based user interface can slow down the interaction and the user flow and become a distraction for the user. Three popular informative and storytelling animations that are used in web design are: background video, animated slideshows, and parallax scrolling. In order to understand what effect these informative animations have on the users’ reading comprehension on websites — four prototypes were created in Adobe Muse. A user study in form of an A/B testing followed by a questionnaire were conducted, showing that the three different animations affected the reading comprehension negative. While they at the same time also brought an entertaining feeling to the user experience (UX).

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1. INTRODUCTION
Today informative animations are common design elements among many modern websites. They have during the last year become a popular trend to follow when it comes to graphical user interface design (GUI design), and thus also web design [1]. By understanding how animations in web-based user interfaces affect the way the users understand written information, designers will be able to base design choices upon facts instead of only following trends. This way animations can be useful and provide a purpose to the UX and the website. The aim of websites is to communicate information to the users, via text, images, video, and animations. To do so, the goal of the designers is to provide the website with good UX that will make the website simple to use and understand [4]. When informative animations are used in a bad way they can distract the users by capturing their attentions [7]. This prevents the designers from reaching their goal of the designs, and the websites from reaching its full potential, when it comes to UX.

How the users perceive information from websites, and where their attention lays are both parts of the cognitive process in their brain. Attention is a concept where the brain sorts out and processes a smaller amount of stimuli at once. The brain is provided with a huge amount of information, and only a small amount of that can be processed at the time, which means that the cognitive process is limited [6][13]. By actively focusing on this smaller amount of information, that information is given the attention. This process can both be conscious and unconscious [12]. Motions have caught our attention since the beginning of the human’s evolutionary history. Back then, it was mandatory to pay attention to movements in order to stay safe from predators. Even though that instinct is not as necessary in today’s nature, movements still capture our attention [11]. Our brain registers movements quite easily, which contributes to movements in form of animations and transitions in web-based user interfaces very efficient implements for gaining the attention of the users while they are scrolling through websites [8].

While thinking of animations in web design one might refer back to the flash era in the early 2000s. Due to the development of HTML5, Java Script, and CSS, that era is long gone. Animations have become more sophisticated and easier to use, which makes them so appealing. One popular way of using animations is in an informative and storytelling manner. Three kinds of animations that are used within that specific area are background video, animated slideshows, and parallax scrolling, which will be the three animations this paper refers to when talking about animations. Apart from providing an entertaining and creative feeling to the UX, those three types of animations can all be used for supporting the understanding and guiding the users through a website [1]. In addition, those animations are also convenient tools for communication and for providing the users with information, as well as guiding the users’ attention [2].

There comes both advantages and disadvantages regarding these informative and storytelling animations in web designs. When they are used in a good way they bring more interactions and an entertaining feeling to the UX. Unlike, when used in a bad way, too much animations do not only slow down the user flow, they also slow down the interface per se, which make the websites load slower. Another disadvantage, these animations might also become a distraction for the users [2], as mentioned earlier, by capturing their attention. The reason is because those kind of animations often are the center of a web design. When the animations become a distraction for the users, their attention are unconsciously processed. The users are actively trying to
focus on one thing on the website, while their brains are focusing and processing the movements of the animations instead.

The aim of this work is to evaluate if the three different informative and storytelling animations, used on websites, make it easier or harder for the user to receive information while reading. The three animations are: background video, animated slideshow, and parallax scrolling. Why those three have been chosen is because they are all staple animations that are given the center of a web design, which makes them quite obvious to notice. This makes it interesting to find out whether the users think of the different animations while using websites? Or if the users are accustomed to these kinds of movements and do not pay attention to them, because their brains unconsciously sort that kind of information out — in situations like this. Therefore it is interesting to investigate if animations affect the reading comprehension, where the users need to consciously pay attention to a text. The key question that is addressed in this work follows: How does background video, animated slideshows, and parallax scrolling, used on websites affect the users' reading comprehension?

One assumption is that the three types of animations used in this work are quite obvious, and in focus of the webpage. They will gain the users' attention which will contribute in the resulting feeling of making it harder to concentrate on the written information. Despite this, another assumption is that the animations will make the users spend more time on the websites, which will contribute to better understanding of the written information. The animations will also help the users grasp the context of the website, which also will make them understand the written information better.

The remainder of this paper is structured as follows: The following section is about the three different animations and related work, followed by a section reporting on the methodology. A user study is conducted in order to find out the effect background video, animated slideshow, and parallax scrolling used on websites, have on the users' reading comprehension. All information about the participants, the procedure, and the measurements can be found in the corresponding section. Then follows the result of the study and a discussion that brings up the assumptions. Finally, a conclusion summarizes this whole work, and presents some future aspects.

2. BACKGROUND AND RELATED WORK

Background video, animated slideshows, parallax scrolling, the human’s cognitive process and attention, are the main fields of research that are related to this work. All will be described further in this section, as well as some previous researches within the field, that will be presented in contrast to this work.

2.1. Background Video

Background video is when the background of an website contains a video of any length. By using video as a design element, it provides the users with storytelling experiences. That experience may not be appropriate for all kinds of websites and suits highly visual sites the best. Storytelling and videos are often associated with television, but background videos in GUI design are helping with reducing the difference between various screen devices such as, TV, computers, mobile devices, etc [1].

In 2001, Pinhanez et al. did a study on UX with the hypothesis "less clicking, more watching". They tested two prototypes of websites that was considered to be more "TV-like". They wanted to bring the feeling of entertainment to websites in order to provide storytelling experiences to the users. In the conclusion Pinhanez et al. suggested that they did identify a strong desire for such storytelling experiences [10]. When this study was made in 2001, webpages looked a lot different from today’s modern websites. It is interesting though, that Pinhanez et al. felt the need of storytelling and the entertaining feeling in websites, which still is relevant today. How this research is related to this work is because the purpose of animations in web design matches at some level with what Pinhanez et al. found out. It can be used as an argument of why animations should be used in web design.

2.2. Animated Slideshows

Slideshows are an effective way of presenting different content. Whether it may be images, short video clips, commercial or not. By “animated” means that the slideshow contains animations that are triggered at a specific cue or has an infinite loop, that runs the slideshow automatic. The latter is used in this work. Animated slideshows are common animation effects, that often are incorrectly designed [1]. Movement and duration have to work in harmony in order to create natural feeling within the slideshow.

2.3. Parallax Scrolling

Parallax scrolling is an animated effect where the webpage is divided into several layers. Each layer is moving simultaneously at a different speed or direction, as the users scroll through the page. Previous study have been done by Frederick et al. where they found out how parallax scrolling affected the UX. An experiment where the perception of satisfaction, usability, enjoyment, visual appeal, and fun were measured in relation to parallax scrolling. The result showed that parallax scrolling improved the UX and made the interface more fun. No distinct tendencies were shown in the four other emotions that were addressed in the study [5]. In the study by Frederick et al. focus lays on parallax scrolling, only from a perspective that takes the users’ emotions into account. In addition to this, it is interesting to investigate how parallax scrolling effect the users’ reading comprehension, which still is a perspective that is about UX.

2.4. Cognitive Process in Relation to Web Design

The human brain is divided into two parts the left hemisphere and the right hemisphere. Those parts have the purpose to do different types processing. The left hemisphere is associated with analytic processing and is dealing with languages, logics, facts, etc. It is the left hemisphere that controls the right side of the body, while the right hemisphere is controlling the left side of the body. The right hemisphere is associated with perceptual processing and is dealing with visualization, imagination, creativity, feelings, etc [4]. While observing a website it is the left hemisphere that will process the written information and the right hemisphere that will process the images and the animations. According to a study by Durrani et al., while designing a website, by
strategically place the text within the visual field of the left hemisphere, which is in front of the right eye, and by strategically place images and animations within the visual field of the right hemisphere, that is in front of the left eye, it will help reducing the cognitive load of the users [4]. Which is good since the cognitive process capacity is limited [13].

2.5. Attention in Relation to Reading
Another relevant study by Mazzei et al., was partly about how the attentional process is related to the reading comprehension. An experiment was constructed where shift in attention was measured with an eye-tracking method. This was followed by a questionnaire with true or false questions in order to understand whether gaze shifts are in relation to reading comprehension. The result was at some level positive where gaze shifts between different types of information was positively related to the comprehension when it came to quick re-reading of a text [9].

All this may bring an interesting perspective to this work, where the animations can be viewed as a different type of information compared to the texts. That would mean gaze shifts between the texts and the animations could improve the reading comprehension if the users re-read the text. Why this research is interesting is because of the similarity to this work. Instead of entirely focusing on how the user paid attention to the text, this work will focus on how three type of animations in combination with text will affect the reading comprehension and find out whether the users pay too much attention on the animations, in a way that affects their reading comprehension negativity.

3. METHOD
In this work it is interesting to compare webpages using the three different animations to similar webpages without any animations. A cooperative user study in form of an A/B test is applied, where the participants are split into two groups contributing with opinions from different point of views. The user study is divided into two parts, an experimental part followed up by a questionnaire. This gives the method a mix of qualitative and quantitative value. In the experimental part the participants are testing four prototypes of different web-based user interfaces (web UI), which gather semiquantitative data about the users’ reading comprehension. The following part is a qualitative semi-structured questionnaire, with the aim to gain understanding about the participants opinions towards their performances from the experiments and the animations in general.

For the experiments, the four prototypes are created in Adobe Muse, which is a GUI website developing package. All the prototypes will be linked together as a single website, in order to fulfill a smooth transition between each experiment. That will provide the participant with the right prototype at the right time. The benefit of using Muse is that it provides an outcome of interactive websites without any coding. To be able to use already existing content from outer sources, the prototypes will only be viewed locally on one computer.

For the second part of the study, the questionnaire are created with Google Forms. It consists of six multi-choice questions and seven open questions. The questions are formulated in order to find out what the participants think about the texts and the web UI in each prototype, and the different animations that will be used. The goal with the questionnaire is to support the key question with qualitative valued data about how the animations affect the users as well as answer the subquestion, whether the users think of the different animations while using the webpages.

3.1. The Prototypes
The four prototypes are created in two versions that slightly differ. The first version (version 1), is using one of the three informative and storytelling animations while the second version (version 2) is created solid without any movements and animations. They are otherwise designed as similar as possible when it comes to layout, images and information, colors, and fonts. In total there are eight different web UIs. Since the study is an A/B testing, both groups will perform the experiments on almost the same web UI.

The aim of the different web UIs are to measure the reading comprehension in combination with parallax scrolling, background video and animated slideshows. In all the prototypes, the animations are strategically placed within the same view as the written information. (See Figure 1) All the eight prototypes are simple with no other interactions than scrolling up and down. They are constructed with one of the three different animations, or a replacing image, combined with a shorter text. Three of the texts that are used are found at the Swedish Council for Higher Education where they have been used as english reading comprehension tests as a part of the Scholastic Assessment Test (SweSAT). From SweSAT, one multi-choice question is included to each text. The fourth and last text is written by Mark Molloy, and published in The Telegraph. In order to be able to measure the reading comprehension, four multi-choice questions were created, with the questions from SweSAT as guidelines.

3.1.1. Description of Design Choices for Each Prototype
The first prototype is focusing on background video. In version 1, the web UI is designed with a full screen
Prototype number two is focusing on animated slideshows. In version 1, the web UI has a slideshow with the same width as the window, presenting three different photographs of St. Pancras Station taken within different years. All the images were found at Google image search with the search string “St. Pancras Station”. The images in the slideshow are showing automatically for two-seconds each. No other animated transitions are added and the images are completely binary showing. Under the slideshow there is a white text box, with the same width as the slideshow, presenting a text about St. Pancras Station in London. In version 2, the web UI is created as a copy to version 1, with the exception from the slideshow. Instead it is designed with one static image of St. Pancras Station in 1990, in the same format as the slideshow.

The third prototype is focusing on parallax scrolling. In version 1, the web UI is designed with all graphic elements in order to produce the layers it takes to create parallax scrolling effects. All the graphics were created in Adobe Illustrator as vector based PNG files. The design has a dynamic header of an elephant in the savanna that slightly changed perspective as the participant scrolls. It is followed by two different sections presenting the text called “Africa’s elephant problem”. One section is created with a slightly inverted parallax scrolling effect, with an elephant that moves the opposite way of the scrolling direction. In that section the main part of the written information is presented, divided into different sections, because the text was longer than the other texts. Since the parallax scrolling animations are requiring a lot of different graphics in different layers, version 2 of this prototype is slightly different. It uses the same color, fonts, and a similar layout as possible. The dynamic header is replaced with a still version of the same elephant picture, in order to maintain an equal layout. Without the parallax scrolling effect and all the layered graphics, the web UI becomes shorter and with slightly less graphics.

The fourth and last prototype is equal to prototype one, as it also focuses on background video. The difference between prototype one and four is the layout and the colors. In version 1, the web UI is designed with a full screen infinite GIF as background, picturing a night sky time lapse. The GIF was found on tumblr with the search term "night+GIF". On top of the GIF there is a transparent black text box containing a text called “Scientific Profs”. Instead of the text box being placed in the bottom of the view, as in prototype one, the text box is placed in the top left corner. In version 2 of this prototype, the web UI is created from a copy of version 1, with the exact same content, except from using a full screen, still image, from the GIF as background instead.

### Table 1. Prototype Setup Scheme

<table>
<thead>
<tr>
<th>Prototype Version</th>
<th>Animations</th>
<th>Background Video</th>
<th>Animated Slideshow</th>
<th>Parallax Scrolling</th>
<th>Background Video</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version 1</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Version 2</td>
<td>B</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

### Figure 2. Showing the distribution of the total amount of time that was spent reading and observing on the different prototypes versions, with and without animations.

Since the study is an A/B test, the participants are divided into two groups — A and B. To obtain as homogenous groups as possible, both groups consist of four men and four women. The distribution of ages provides group A with the average age of 20.9 years, and group B with the average age of 21.6 years.

### 3.2. The Procedure

Each participant will individually be involved in four short experiments, trying one version of each of the four prototypes. All the experiments are following the same steps, and are led by a moderator. The first task for the participant is to observe one web UI and read the text that is provided. The total time reading and observing is measured by the moderator. The second task for the participant is to answer one to four questions, regarding
something about the text. This procedure is then repeated four times. Afterwards the user study will be getting to part two, where the participants will be asked to fill out the semi-structured questionnaire about their performances and opinions toward the animations in the prototypes. The participants will fill out the questionnaire in the presence of the moderator, with the purpose to be able to prevent misunderstandings of the questions and in case the participants are in need to ask questions.

The procedure is exactly the same for both group A and group B. The difference is what version of prototypes they are using. Both groups will do the experiment on two web UIs with animations (Version 1), and on two web UIs without animations (Version 2). Group A will perform the experiment on background video and parallax scrolling, and group B on animated slideshow and background video. (See Table 1)

The instruction that will be given to the participants in the beginning of the user study is to observe and explore the web UIs for as long as they might need, and that they only are allowed to do so once, for each experiment. The participants will not be knowing the aim of the user study in advance, in order to prevent it from affect the result. While answering the questions about one text, they will not have access to the current interface.

3.2.3. Data Analysis and Measurement
The prototype setup scheme (see Table 1), is constructed in a matter where both group A and B will perform the experiments on both web UIs with and without animations. That way an analysis could be made both within the groups and between them. Since both groups will know the difference of using a webpage designed with and without animations, and therefore could obtain opinions about it.

The reading comprehension will be measured by number of correct answers. In each of the experiments one, two, and four there is one question. In experiment three there are four questions. The seven questions are all multiple choice questions, where the participants are allowed to choose one alternative, which will provide accurate measurement. The amount of time each participant will be spending on each interface will be measured with a stopwatch by the moderator, with an accuracy of two hundredths seconds.

When it comes to the analysis of the answers from the questionnaire, the answers will be grouped together by similarity in order to represent tendencies. Since the questionnaire contains of both multiple choice questions and open questions, the answers will have both qualitative and quantitative value. Though the number of participants are 16, only tendencies and trends will show in the result.

Table 2. Number of Correct Answers From The Reading Comprehension Questions

<table>
<thead>
<tr>
<th>PROTYPHE: background video</th>
<th>animated slideshow</th>
<th>parallax scrolling</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version 1 Animations</td>
<td>5</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>Version 2 no animations</td>
<td>7</td>
<td>3</td>
<td>24</td>
</tr>
</tbody>
</table>

Figure 3. Showing the distribution of the participants opinions regarding reading on the different prototypes with and without animations.

4. RESULT
In the following section the result of the user study will be presented. First some semi-quantitative statistics will be presented, which is how long time the participants spent on each prototype version and their result on the reading comprehension questions. Second follows the qualitative answers from the questionnaire, regarding the participants opinions.

4.1. Amount of Time Spent on the Prototypes
In prototype one, group A performed the experiment on version 1, with background video as animation. Together the whole group spent 260,48 seconds reading and observing the web UI, with an average of 32,56 seconds per participaton. Group B who used version 2, without animations, spent in total 296,90 seconds. Their average was 37,12 seconds per participant. This proposes that slightly more time was spent on version 2, without a background video. (See Figure 2)

In prototype two, group B performed the experiment on version 1, with animated slideshow as animation. Together they spent a total of 521,64 seconds, with an average of 65,21 seconds per participant. Group A spent together a total of 685,68 seconds on the version 2, their average was 85,71 seconds per participant. This also proposes that slightly more time was spent on version 2, without the animated slideshow as animation. (See Figure 2)

In prototype three, group A performed the experiment on version 1, with parallax scrolling as animation. Together they spent a total amount of 685,68 seconds with the average of 85,71 seconds per participant. Group B who performed the experiment on version 2, spent together a total amount of 521,64 seconds observing the web UI without animations. Their average was 65,21 seconds per participant. This proposes that slightly more time was spent on version 1, using parallax scrolling effects. In addition, compared to the other prototypes the participants tended to spend more time on prototype three, regardless which version that was used. Prototype three showed the biggest difference in time between the two versions. (See Figure 2)
4.2. the prototypes one and four added together, is equal to questions associated with background video, which are can be compared. The number of right answers for the video, the answers from all the three different animations answers from both the prototypes that used background the prototypes can be compiled. By grouping the correct comprehension questions belonging to each version of All the number of correct answers from the reading prototype, where animations were used.

In prototype four which also used background video as animation, group B performed the experiment on version 1. Together the group spent a total amount of 335.72 seconds, with an average of 41.97 seconds per participant. Group A spent together a total amount of 296.39 second on version 2, with the average of 37.05 seconds per person. This proposes that slightly more time was spent on version 1, with background video, which is the opposite to the result from prototype one. (See Figure 2)

Background video was tested twice, in both prototype one and four. By adding the results from those experiments together, the total amount of time spent on observing version 1 was 596.20 seconds. With an average of 37.26 seconds per participant. The total amount spent on version 2 was 593.37 seconds, with an average of 37.09 seconds per participant. This suggests that there was no clear tendencies on which version the participants spent more time on, when it comes to background video.

In order to compare animations with no animations, the total amount of time, all participants spent on all version 1 and all version 2 are calculated separately. The participants spent in total 27 minutes and 18 seconds on all version 1 combined together. This is compared to version 2, where the participants spent 24 minutes and 51 seconds. This proposes that in all the experiments there was no remarkable result of which version the participant spent more time on. However the participants tended to spend slightly more time on version 1 of each prototype, where animations were used.

4.2. Reading Comprehension and Number of Right Answers
All the number of correct answers from the reading comprehension questions belonging to each version of the prototypes can be compiled. By grouping the correct answers from both the prototypes that used background video, the answers from all the three different animations can be compared. The number of right answers for the questions associated with background video, which are the prototypes one and four added together, is equal to five for version 1, compared to seven for version 2, where no animations were used. The correct answers from the questions associated with animated slideshows are one compared to three, for version 1 and version 2. When it comes to parallax scrolling, the number of questions was four instead of one, which gives the result of 18 correct answers for version 1, where the animated effects were used, and 24 in version 2 where no animations were used. The total number of correct answers from the reading comprehension question, distributed over all version 1 and all version 2, is 24 to 34. (See Table 2) All this proposes that in total, the participants tended to get more right answers while answering questions about written information on a web UI designed without animations.

4.3. Opinions Form the Questionnaire
In the questionnaire the participants were asked questions about the prototypes, where the different versions using animations were compared to the versions without animations. One questions was: in which experiment the participant thought it was easiest to read and in which experiment was it hardest to read. Similar question was asked about understanding; in which experiment was it easiest to understand and in which experiment was it hardest to understand. The result indicated that eleven participants thought it was easiest to read from one of the prototypes using animations, compared to five participants who thought it was easiest to read from one without animations. Twelve participants found it hardest to read from one of the prototypes without animations compared to four who said one of the prototypes with animations made it harder to read. When it comes to understanding, equal amount, nine, said it was easiest to understand the written information on one of the prototypes using animations. They also said that it was hardest to understand the written information from one prototype without animations. Compared to seven participants who thought the other way around. (See Figure 3) By viewing the three different animations; background video, animated slideshow, and parallax scrolling separately, there was no distinct tendencies that showed one sort of animations made it easier or harder to read or understand. Regardless which version of the
prototype the participant used, they all had similar opinions on which web UI made it easier or harder to read and understand.

The participants were asked for the reason why they answered as they did in the previous four questions. The main reason why animations made it easiest to read was not because of the animations per se. Majority of the participant who shared that opinion said it was because of the text. Either that the text was simple or because it was divided into sections which made it easier to read. Among the five participants who said no animations made it easier to read, the main reason was because there were no distracting movements. When it comes to understanding of the written text, regardless of which version, 1 or 2, the participants used, the majority shared similar reasons. Nearly all participants thought the text was simple and since it was divided into smaller sections, they thought it contributed to better understanding. Even though, there was three participant that though helpful animations made it easier to understand. The 12 participants who thought animations made it harder to read, said that the main reason was because the animations became a distraction while reading. The main reason why four participants thought the other way around, was mainly because they thought the text per se was hard and that they therefore did not understand the context. That is also the same main reason why nine participants thought no animations made it harder to understand. The ones who answered that animations made it harder to understand said that the reason was because the text was hard, the animations were distracting or they spent too little time on that prototype.

The participants were in one question asked which of the four prototypes they preferred. Nine participants said that they preferred one of the prototypes with animations over seven who preferred one of them without. Five of them who preferred animations liked parallax scrolling the best, two liked background video the best, and another two liked slideshows the best. (See Figure 4)

Despite this, when the participants then got the question whether they in general prefer a web UI designed with animations or no animations, ten participants said they prefer a web UI with animations over six who preferred no animations. By the participants who preferred a web UI designed with animations, 31% of the participants said it was because animations made an website more fun. Although 25% also said that they preferred animations but it did not suit all kinds of websites. 19% of the participants also thought that animations did boost the understanding. The main reason why six participants in general preferred a web UI without animations was according to 83% of them because they thought animations were distracting. All the main opinions in decreasing order regarding animations are shown in Table 3.

The participants were asked to describe the animations from each experiment, as how they remember them. It showed that all the participants did remember all the animations, which proposes that all participants did notice all the animations as well.

5. DISCUSSION

Informative animations in web UI can both guide the user’s attention [2], that can help with the interaction which might enhances the understanding as well as they can distract the user [7]. The aim of this user study is to provide designers with information, that can help them to make good design choices. To find out if the three informative and storytelling animations: background video, animated slideshows, and parallax scrolling, used as design elements on websites affect the users’ reading comprehension. Is it a good decision to combine rich text with those types of animations, as they often are quite obvious and hard to not notice in a design?

By taking the structure of the human brain into consideration, and parts of the research by Durrani et al. [4]. The left hemisphere would processes the written information from the websites, while the right hemisphere would processes the animations. This means that the user needs to use both the hemispheres in order to process the websites, which might lead to increased cognitive load. The cognitive load is referred to as the amount of mental effort that is being used. Is it possible for the animations to fill the cognitive load? Since it is known that animations can distract the user’s attention [7]. The result suggests that the participants perceived one of the prototype versions with animations to be hardest to read from. The reason was because they thought the animations were distracting, and they could not focus on the text. This could have been due to increased cognitive load on the participants, but it was something that could not be measured in this user study.

One of the most common opinions regarding animations in general tended to be "Animations are distracting". For the participants to have that opinion they most likely have experienced badly designed animations in web UIs. Even though, this result was expected. Since background video, animated slideshows and parallax scrolling are all informative animations that are mainly in focus of a web design, make them hard to ignore and to not notice. The animations most probably will contribute to the feeling of distraction. Less than half of the participants shared this opinion, which is something to take into consideration, no matter how many are sharing that belief. The feeling of distraction is affecting the UX, and a great UX design does value the users opinions [4]

Another assumption that was made in the beginning of this study was that the animations would make the user spend more time on the webpage which would lead to better understanding on the written information. In contribution to this, the animations would also help with the understanding of the context. The result suggests that the participants tended to spend slightly more time on the prototype versions with animations compared to the ones without. However, the difference in amount of time spent is too narrow, no specific conclusions can be made. The assumption also suggests that animations would help the participants understand the text better. Looking at the results, in all experiments the participants got a higher number of correct answers on the reading comprehension questions, when reading a text from one of the prototype versions without animations. The difference of total number of rights answers between animations and no animations are showing the tendencies that a web UI with no animations provide the users with better reading comprehension. This strikes against the second assumption.
By only looking at the qualitative data, the result shows that the participants had split opinions regarding animations in general. About half of them would prefer an interface with animations because the main reason of animations is to make a website more interesting and fun. This is strengthening the result that was showed in the study by Pinhanez et al. where they found a desire of entertainment in websites. However there were some participants in this study who said that animations boost the understanding, which was also suggested in assumption two, but overall the second assumption is denied.

By viewing the three different animations independently, the biggest time difference between version 1 and version 2 of the prototype, was parallax scrolling. Even there the differences were not as significant as expected. By looking at the numbers of correct answers in experiment three, the version without animations contributed with higher number of right answers, which again strikes against the second assumption. The third prototype could be argued to be containing different types of information. Where the text was divided into sections, using different graphics and triggers for the animated effects. According to Mazzei et al. gaze shifts between different informations could improve the reading comprehension if the user re-read the text [8]. This would mean that by letting the participants re-read the text on the third prototype, it might have lead to a different result. Because the prototype allows the participants to shift their gaze, even though would have been hard to measure. Why the result may show this tendency, is because in prototype three the two different versions, 1 and 2, did differ the most compared to all the other prototypes. This might have contributed to different UX.

When it comes to the key question; how does background video, animated slideshows, and parallax scrolling in websites affect the users’ reading comprehension, it is hard to tell how it affect the user, since it requires quantitative answer. However the result shows tendencies that these kinds of animations affect the reading comprehension negatively. When a text is presented in the same sight as the animation, the user will most probably understand less and might as well feel distracted. This points out that this kinds of animations do not fit all types of websites.

5.1. Method Discussion
Since the method for this work was a user study in form of an A/B test of four prototypes, both the creation of the prototypes and the execution of the user study can be criticized.

5.1.1. Critics on the Prototypes
For each prototype both versions, 1 and 2, were created to be as similar as possible with only the animations as a separation. No specific consideration was taken when it came to the choice of font, font size, color, spacing, e.g. All those factors might have been contributing when it came to the results. The prototypes were designed for the two different versions to be as equal as possible. However, while the four prototypes were compared, they all used different colors, font sizes, layouts, e.g., except from the different animations that were used. That might have affected the result as well, especially when the three animations were compared to each other. It provided one animation with the possibility to have been perceived as more disturbing compared to the other because of the wrong reasons. Another reason why it would not be fair to compare the three animations is because the contribution level to the context differs, which could have been one reason why a certain animation is preferred over the others. Therefore it is concluded in this study that the different animations; background video, animated slideshows, and parallax scrolling, cannot be compared to each other.

5.1.2. Critics on the User Study
The user study was constructed in two parts, the experiments and the questionnaire. Starting with the experiments, while measuring time, there was human factors affecting the results. The participants gave a sign when they were done observing, then it was up to the moderator to stop the timer. That might have contributed with some delay from the reaction of the moderator. However in all experiments the same moderator was used, meaning the delay from the reaction time would be around the same for all participants.

The goal with the questionnaire was to contribute qualitative value to the result, since the feeling of distraction from animations most probably would be on an individual level and therefore it would be important to gather the individual opinions. The number of questions could have been higher, and providing more depth. One disadvantages with using a questionnaire, is that there is no way to ask more detailed follow up questions. Even though the moderator was participating the whole procedure, there was no possibilities of asking follow up questions.

5.1.3. The Contribution of the Participants
There was only 16 participants, with only eight in each group. This work could therefore classify as a qualitative study, though the number of participants is too small to classify this study as a quantitative study. Therefore it is in advanced called semi-quantitative. However this study have used a mixed method, where the low quantity of the quantitative data is balancing the low depth of the qualitative data.

In a qualitative research the background of the participants should be as wide as possible in order to get a broad view regarding opinions. The age difference and background are pretty much the same of all participants which might have a contributed effect on the result. Another contributing factor may be that English is not the first language for any of the participants which could affect the number of correct answers, while measuring the reading comprehension questions. The fact that one participant has dyslexia, might also affect the result. But since all participants were allowed to read and observe each prototype for as long as needed, as well as answering the questions in their own phase, dyslexia should not prevent the result. Each participant performed the user study on both interfaces, with and without animations. This one participant should not have negative impact on the result while looking at all the animations together. The only thing would be that it might slightly raise the time spent on two of the prototype versions using animations. But that would have been the same for the versions without animations as well, which would make this unessential.
5.2. Future Work
Since this study only had 16 participants, it would be interesting to enlarge the groups of participants in order to get a proper quantitative result. Also this work only focuses on informative animations that are used in storytelling and with informative purposes. It does not focus on the specific animations in detail and therefore it would be interesting to investigate further how different animations affect not only the reading comprehension but also the UX. Furthermore, it might also be interesting to do a similar study on micro animations or other kinds of animations that are less noticeable, because there is a large amount of animations that are being used in web design. Apart from doing a research about different animations, it might also be interesting to find out if the result might have been different on other platforms, to explore animations in relation to other kind of graphical user interfaces, since smartphones and smartwatches also requires GUI.

6. CONCLUSION
In this user study, four shorter experiments on prototypes of webpages measuring reading comprehension where done in relation to three different informative animations: background video, animated slideshow and parallax scrolling. The findings from the user study suggest that all these animations can contribute to a distracting feeling for the users. However, the three animations in this work cannot be compared together.

The overall conclusion is that all the three animations do affect the reading comprehension negatively, when the written information is in the same sight as the animation. However, a majority of the participants had a positive attitude towards animations and pointed out that the animations give the website a fun approach, and a boost when it comes to understanding the context. A suggestion is that designers still should use these kinds of animations since they bring an entertaining feeling to the UX, but should strategically place them separate from the written information. This also means that background video, animated slideshow and parallax scrolling do not suit all types of websites.

7. ACKNOWLEDGEMENTS
A special thanks to all the participants for volunteering, and to Anders Hedman for valuable comments and support.

8. REFERENCES