Master thesis

How online-based companies can strengthen the web usability test phase by looking at the cognitive workload of an online user

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Hvordan online virksomheder kan styrke deres usability test fase med henblik på den kognitive arbejdsbyrden fra en online forbruger

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ABSTRACT
How the processes of workload theories can strengthen online usability test phases

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The purpose of this thesis is to investigate how online companies can strengthen the web usability test phase by investigating the cognitive workload of an online user. In order to answer the research question it was necessary to employ both secondary and primary data in this report. Secondary data was collected by employing theories from the working memory, hereunder information overload, multitasking as well as the dual-process theory, that serves the purpose of investigation the process fluency. The primary data is collected through experiments that investigated the workload of an online user while performing a certain task from a landing page.

Research argue that usability testing today is mostly concerned with the conscious answers of participants. However, this paper argues that specific workload theories can contribute to a more accurate usability test phase for online companies by retrieving unconscious answers, which mean no interaction with participants during the experiments. The report provides the reader with information on how to retrieve this information by conducting experiments with framework from Sternberg and tapping tests.

Using Børnefonden as a case and example for this report the results suggest that the information workload of each participant was decreasing when provided with a reduced product text. The results also showed that multitasking, when reading a product text, seems to have an effect on the workload and the remembering of important information needed in the further decision-making process. Furthermore the results suggest that the process fluency has an effect on the reliability and sufficiency of a product text, depending on the length of the provided product text. This thesis gives online based companies insights on how to optimize the usability test phase when working with the workload for each online web user.
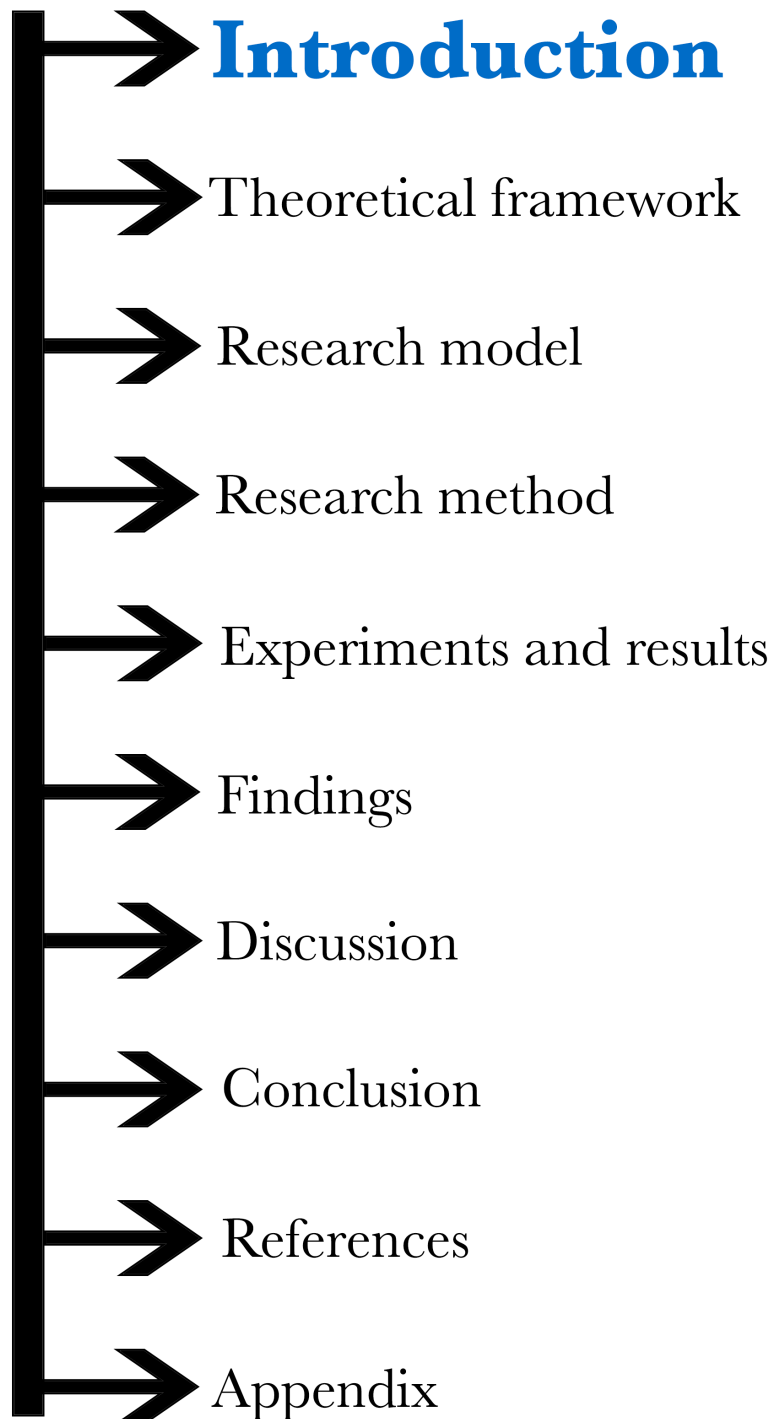
Keywords: Working memory, information overload, multitasking, process fluency, usability testing

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The Internet has become an integral part of our life and using the web for an everyday purpose is becoming more and more central to our lives. Today 93% of the Danish population has access to the Internet, and this number has increased by 24% point over the last 10 years. In addition, a whole 85% of the Danish population spends time on their computer every day (IT-anvendelse i befolkningen, 2014). Due to this increased use of the Internet it has become paramount for online business' to attract and improve the overall web experience. To do so usability is a key factor when evaluating and improving the "ease of use" of a website (Salvendy, G., chapter 46, 2012).

When conducting usability tests online companies can from this measure the difficulties one consumer might have when visiting their website. From the tests companies can establish the difficulties in a specific area for further improvements. However, measuring the ease of use is very challenging because all potential customers have different unconscious preferences that affect their web-use and thus their decision-making process. Therefore, the development of websites is getting extremely complex for online companies in their development of better websites that facilitate a positive decision-making process and lead to the action they seek. This paper will investigate the cognitive workload that influence the web user and thereby the" ease of use" in the further decision-making process.

Papers published since 1998 have frequently questioned the reliability when conducting online usability tests (Kessner et al., 2001; Molich et al., 2008). Findings in research when the same factors were tested produced different sets of problems. In this specific investigation more than 141 different problems where detected with only one usability problem in common among all problems (Ibid). Retrieving conscious answers from online users is not always enough, but interviewing the brain and the unconscious mind as well as determining the cognitive workload one user might have the possibility to increase the validity and reliability within the usability test industry, and will be discussed later on in the report.

One online website that is facing major challenges today is Børnefonden. Børnefonden aims to support more than 63.000 children from the poorest countries to brighten their future. Danish research has shown that it has become more difficult to access the mind of buyers, and that marketing expenses are rising, making the donations even more important than ever (Danskerne og velgørenhed anno 2013). This paper is based on websites from Børnefonden and will investigate the cognitive workload of web users in order to see how Børnefonden as well as other online businesses can benefit from these findings and thereby strengthen the web usability test phase within thie area of workload. Børnefonden is thus used as an example, which can be used by other companies that have an online presence, as the overall challenges when it comes to cognitive workload and decision-making will be of the same character.

1.1 Purpose statement

Based on the above introduction the purpose of this report is to examine how online companies can strengthen the web usability test phase when looking at the cognitive workload online web users experience in the modern world when surfing the web on their PC/Mac. This paper will focus on the working memory and the dual process theory as well as combining these factors with visual content and the concept of multitasking. The report will pay great attention to the unconscious factors, in order to investigate if this produces more accurate conclusions in the usability test phase.

1.2 Research question

The above explanation is leading to the main research question. The research question that will be examined and answered is:

How can online-based companies strengthen the web usability test phase by looking at the cognitive workload of an online user?

The contribution of this research will sheds some light on the relationship between the usability test phase and the applied theories in order to create a better usability test

phase when working in this specific area of usability. This research will frame and give ideas on how to develop new, or improve existing strategies in order to create clean and up to date webpages that follows the trends and the user's ability to search the Internet without increasing a companies bounce rate.

1.3 Limitations

Focus on PC

The field of usability testing has a variety of divisions, and it is therefore important to limit the scope, in order to answer the research question and the hypotheses. In 2013 88% of all Danish families had a PC in their household. 99% of all households had access to a PC. (IT-anvendelse i befolkningen, 2014). Therefore, it has been decided to only focus on applying the concept towards websites for PC. This channel is chosen because of the huge potential for improvement among online platforms. The choice of only focusing on one channel has been made to not confuse the reader and the researcher through out the process, and limit the scope.

Narrowing the choices of methods

When looking at the ease of use, and the web usability process, a lot of factors like accessibility, point of gaze, colors, etc. could have been investigated, but this report will investigate how focusing on the workload of an online web user can help companies improve the web usability test phase. The report will therefore be looking at specific methods that benefit the scope of this report.

Population

Since the report use statistical facts about the Danish population, the report is only focusing on the Danish population. The results might be converted and used in other countries, but is it important to adjust the hypothesis for the specific culture in order to retrieve valid and useful information.

Case choice

Børnefonden will form the framework and basis for experiments. Anne-Mette Krøyer, Corporate Relations Manager is very exited to receive suggestions on how to improve their usability test phase. It is important to stress that the experiments could have been done on all other websites, but has been chosen because of personal interest as well as common interest for the people and countries that are not as fortunate as many other people in the world. The company has furthermore been chosen to cast a light on their work, and to hopefully improve their current usability test phase, and thereby attract more donations.

1.4 Document structure

This section presents the document structure for the reader. The section will provide the reader with a good overview of the report, and the illustration can be seen hereunder:
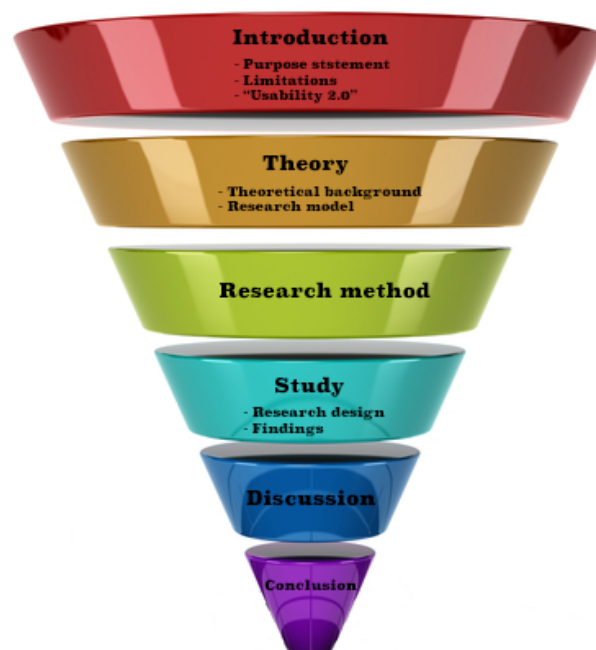
Figure 1.0 – Document structure. Redesign made by author

Model found here: http://www.sundaymag.tv/creating-easter-west-ridge/

The report has been divided into 6 sections. The first section presents the introduction, which will start off by introducing previous research and findings in order to state the research question. Hereafter the limitation of the report is found, in order to explain

why certain factors have been left out, and which factors will be more prominent. In order to illustrate how businesses are conducting usability tests, and where the market is going, a "usability 2.0" section aims to give the reader a quick overview of the factors that are present today, and which factors that influence the market today.

The Report will hereafter go straight to the theory section. In order to investigate how online-based companies can improve the usability test phase by looking at the cognitive workload it is important to introduce the theory and methods that will pose as the form for further research in regards to the objective of the report. The reader will learn how the working memory effect the human brain, how the dual-process theory can tell you about the process fluency as well as the visualization in which humans tend to focus a lot on. These theories will later on be used in the experiment section, in order to investigate the hypotheses that will be formed in the report. The report will next be focusing on the research model. This is where the hypotheses are formed. The section will go into depth on how the chosen theories can contribute to the best possible conclusions from the report.

After stating the hypotheses, the research method is presented in the third section. The report will be using the research onion by Saunders as a framework, as we peal of layers in order to uncover the research choices for the report (Saunders et al., 2008). The section will be focusing on choosing the research philosophy, defining the research approach, introducing the research strategy and the research choices, as well as establishing the instrument design, the data collection and finish it off by touching the validity and reliability of the report. Here the researcher will explain the difficulties of working positivistic reports in regards to validity and reliability.

The fourth section presents the results from the data collection. The report will showcase a rather rare structure since the research design will be presented in this section instead of the research method section. This has been decided in order to bring it all together, and to first introduce the sections, when the reader reaches the

findings. By employing this frame it aims to provide the reader with a better overview of the report, and the overall structure. Further on in this section the report will present the findings from the experiments. The researcher will, after using the right theory conduct different statistical data, in order to form a conclusion based on the findings.

The fifth section presents the discussion. After highlighting the findings, this information will be used in order to start an objective discussion on how the information can be used in the industry, and further gives an idea of the limitations and obstacles there might be when conducting such experiments.

The conclusion forms the six's and final section and serves the purpose of summarizing the arguments from the report, and to draw the final conclusions from the report.

As described in the introduction usability have raised questions about the reliability when conducting an online usability test. The following section aims to discover why online companies need to place great emphasis on the workload of an online user when conducting usability tests in the future. The section acts like a foundation and argumentation for the further development and improvement when conducting web usability tests, which is why the section is called "usability 2.0".

1.5 "Usability test 2.0"

Research done by Rolf Molich has helped online companies to better understand the limits of even the best usability test methods (Molich et al., 2008). Rolf Molich arranged the same usability program and included four laboratories. The aim was to discover the very different ways and angles, these laboratories carried out the testing phase. This research found that some of the labs found very few usability problems (4), while other laboratories found many more (98) (Ibid). A graph hereunder shows how different results the laboratories got:

Usability Laboratories	A	B	C	D
Usability Specialists	2	2	1	3
Number of Tests	18	5	4	5
Problems Found	4	98	25	35

Figure 1.1 – results from laboratory A,B,C and D. Source: Molich et al., 2008

Further research created a follow-up test to determine if the results were unique, or could be replicated. This time seven professional usability laboratories were to test a well known website, Hotmail.com. After looking through the report the same pattern showed and some labs found very few problems (10) whereas other laboratories found a lot of problems (150) (Molich et al., 2008). A diagram of the second test can be found hereunder:

Usability Laboratories	A	B	C	D	E	F	G	H	I
Usability Specialists	2	7	1	1	3	1	1	3	7
Number of Tests	7	6	6	50	9	5	11	4	6
Problems Found	26	150	17	10	68	75	30	18	20

Figure 1.2 – result from the second test round. Source: Molich et al., 2008

Later, Kessner wanted to retest what Molich already did, by focusing on creating some rules for the laboratories before conducting any research (Kessner et al., 2001). Six laboratories was participating, and the rules was as flowing (HFI, 2015):

- Testing a prototype that had not yet been used by actual users,
- Limiting the issues to be evaluated to five questions specified by designers,
- Focusing exclusively on usability issues (excluding all marketing and other issues),
- Having two evaluators group similar observations into categories of problems that were essentially the same, and
- Using only professional usability teams (no student teams).

From a possible 117 "usability problems" reported by the laboratories, 31 were excluded as being a "non-usability problem". This research showed that every team found none of the same usability problems, and the majority of the usability problems (44%) were found by only one team (Kessner et al., 2001).

While usability is still a key factor when developing an effective website design, it is no longer enough, and the next big wave in site development designs for persuasion, emotion and trust. Usability has today become the price of competition, and is an effective way of setting yourself apart from competitors. Today, usability testing is more about providing users with the right amount of content. The reason for wanting to improve the web usability test phase is to create a more precise buying decision process. If companies can control and better understand the needs of the user, it might be possible to create better brand loyalty and trust.

To better understand how usability testing can be improved, the section below explains and provides the reader with insights from the brain of the human. The section aims to illustrate how the human brain works, and serves to create a foundation and a better understanding in the further process of this report.

The 3-brain of a human

Web experience is highly influenced by the unconscious thoughts and actions that are controlled by the human brain (Weinschenk, 2009). Online users prefer things that are easy to process, so when provided with too much information or bad visual factors, the human often loses focus, and find themselves searching for another website that is more simple and easy

The 3 brain. Source: Weinschenk, 2009

to access and process. The user evaluates websites that have better colors, are distinguishable from their background, and focus more on easier readable fonts as

being more attractive. This is where usability has the power to improve a website when looking into the brain of the human.

The oldest part of the human brain, called "old brain" deals with our survival. The old brain is constantly and unconsciously looking at the environment around us, deciding what is safe, and what isn't. This part of the brain takes care of the automatic things as breathing, movement and digestion (Weinschenk, 2009). The "mid brain" is where all of our emotions are processed. This part of the brain causes you to feel things, and is described as being the root to all impulse buying, and is a very important part of the brain to consider, when creating usability tests (Ibid). Lastly, we have the "new brain (Cortex)", which is the most recent structure, and what separates us from animals. This part of the brain manages the language processing, speech, reading, playing music, listening to music, thinking thoughts and planning (Ibid).

Most of the old and mid brain activities occur outside our conscious awareness, and this is the area of the brain where researchers can retrieve much more valid information, since the human cannot control these aspects. A recent imaging and neuropsychological study suggested that the unconscious processes take place hundreds of milliseconds before the conscious awareness (Berlin, 2011).

In traditionally usability testing there are several ways of creating a usability test, which among others could be:

- Hallway testing
    - o Random people test your website and give feedback to the researcher. Here the participant expresses their conscious opinions.
- Focus group
    - o Sets of people have a conversation with each other, about their experiences and expectations. Here, participants might get a collared mind from hearing good or bad things from other participants.
- Thinking loud

- Participants navigate around the website while speaking out their thoughts to the researcher.

Common to these methods is that the respondent always gives a conscious answer. If research suggests that the unconscious processes takes place hundreds of milliseconds before the conscious awareness, researchers can by interviewing the brain instead of getting conscious answers retrieve information the human itself did not know.

The next section provides the reader with information on how online based companies try to improve the validity of their usability test phase by using modern methods, which in this section gets its inspiration from the field of neuroscience, and lay a special focus on the unconsciousness of usability testing.

1.5.1 Traditional consumer persuasion

For a long period of time companies have created promotions towards customers in order to provoke a specific action like a sale, etc. Through the *screening* process, targeted individuals are presented with specific stimuli, and the feedback is later on collected to refine the stimuli attack. In the *intervention* process the targeted individuals are exposed to the resulting promotions, and their cognitive and affective processes are activated. Behavioral intentions are in this stage formed. The *outcome* process shows whether or not a purchase occurs. The process also includes the consequences to the exposed individual, and can be described as negative or positive. This model does not invade the private thinking and rely only on the opinions and feelings of the targeted individuals.

The rest of this section illustrates how new technologies from psychology and neuroscience can be blended into methods that are already being used in order to persuade the online user in the buying decision process, and to improve the online usability test phase towards the online user.

1.5.2 Preferences in Consumer Persuasion

The traditional consumer persuasion has quickly developed to be more invasive, and companies like Tesco, Britain's largest retailer and Coca-Cola already use these strategies (Wilson et al., 2008). When looking at the *screening* process it employs a loyalty card program to record the purchasing behavior. These data are then used to design promotions, which is targeted to specific clusters of individuals. This data is being used to enhance the persuasion effort, and provide the web user with a better user experience.

In newer times, neuroimaging has been brought to the *screening* phase (Wilson et al., 2008). Instead of introducing loyalty cards and "interviewing" the conscious mind of the user, companies employ unconscious aspects into their web usability strategies. During the *intervention* phase, the persuasion attempts are created based on brain scans of future potential users. If the user creates a positive view towards the products it activates areas of the brain, which is associated with pleasure and rewards. This could potentially lead to a purchase.

As with the previous section, the *screening* process consists of groups of customers. The *intervention* is, however directed to only individuals. This allows researchers to discover the impact of different stimuli when entering a specific website. This admits researchers to target consumers directly, based upon the brain scan. The insights of the stimuli will create a more sophisticated picture of the customer, and thereby making sure that the usability and the ease of use is customized to its fullest.

These four sections illustrate how persuasion and the thinking of usability have evolved, and how websites can leverage from this information. Creating a better usability test by looking at the cognitive workload of an online user could have a positive reflection on the ratios which have the possibility to create a better website and company.

1.6 Summery of the "Usability 2.0"

The previous section was intended to illustrate the need for the development of new methods within the usability test phase, and to cast a light on how to improve the validity by using inspiration both from neuroscience and the cognitive workload areas. The section highlighted the fact that web experience and usability is highly influenced by the unconscious processes and actions that are controlled by the human brain. The 3 brain of a human provided the reader with insights into the processes behind the unconscious process. The section also argued that professional usability laboratories have a hard time defining the same usability problems leading to incorrect or misleading conclusions. The industry is moving from a traditional consumer persuasion process where targeted individuals are presented with specific stimuli, and when the feedback is later on collected to refine the stimuli attack, to an individual persuasion model process where the focus is about the impact the specific stimuli have on the specific individual. "Usability 2.0" showed that because of the diversity among humans, targeting on the individual scale can provide companies with more accurate conclusions and provide online-based companies with broader insights on how to target and perceive a product and brand. The following section looks further into the theoretical framework, and aims to explain certain phenomena relevant for this report. The section also aims to help develop the hypotheses.

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Appendix
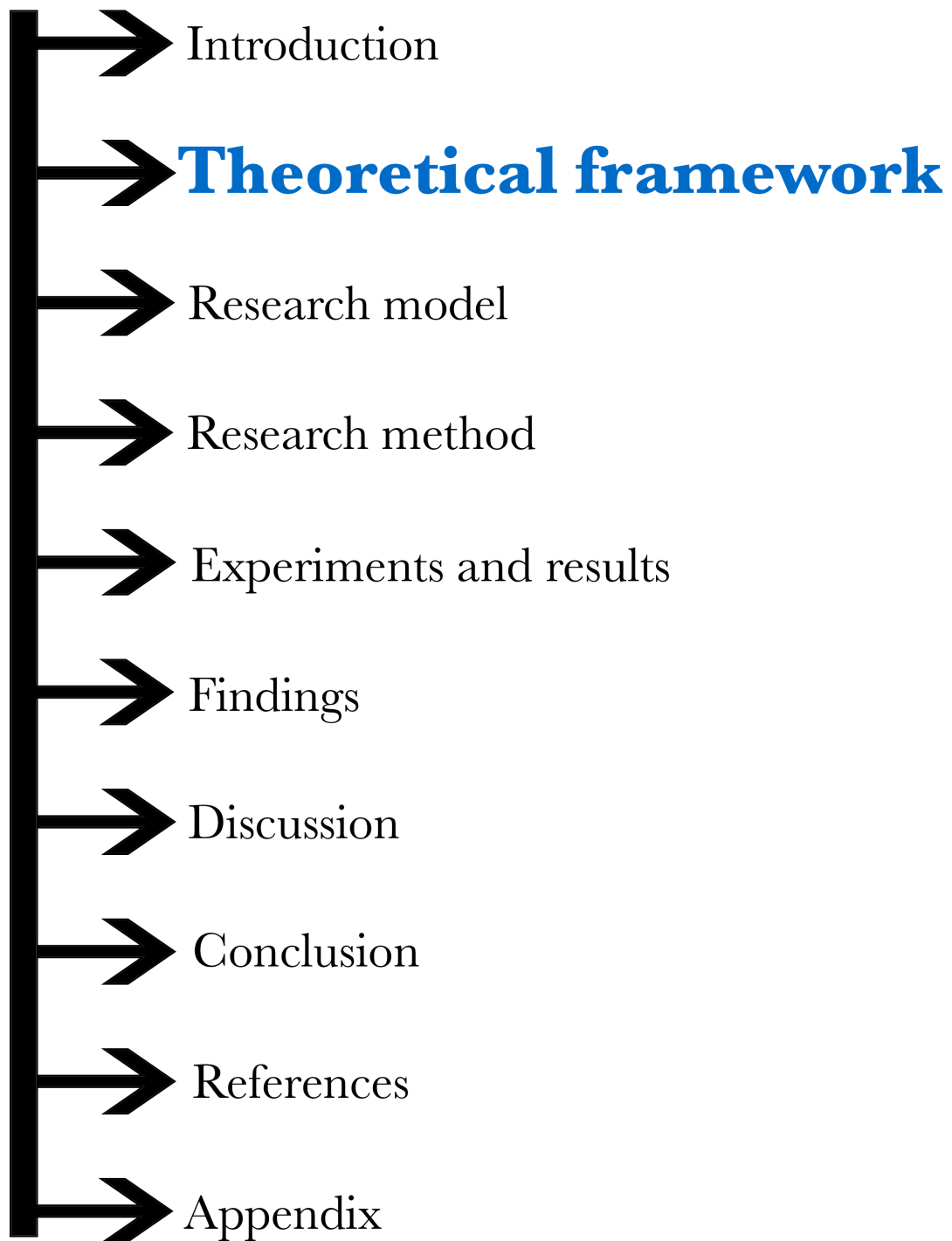
This section provides the reader with a presentation of the theory, which serves the purpose of explaining a certain phenomena that might have an effect on the further process of the report. The theories will furthermore be the stepping-stone to the development of the hypotheses. The chosen framework is used to ensure quality of the data analysis, as well as a guidance for the reader in order to make sure enough information about the topic is given.

This section begins with a presentation of the working memory, which will acts as a recurring theme throughout the report.

2.1 The working memory (Cognitive load measurement)

What is working memory exactly? Is it the ability to remember a product you just saw online at a cheaper price elsewhere? Is it the fact that you don't think when you take a walk in the park? Maybe it is both? This report focus among others on how human process information and what happens when we are presented with too much information. To investigate how the cognitive workload of an online user can both retrieve better insights and strengthen the web usability test phase the report are looking further into how humans process information.

We find the working memory in the frontal cortex of the brain, which is a system that is used for temporary storage and manipulation of information (Smith, 1999). The working memory includes two components: (1) the short-term storage, (2) executive process that operates on the contents of storage (Ibid). The working memory controls among others cognitive task such attention, finding your way around, completing tasks and remembering simple things in your everyday life (Klingberg, 2009). Consumers are not able to store much information in their short-term memory, mainly because humans are bombarded with information when searching the web (Nielsen, 2009).

Measuring the cognitive load can provide companies with insights about the design, provided information or ascetical features. The human brain was basically the same as

10.000 years ago, and is of obvious reasons not wired to use computers, driving cars, etc. This is why methods from the working memory has the potential to improve the usability test phase in order to establish how the attention and remembering of information can be improved to create as little noise as possible for the human brain. The working memory also deals with the long-term memory storage where memories and experience are stored. If the working memory storage is exceeded it causes a so-called "information overload", which will be explained later on in this section. The ability of solving problems on the cognitive front depends on the information a human can retain in the working memory (Kyllonen, et al., 1990). When provided with too much information essential information will most likely cause the user to leave a certain website, because of poor usability (Jacoby, 1984). A European research establishes that the Danish population has acquired new media habits, and that online users tend to multitask, whenever they're online (Christensen, 2014). This comes with usability issues, which are explained in the section below.

Researchers furthermore estimate, that a human with a full time job in average waste 28% of a 8 hour working day on inefficiency because of multitasking (Ernst, 2015). This information leads on to the next section, which will be presenting the concept of multitasking. This theory has been chosen because of the high pressure web users experience when surfing online while juggling other devices, like a mobile phone, watching TV, etc. The section argues for what happens when doing too much at the same time.

2.1.1 Multitasking

The expression "multitasking" means the ability to perform more than one task at the same time in our working memory (Rosen, 2008). For example, when you read about how you can donate money for new toys on Børnefondens website, while texting a friend on your iPhone. The human is not programmed for multitasking and in fact, the more people try the worse they perform a certain task. 98% of humans are believed to

underperform when multitasking, and only two percent of the population can claim the prize as being a "supertasker", according to David Strayer (Loria, 2014).

A study showed that when participants did task in parallel it took 30% longer and made 50% more errors than participants who completed the same tasks in one sequence (Dux et al., 2006). The human brain is simply not wired to perform two activities at the same time (Ibid). Another study done by Glenn Wilson, found that the problem solving skill of people dropped by the equivalent of 10 IQ points when multitasking (Morris, 2009). Furthermore the stress level rose, making the attention to the user decrease significantly (Ibid). Furthermore research argues that online users who were multitasking were the worst at ignoring irrelevant information. Additionally the respondents scored lower in short term memory tests (Ibid).

According to Dave Crenshaw the damage itself happens in the "switching cost" process, when switching from one device to another while still staying focused. Companies cannot control the use of multitasking, when users search online, but they have the ability to simplify the design, etc., making sure that online users perceive the provided information better. The following section provides the reader with an overview of what happens when a user is provided with too much information, getting into information overload, which in many cases can damage the overall experience when visiting an online webpage.

2.1.2 Information overload

Information overload, or information entropy happens when messages or text are not well organized to be easily recognized as significant information (Hiltz et al., 1985). When developing a usability test before launching of a webpage companies must take into account the amount of text in order to prevent an information overload of the user. This process of information overload is shown in the figure hereunder:
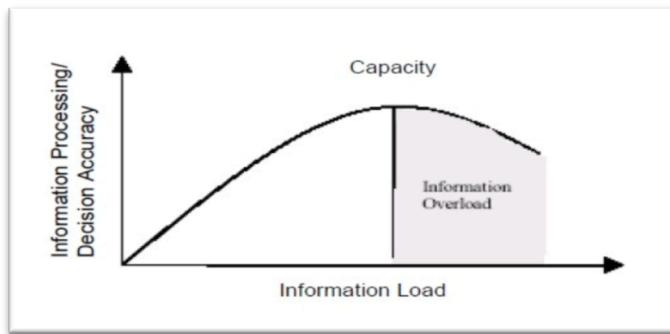
Figure 2.0: Consequences of information overload. Source: http://www.excelcharts.com/blog/fibonacci-working-memory-and-information-overload/

The figure describes and demonstrates how the quality of a decision improves when given the right amount of information. Any given information after this point will cause information overload and thereby decrease the quality of the decision (Schroder et al., 1967), which could cause a potential loss in a purchase and increase in bounce rate. This is a factor in which are going to be examined closer in this report, in order to provide the user with an increased user experience, and a better usability test phase for the development. Several things can cause information overload using a website:

Distraction

- Pop up banners/pictures etc. during the intake of information.

- Distractions as telephones, people speaking or listening to the TV.

Engaging in demanding tasks

- Trying to calculate the final price, while reading the terms of delivery and try to find the "add to basket" button

Holding on to too much information

- Remembering the size, color, specific model and the buying terms when shopping online

There are consequences of sending the user into information overload, and the section below explain those consequences online based companies face when not evaluating information overload.

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2.1.3 Consequences of information overload

Websites that provide users with poor usability might not succeed in making sure the user perceives the provided information, which end up being lost forever. Information overload will cause errors as well as lowering the comprehension and performance. The only way to retrieve the data again is by restarting the process, which might lead to an early exit and an increasing bounce rate. Online users allocate resources to various tasks when they decide to click on a link. The table below shows the cognitive resource allocation, and how an online user might go into information overload:

| A | Initial question | Navigation | Understand content |

| B | Initial question | Navigation | Understand content |
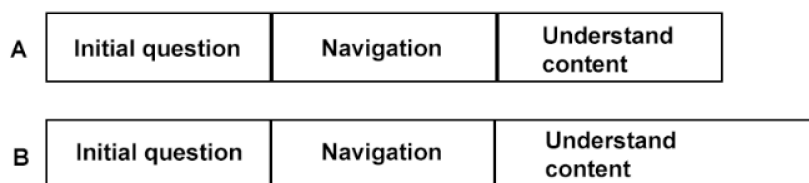
Figure 2.3 – allocation of resources. Source: Albers, 2011.

Figure "a" illustrate a well organized website, where the online user is allocating the right amount of cognitive resources. Figure "b" shows an extension of the cognitive allocation, which is caused by poorly understanding of the content. This could potentially cause the user to leave the website, or find other options.

These are aspects that must be taken into consideration when developing the usability test. By using methods from the working memory and by measuring the cognitive load and allocation online companies can increase its web usability. By looking at the cognitive measurement and thereby getting unconscious answers might increase the performance of a website, since the researchers are now looking directly at the instinct answers instead of the conscious answers. The report is later answering the proposed hypotheses, which includes the working memory and will be tested on choosing participants.

2.2 Summary of the working memory

This theory argued that the working memory function as a system in the brain that stores information for a limited time frame, when users perform a certain task. Humans are not programmed to store much information mainly because of the information overload. The section established that information overload happens when a message or information is not well organized or easily recognized. Whenever a company provides the user with poorly usability the information will be lost forever until the user is exposed to the information again. The section furthermore recognized that the human are not wired to multitask, and only two percent of the human population is believed to be a "supertasker". Previous research argued that humans in a full time job in average waste 28% of an 8-hour workday because of multitasking. Furthermore the reader was presented with research that argued that people who are multitasking has a drop equal to around 10 IQ points.

Further on the report are looking further into the dual-process theory that is believed to have an influence on the decision-making process and the usability test phase. The theory will cast a light on the perception and learning of the information given to a human as well as provide the reader with facts and reflections on why this specific theory can be employed when conducting and strengthening the usability test phase for online companies operating on a PC.

2.3 Dual-process theory

This theory has previously been used in decision-making and psychology learning (Carlston, 2013, Chapter 14, Dual Process Theory), and can easily be used in the field of usability testing, since the aim of usability is to guide the user to a better user experience and to make a decision, which benefits both the user and the company. The theory explains the different levels when processing information as an individual. The dual-process theory is closely related to the working memory, since system 2, which is going to be explained in a bit, requires access to this area.

The dual process theory divides the processing into two pathways, which is "system 1" and "System 2". System 1 processes information fast and automatic. The process is unconscious and the human is not in control of this process. System 2 processes information very slow and voluntary. The human is in this system aware of their decisions, as it happens on a conscious level. The working memory is being used in system 2 to process the actual information. The information being processed here is more detailed than systems 1 (Carlston, 2013, Chapter 14, Dual Process Theory). Some of the key differences from system 1 and 2 are illustrated in the figure below (Evans, 2008).

System 1	System 2
Unconscious	Conscious
Implicit	Explicit
Automatic	Controlled
Low effort	High effort
Rapid	Slow
Holistic	Inhibitory
Shared with animals	Uniquely human
Nonverbal	Linked to language
Independent of general intelligence	Linked to general intelligence
Independent of working memory	Limited by working memory capacity

Figure 2.4 – Difference between system1 and 2. Source: Kahneman, 2011

However various researchers look at this process at different ways, and the figure below highlight how different this process can be looked upon.

References	System 1	System 2
Fodor (1983, 2001)	Input modules	Higher cognition
Schneider & Schiffrin (1977)	Automatic	Controlled
Epstein (1994), Epstein & Pacini (1999)	Experiential	Rational
Chaiken (1980), Chen & Chaiken (1999)	Heuristic	Systematic
Reber (1993), Evans & Over (1996)	Implicit/tacit	Explicit
Evans (1989, 2006)	Heuristic	Analytic
Sloman (1996), Smith & DeCoster (2000)	Associative	Rule based
Hammond (1996)	Intuitive	Analytic
Stanovich (1999, 2004)	System 1 (TASS)	System 2 (Analytic)
Nisbett et al. (2001)	Holistic	Analytic
Wilson (2002)	Adaptive unconscious	Conscious
Lieberman (2003)	Reflexive	Reflective
Toates (2006)	Stimulus bound	Higher order
Strack & Deustch (2004)	Impulsive	Reflective

Figure 2.5 – labels attached to the dual process theory in different literature. Source: Evans, 2008

Psychologist Daniel Kahneman state that system 1 gets us through the day, and help the human perform most tasks during the day (Kahneman, 2011). System 1 has the ability to create complex patterns of ideas, based on the experiences of the human, and thereby solve the problem, but system 2 takes over when trying to construct the ideas into steps. When performing system 1 activities it requires no to little effort. The human are born with the skills from system 1 and we are with this system able to recognize objects, avoid loses and orient attention. As the human keeps acquiring new experiences and practice, system 2 will with time become more automatic as well, but still be processed by system 1. When learning how to read, this takes up a lot of effort to understand the words and make a correlation between them, but when we become more skilled, this process happens automatically. The theory can benefit online-based companies in the sense, that being able to provide the online users with simple text could result in a better processing fluency, and thereby create a better decision-making foundation and increase the sufficiency and reliability of online content. The section below argues about the experience of an online user, and why this is an important factor to take into account when trying to strengthen the workload of an online user in the modern world of online technology.

2.3.1 Acquiring experience

Like every human getting experience within a certain area makes us improve our skills. After some time, the mental effort becomes intuitive. Most people spend hours engaging on online platforms, and this makes us very good at filtering the right information. I happen fast and over time the activities from system 2 becomes a part of the activities in system 1, where most of the process fluency takes place unconsciously. Complex tasks and low experience will cause a poorly processing fluency and a higher cognitive load, causing the online user to make an error. Taking these factors into account can both strengthen and prevent a certain bias to the decision, and make sure that the usability test phase is more accurate. The dual process theory helps to understand the rational thinking and decision-making process

of a human, and is something online websites can take into account when strengthen the usability test phase.

2.4 Summary of the dual-process theory

We can from this section conclude that the dual-process theory contributes to the decision-making and the psychology learning area, making this theory relevant to the report since the aim is to find methods that can strengthen the usability test phase. The theory deals with the different levels when processing information, and is closely related to the working memory. The section furthermore explained system 1 and 2 where system 1 is processing information fast and automatically on an unconscious level, where system 2 process information very slow and voluntary. Previous research also concluded that when humans acquire new experience and practice, system 2 is becoming more automatic by time. The section also presented the reader with views from other researchers, that view the theory different, which only conclude that the theory can be looked upon very differently, and for many purposes. The section also highlighted the increasing engagement in online platforms, which contributes to an increased and improved experience learning as well as being able to filtering irrelevant information. The section aimed to provide the reader with information on how the theory can help to understand the rational thinking and decision-making process that is required when conducting usability tests.

The next section aims to investigate the visualization and the emotional factors that have the power to catch the attention of a human. The section will from previous research investigate why visual content can contribute to a strengthening in the usability test phase, and has been included in this report in order to investigate if online-based companies can take advantages of the visual interest of the human.

2.5 Humans are visual

When buying a product online, nine out of ten times it is not something we need, but something we want. The divide between what users are saying and how they actually behave online have confused marketers for decades (Online-behavior.com, 2015). This is a factor company's take into account when creating web usability in order to persuade customers to make a purchase (Morris, 2012). In order to improve usability test when using visual content, it is important to understand the concept of emotion, since the human in many aspects acts on emotions. There has been argued a variety of different opinions regarding the importance of the emotions. Duffy, 1962, has argued that emotions are unnecessary for the science of behavior (Izard, 1977). Others have argued that the activation of arousal has other explanatory power and that the concept of emotions is less confusion (Ibid). Tomkins, 1962 however, believes that the emotions constitute the primary motivational system of human being (Ibid).

Most theories have already acknowledged that emotions aren't a simple phenomenon, and cannot be described by having a person describe a certain experience. Emotions vary from person to person, and are never the same (Izard, 1977). C. Izard argue that the correct definition of an emotion must take into account three aspects: "

1. *the experience or conscious feeling of emotions,*
2. *the processes that occur in the brain and nervous system,*
3. *and the observable expressive patterns of emotions, particular those on the face."*

Most people are aware of the situations that trigger a certain emotion. Seeing one's beloved after years of separation, getting angry when being insulted or laughing when hearing a funny joke. However, scientists do not agree on how an emotion is created in the human brain. Stanley Schachter argues from his "two factor theory" that emotions are a united function between physiologically arousing and a person's appraisal of the specific situation, and can be defined from theories within the cognitive theory of

emotions (Reisenzein, 1983). Another scientist describes appraisal as a set of cognitive the s and an intuitive automatic process (Izard, 1977).

Silvan Tomkins argues that emotions are activated by the changes in the neural stimulations and the number of neurons firing per unit of time (Scherer and Ekman, 1984). The idea behind the theory state that the factors that change the density of neural stimulation go beyond the cognitive concepts of appraising. Tomkins also argues that the activation of emotions can occur from seeing an image, other emotions, or a state of mind (Izard, 1977). When a human is having an emotion, or thinking about a certain thing, we think in pictures (Weinschenk, 2009). This questions the power of pictures and emotions, and argues for why this report is looking at the workload of a web user combined with pictures. If humans visualize everything in pictures, this approach might improve the remembering of the provided information, and thereby improve the web usability. The section below explains the Pictorial superiority effect, and how humans tend to visualize.

Pictorial superiority effect (PSE)

Human understands things better if we visualize them. Have you ever noticed that when you think about a story, you think in pictures and visual images (Weinschenk, 2009)? The visual part of the brain takes up 50% of the processing power, so it doesn't come as a surprise that the human remember visually things much better than anything else (Ibid). Research done in the 1960s argue that the visual memory for the visual information is vast, and that people can with 90% accuracy remember more than 2500 pictures (Ibid). John J. Medina furthermore argue that humans can remember picture a year after with an accuracy of 63% (Medina, 2008). The same study also showed that test subjects were able to remember pictures decades later (Ibid). This information is in contrast to what the human hear or reads. Research shows that only 10% is remembered when hearing or reading something without pictures (Weinschenk, 2009). Previous research establishes that when being exposed to a face, the human spend around 40% of their time looking at the eyes, and the direction in

which they are looking. If a face and eyes have such power, the usability industry might leverage from this research since pictures of humans could draw attention to factors set by the company, which could be a certain text or a button. The report will in the hypothesis development look deeper into the effect of PSE, and are furthermore going to be evaluated in the findings section.

2.6 Summery of the visualization

The section investigated how online companies are having a hard time understanding what users are saying compared to what they actually do. The section investigated the different ways to understand the concepts of emotions, which have an important role in the visualization aspect of usability. This paper found out that every human is a visual creature, and understand things better when visualizing. The visual part of the brain takes up 50% of the processing power and the section also argued that previous research argued that a human could after one year remember specific pictures with an accuracy of 63%, and only 10% when hearing or reading something without pictures. The section also recognized that the human spend around 40% of their time looking at the human face and the direction of their eyes, making faces a possible attribute to the existing usability test phase process.

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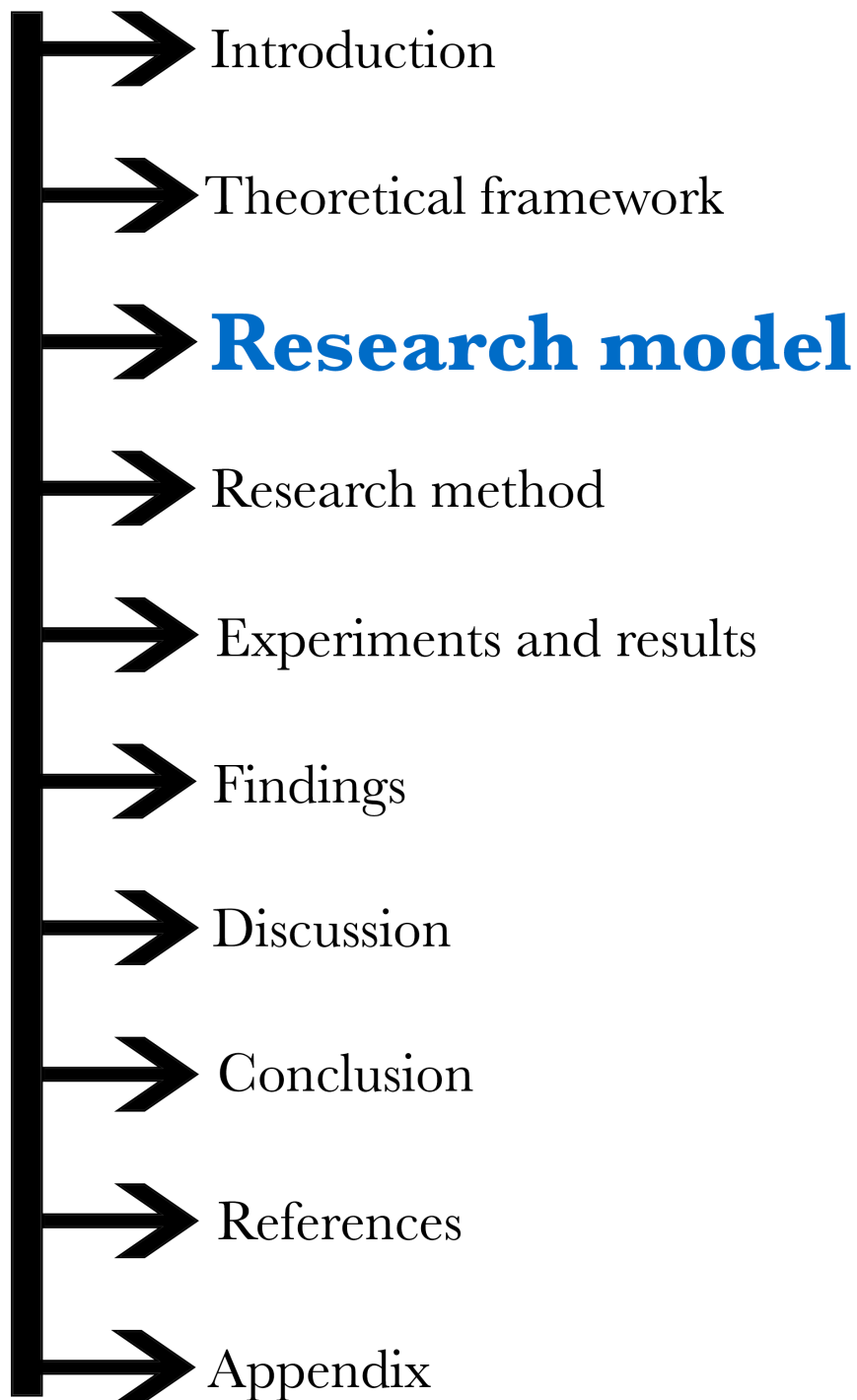
The previous section presented the theoretical framework, and the following section takes into account the applied theories and forms the hypotheses, which will answer the main research question. The hypothesis will afterwards be evaluated and discussed based on the findings from the data collection. The report investigates a limited field when it comes to usability, and specific hypotheses have been chosen in order to go into depth with the workload of a human. As explained in the working memory section, humans in general tend to go into information overload when trying to multitask or to store much information for a longer time frame. The hypotheses in the below section are trying to investigate the concept of cognitive workload in order to provide online-based companies with information about how to strengthen the usability test phase by taking into account the workload that online users often are presented with.

3.1 The human memory and visualization

As explained in *The working memory* the human cannot store much information for a long period of time without forgetting central parts of the message (Nielsen, 2009). Today the human can retrieve information very quickly and companies must therefore be very clear when delivering a message to the consumer, trying to buy a product or similar. Humans have become very impatient, and do not hesitate to enter another website if the provided information is insufficient (Falls, 2012). This lead to improvements of the usability since the amount of text can have a negative effect on the user. The amount of provided text varies since some products require more text than others.

The question though, is how much text should an online based company provide in order to prevent information overload, and thereby prevent a higher bounce rate, and can it be demonstrated that websites with less information will improve the cognitive load of the user? The hypotheses below aims to investigate if a reduction of a specific text can improve the cognitive load, making the user remember more of the provided information, leading to a better decision-making process. Precious research argues

that humans focus on faces, and especially the eyes, and the direction of the eyes. Therefore, this report takes into account the section from the visualization and test if users are more drawn to websites where faces are looking at the target, and therefore remembers more from the provided product text. The hypothesis, which are being tested later on is:

H1 *Websites with more unnecessary text requires a higher cognitive load than websites with a 66% reduction of the identical text.*

H2 *Users remember more information from a website if a picture of a human is looking directly at the respondent instead of looking directly at the product text.*

3.2 Multitasking and information overload

More than 98% of humans are believed to underperform when multitasking (Loria, 2014). Research done by Thomas Buser shows that multitasking in fact lowers the performance as when doing a sequential task. This research suggests that even though the human might believe to get more done when multitasking might overwrite the value of a "fresh eye" (Buser et al., 2012). By excluding the multitasking factor the usability test phase could possible benefit from this. However, due to the complexity and the increasing amount of global information, online based companies must take into account the various ways of multitasking and therefore investigate how to create a clear and simple website, but still provide the user with the necessary information. Since the complexity of the amount of global information only increases, new web technologies must be developed in order to create an effective information behavior, and to better recognize the usability problems that multitasking brings (Spink et al., 2006).

The findings from this investigation will be described with descriptive analysis, and the report will therefore not frame a hypothesis in regards to this research, but will work as an investigation within the multitasking concept. The Investigation will be concerning the following question:

"The cognitive load of a website user increases when multitasking on a website"

3.3 Process fluency - dual core process

The following hypotheses have the aim to address the automatic processing of fluency. Several research indicates that a website is rated as more reliable and sufficient if the processing fluency is higher (Häfner et al., 2010). From this statement the following hypotheses will be tested in order to evaluate the processing fluency. The final outcome of testing this hypotheses is to better understand the processing fluency, and how companies in the future can take the experience aspect as well as the process fluency aspect into account when developing new landing pages as well as reviewing old ones.

H4 *Websites with less unnecessary information is rated as more reliable than websites with more unnecessary information.*

H5 *Websites with less unnecessary information are rated as more sufficient than websites with more unnecessary information.*

After the development of the hypotheses has been created, a methodology section will be presented. Our observation is not always correct. Therefore, we need to find mechanisms in which we assume that our observations are as close to the real world. This is why and where the research is coming into its place. The report is in the following section going to provide the reader with methodological reflections drawn from the content of the report.

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This section provides the reader with methodology and furthermore discusses the consequence(s) of these choices. The "research onion" is used as the framework for the methodology, which provides the reader with an overview over the layers that need to be peeled off in order to move on to the undergoing layers in order to ensure a thorough methodology.

This section will thus focus on: the research philosophies, the chosen research approach, the research strategy of this report, the research method choices, the time horizons and finally the data collection and data analysis.
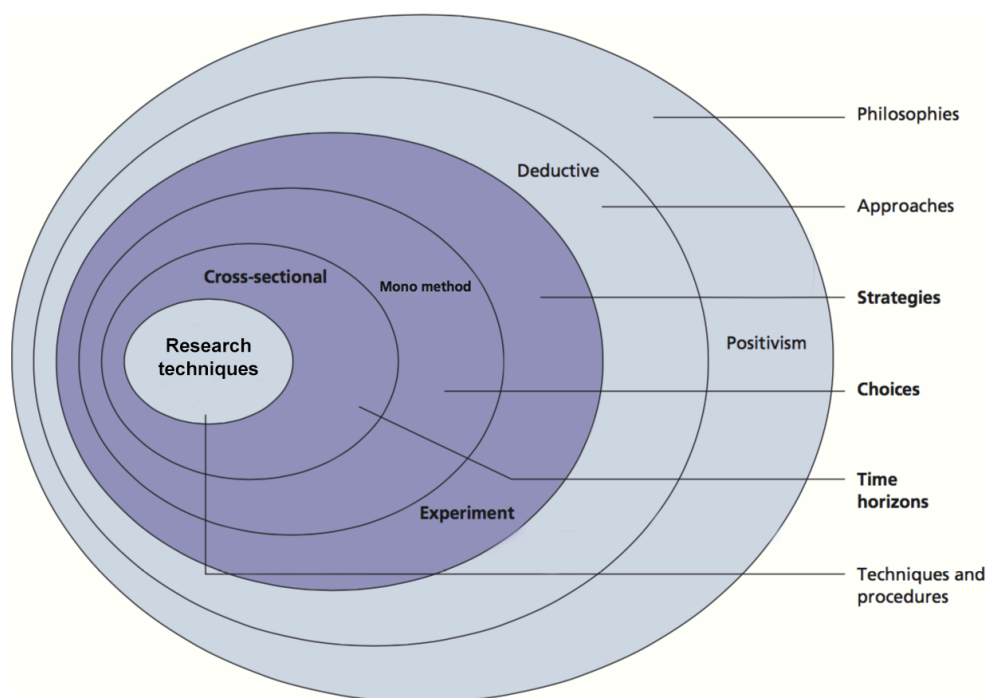
Figure 4.0 – The research onion. Source: Sounders et al., 2008

4.1 Research philosophy

It is paramount that the researcher know how knowledge is gathered i n order to stay as objective as possible as researcher. (Saunders et al., 2009). The fact about how the research should be concluded is embedded in a science of philosophies (Blumberg et al., 2011). The research philosophy formulas an important influence on the collected data, how the data is structured and how to address the research question. By understanding the research philosophy it helps the researcher to clarify the design of

the research and lighten the decisions, granted they are arguing in a valid way. How Reasoning and the observation are developed is the key argument behind the research philosophy. The chosen philosophy ends up affecting the methodology in the epistemology, ontology, final conclusions, the notion of truths as well as the research techniques. From the literature five different views of research philosophy are outlined: Positivism, interpretivism, pragmatism, constructivism and objectivism (Saunders et al., 2009). These approaches are all different ways of viewing the world, and have different views on how knowledge is formed. In order to fully explain the chosen research philosophy the report will look at the two ends of the scale, which is the interpretivism and positivism approach.

4.1.1 The interpretivist view

This approach argues that knowledge and recognition does not always mirror the reality, but will instead always be an interpretation of this (Rasborg et al., 2005). This approach argues that all knowledge is socially constructed, and that objective knowledge does not exist. One main "disadvantages" for this approach is that primary data cannot be generalized because the data is impacted by personal views, opinions and values. The reliability of the gathered data is therefore undermined to an extent (Saunders et al., 2009). This approach furthermore argues that the social world cannot be defined and theorized by definite laws, because this would hinder the understanding and the complexities. Every case is seen upon as being unique due to the subjectivity and thereby making it very hard to generalize. Because of the subjectivity of the approach, the researcher will color the conducted research and thereby you could argue that the interpretivistic approach present a subject issue on the question.

4.1.2 The positivistic view

At the other end of the scale we have the positivistic approach. Within this approach knowledge is based on observations in the world, an observation that are objective. Knowledge and data are developed from observations that can be observed (Saunders

et al., 2009). Saunders argues that conclusions within this approach can be turned into "law-like-generalizations" (Ibid). A challenge within this approach is the need for a validation of all the conclusions presented. It is often very hard, and almost impossible to frame verifiable sentences, and that might limit the scope of science.

4.1.3 Positivism as a final research philosophy

The aim of this report is to look further into how online based companies can create a better usability test phase, when looking at the workload of a web user, as well as visualization. Therefore, specific hypotheses are being developed in order to answer the research question. These answers will from this report work as social reality and the end research will function as a law-like generalization (Saunders et al., 2009). The research drawn from the observations lead to the production of credible data, and the conclusions will be made from existing theory in order to develop the hypotheses. What differs from other philosophies is that this report with be concerned with actual facts through theory rather than impressions. This factor aims to give the research question as much validity as possible in order for the researcher to make law-like generalizations (Ibid).

The positivistic philosophy also looks at the adopted ontology and epistemology of the methodology phase. The ontology is characterized by the nature of reality, while the epistemology is defined as the relationship between the reality and the researcher.

Ontology

What characterized the positivism is that the ontology of the world is external, and that there is a single reality of the research situation no matter the researcher's beliefs or perspective (Carson et al., 1988). This report undertakes a structured methodology when conducting the research and identifies a clear research topic and thereby creates valid hypotheses. As explained in the above section positivists stay separated from the participants and create a distance in order to remain emotionally neutral and to seek objectivity.

Epistemology

This report defines some pre-known hypotheses, which will be presented later on in the report, and only the observable phenomena and the outcome from the research can provide credible facts and data (Saunders et el., 2009).

4.1.4 Implications of the positivistic philosophy

The researcher is by employing this philosophy undertaken in a value free way. This might seem plausible, but you may argue that it is difficult to exclude the "feelings" and the fact that the researcher is independent and not affected by the research or the subject (Remenyi et el., 1998:33). The report will collect data that look into how companies can improve and strengthen the web usability from the chosen methods in order to provide a better user experience for the online user, and then test the hypotheses. Even though the researcher claims to be value free, you might argue that the feelings of the researcher is a part of the data collection process, and it would be normal for, at least part of the process to get personally involved. When evaluating the data, the researcher must in order to evaluate on the data use a small sense of subjectivism, in order to gain knowledge from the experiment. This is what makes the researcher human, and emphasize that you cannot remove feelings from research. This factor needs to be recognized in order to follow this philosophy.

4.2 Research approach

The research philosophy has now been discussed, and the report now peals of another layer, and comes to the research approach. This section aims to determine how knowledge is acquired, and how conclusions are drawn from this (Saunders et al., 2009). The section is looking further into the inductive and deductive approach.

4.2.1 Inductive approach

Think of this approach as a manager in a company, who go around the office interviewing supervisors about their working experience with the new IT system. The manager wants to get a feel of what is going on in order to understand the problem. After gathering the information and analyzing it, the result will be a formulation of a theory. This could maybe be that there is a relationship between the old computer system, that makes the IT system even more slow. In other words *"theory follows data rather than vice versa"*

4.2.2 Deductive approach

This approach involves the creation of theory that is subjected to an exact test. This approach is the dominant part in natural science, where laws are the basis of explanation, and permit the phenomena to be controlled and predict their occurrences (Collis et al., 2003). There are 5 stages of the process of the deductive research, which is shown in the model below.
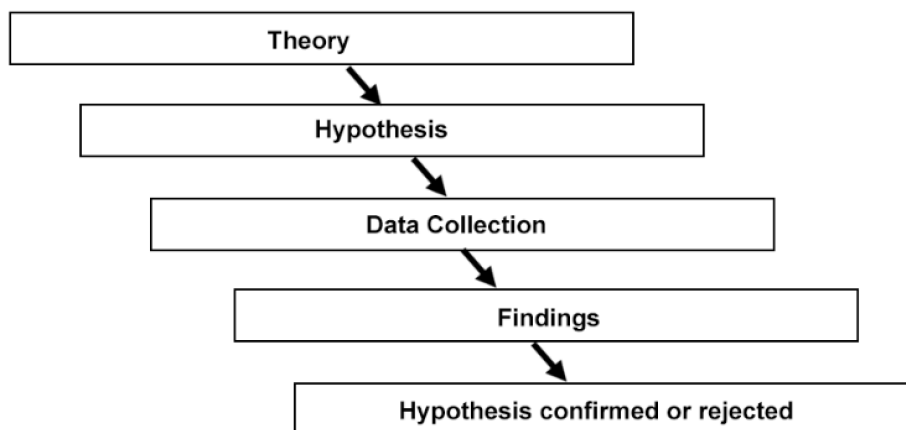
Figure 4.1 – the inductive process. Source: Saunders et al., 2008

The deductive approach explains the causal relationships between variables. This report is moving on and looks into the causal relationship between the hypotheses in the further process of the experiments. In order to practice the principle of this approach the researcher should act independent of what is being observed.

4.2.3 Using the deductive approach

Due to the positivistic philosophy of this report, the deductive approach is believed to serve this report in the best way. When creating hypotheses, the deductive approach comes into its place. The deductive approach is chosen since the report will highlight specific hypotheses, and thereby develops a theory that is subjected to a rigorous test and a final outcome of the experiments.

4.2.4 Implications of the deductive approach

In order to generalize the statistical regulations it is necessary to select samples of sufficient numerical size (Saunders et el., 2009). The researcher is aware that the sample size does not include a large numerical size of respondents, and is thereby unable to make any descriptive conclusion.

4.3 Research strategy

The purpose of the research strategy is not to label a specific strategy to the report, but instead help to answer the research question, and fulfill the objectives of the report. We now peal off jet another layer and cast a light on the use of experiments in this report in order to discover how online-based companies can improve their web usability when looking at the methods from the research model.

4.3.1 Experiments

The purpose of this report is to study causal relationships, and to discover whether or not a change in one variable affects another dependent variable (Saunders et al., 2009). This research strategy owes much to the natural science, and especially psychology. Since the report will investigate HOW the online web usability test phase can be improved, using experiments is therefore employed for this purpose. The experiments include both be experimental groups, where the respondents among others, will be exposed to a planned manipulation or intervention in the form of reduced text of 66% and a control group where no such manipulation or intervention

is made, and where 100% of the text is included. The experimental group will be compared to the findings from the control group, in order to discover whether or not online-based companies can improve their web usability.

A more detailed explanation of the hypotheses in which are going to be tested is going to be examined in the *experiments and results* section where the techniques are presented. When carrying out an experiment with an experimental and control group the report aim to control the effects of an alternative explanation. This will furthermore try to eliminate certain risks to the validity. However, this form of research strategy has some disadvantages. Experiments are often conducted in closed rooms, making the external validity difficult to establish. Laboratories or closed off rooms does not reflect the real world and, and the findings might differ when conducting the same experiments in field-based experiments. In summary the experiments as a research strategy will involve:

- " Definition of the hypotheses
- Selection of respondents from a population
- Experimental conditions (Experimental group and control group)
- Introduction to the manipulation to several variables
- Controlling the variables "

Source: Saunders et al., 2008

4.3.2 Limitations to experiments

Because participants might change their behavior when undergoing an experiment, several factors can have an influence on the external validity and the findings. This section provides the reader with the limitations when doing experiments for this report.

Hawthorne effect

The Hawthorne effect is defined as being, quote: *"The problem in field experiments that subjects' knowledge that they are in an experiment modifies their behavior from*

what it would have been without the knowledge" (Adair, 1984). This is a factor that must be taken into account. To minimize this effect the researcher is not going to interact with the participants. This effect will be further examined in the *experiment and results* section.

Demand Characteristics

When undertaken an experiments and when thinking of the hawthorne effect, participants might think that the researcher wants a specific answer. The participants want to be a "good participants" and provide the "right answers", in order to come across as intelligent. If the participant sees him/herself as being evaluated by the researcher, he/she might tend behave in that way, in order to make him/herself look good (Rosenthal et all., 2009, chapter 5). This factor is being examined in *"experiments and results* section".

4.4 Research choices

So far, the 3 first layers have now been pealed, the research philosophy, approaches and the strategies. The next layer, which together forms the research design is split up into 2 sections and layers: (1) the purpose of the research, and (2) data type. The research design provides the reader of a plan on how the research question is turned into this research project. Basically, this section deals with how to answer the research question.

4.4.1 The purpose of the research

This study will through an explanation of the difference between the exploratory, descriptive and explanatory frame the purpose of the study and furthermore parse the problem statement for the report. By using a descriptive research you aim to explain the "what" and "how" questions, and as the word states describe characteristics of a certain phenomenon. When conducting an exploratory research study, the researcher does not have a clear idea of the subject and have not established any hypotheses

(Blumberg et al., 2011). A causal research study aims to understand the cause-and-effect relationships between different variables.

4.4.1.1 Using a causal research method

To gain insights on how the online usability test phase can be strengthened, it is important to investigate behavior, and thus use the rules of the causal research. When adopting this research it is important to observe a certain variation in the variables that might cause a change in other variables. This report uses a positivistic philosophy and hypotheses have therefor been created in order to establish the cause-and-effect relationship between the variables in the hypotheses. There are two main research methods when exploring the cause-and-effect relationship in the causal research, which are the experimentation and the statistical research (Blumberg et al., 2011). Thus, this report will focus on the statistical research, which aims to show whether or not the data show any sufficient variation and thereby influence other variables that can be measured for further analysis. The report will be using a mix of t-testing and chi-tests when accepting or rejecting a certain hypothesis. The report will furthermore be used describing statistic in the cases where it makes sense to use this form of evaluation.

4.4.2 Data type

This section will argue for the use of quantitative research method. The structure when working with a quantitative design is based on a scientific method. As already established this report uses the deductive reasoning, where the hypotheses are formed, data are being collected, and the results from the investigation aims to prove the results/hypotheses true or false, and thereby frame a conclusion. The research question has an influence on the appropriate data collection method, and challenges that uses the "what", "how" and "why" supports the quantitative data collection method (Marshall, 1996). This study aims to investigate *how* online based companies can improve the usability test phase when looking at the cognitive workload of a web user in order to create a better ease of use for the user. The focus on quantitative

research has like qualitative research pros and cons. In-depts answers are not possible to retrieve, and crucial information might me lost in the investigation. Furthermore the respondents might not provide the researcher with a true opinion since the questions is already premade. This could cause different biases for the respondents, and is something to take into account when conduction the investigation and experiments.

4.4.2.1 Single data collection technique

This report is using a single data collection technique, and combines a single qualitative data collection, which in this case is different experiments, to test the hypotheses with quantitative data analysis procedures. Mono method comes with pros and cons, and those have been taken into account before creating the research. The following section will present some of the advantages and disadvantages of using mono research. When using mono method is it important to consider the biases of only using one technique. Would the same results have been established if the experiments were using mixed methods? Using more than one method might increase the validity of the experiments, but because the aim of the research is to affect the unconscious part of the brain, the respondents must not interact with the researcher. This is why the choice is to only use one data collection technique.

4.5 Instrument design

This section aims to peel another three layers of the research onion. The following section will describe how the research design will be shaped. The section is divided into (1) topical scope and (2) time horizons.

4.5.1 Topical scope

It is either possible for the topical scope to be a case or statistical study. The report is more breadth rather than depth and focus on qualitative research instead of qualitative. Furthermore the report tries to seize the characteristics of a population by

creating interference from the characteristics from a sample. Therefore, is it concluded that the report acts as a statistical study.

4.5.2 Time horizons

We now peal yet another layer an presents this section, which serves the purpose of incorporating the time frame and the process of the research. The two main time horizons are: longitudinal and cross sectional. This report is a cross sectional study as the study has a framework of time and is dealing with a present issue, basically a snapshot in time. The collected data consists of experiments, where the results are analyzed at a given point in time, and thereby follow the rules of the cross sectional time horizons. The phenomenon's in which are being studied are most likely to change over time, since usability testing is a dynamic phase. This is a very important factor to note in this report.

In order to peal of the last layer, the report will now be looking at the data collected, and how the report will create the collection of the data. To give the report a better overview, the information on how the actual experiments were conducted can be found in *experiments and results*. Even though this information normally goes into the methodology section, it has been chosen to follow a different style of structure in order to provide the reader with a better overview.

4.6 Data collection

4.6.1 The use of primary and secondary data

Primary and secondary data gathering is a very important part of this research since this empirical information will be used to support the research question and the chosen hypotheses (Blumberg et al., 2011).

The section below will briefly describe the pros and cons of using primary and secondary data, as well as arguing for the consequences of the researches choice.

Primary data

This form of data is primarily to the study of the research, and is created for this specific purpose. To understand how the online usability test phase can be improved is it important to gather primary data, in order to uncover the truth about the hypotheses. This makes the validity of the research much more valid. For this research the primary data will consist of experiments based on the formed hypotheses.

Secondary information

To go more into depth with the topic, secondary data has been collected as well. Secondary information has already been used for other purposes and aims to give the report further validity, and understanding of the field. One advantage of using secondary data is the quality of the data, which often is very good, since research institutions often have a good access to more accurate information, and people with skills from the field have looked through the research. This report uses among others secondary information from the working memory in order to determine how much people actually remember, the dual-process that helps us understand how the processing fluency affect the judgments of the online user and memes, which deals with a unit of information that is stored in the brain.

However, there are certain disadvantages when using secondary information. As mentioned, this form of data has already been used for other purposes. That means that secondary information alone is not enough to answer the research questions and the hypothesis, nor cover all the needed information. This is why primary data is used to increase the validity of the research. Furthermore the data might not be collected within the same population, and therefore cultural and behavioral factors must be taken into account. Lastly some of the data might be outdated, and replaced with newer information.

4.7 Validity and reliability

How do we know that the web usability test phase can be improved? The simplest

answer is: we don't know. But we can reduce the possibility of getting any answers wrong (Saunders et al., 2009). As Rogers summarizes, (1961; quote by Raimond 1993:55): *"scientific methodology needs to be seen for what it truly is, a way of preventing me from deceiving myself in regard to my creatively formed subjective hunches which have developed out of the relationship between me and my material".* Reducing the risk of getting the answers wrong means that the researcher needs to pay a special attention to reliability and validity. Powell and Connaway, 2004 explains that research is considered to be valid then *"conclusions are true, and reliable when findings are repeatable"*. However, this report like every other is not perfect, and there will always be some sort of measurement errors. It is the researcher's job to minimize these aspects, but it is still a very important factor to highlight and acknowledge, when creating this research. The reason for looking at the cognitive workload is to create answers that have been retrieved from the unconscious mind instead of the conscious. To truly uncover how to strengthen the web usability test phase, it is important to gather as reliable data as possible.

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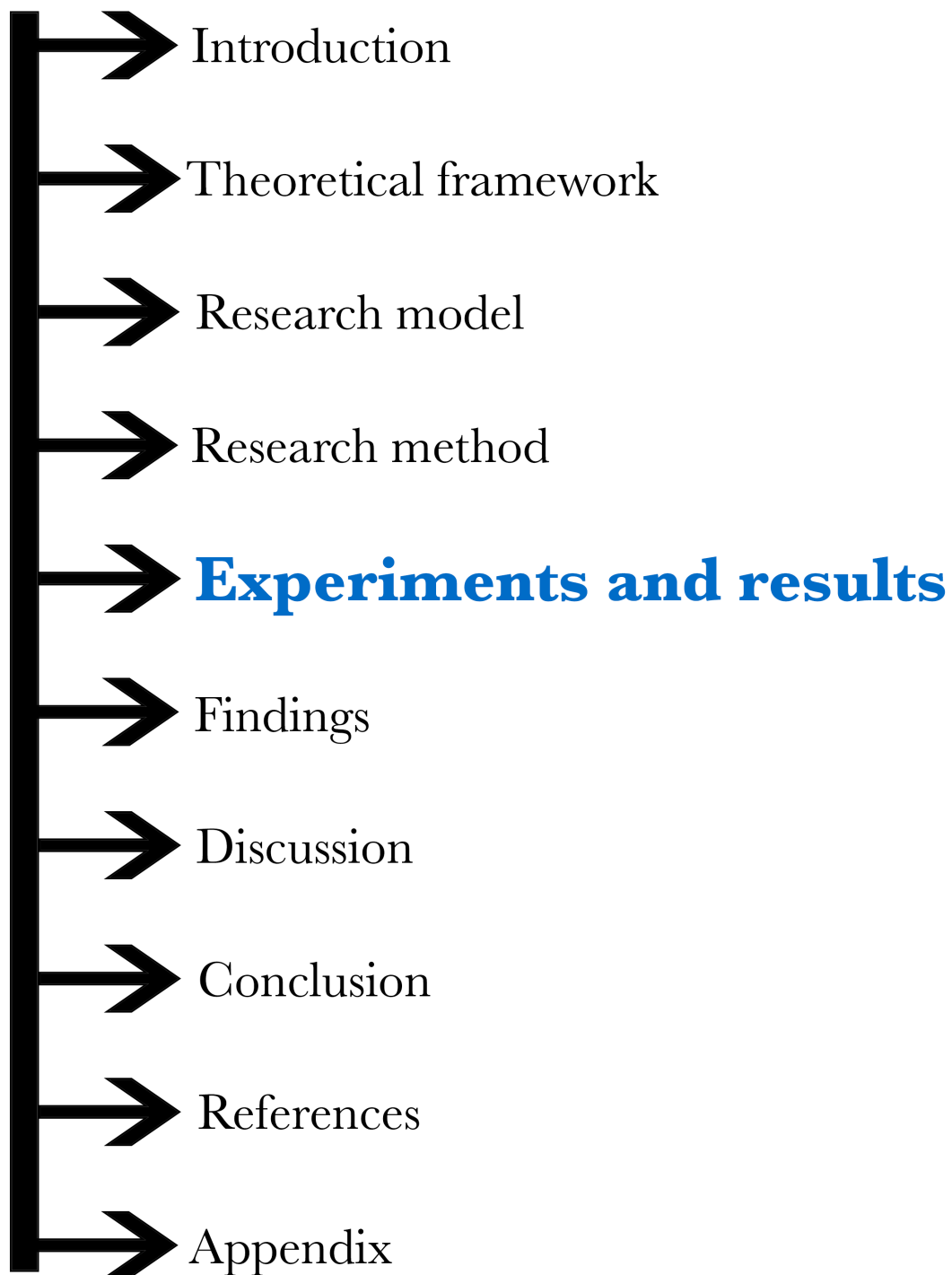
The following section establishes how the data collection and the actual experiments are going to be carried out. Even though some of this information belongs in the methodology section it has been decided to insert the information in this section, as it gives a better overview of the report. The results and findings from the experiments will be presented lastly in the section, which will be used later on in the discussion and conclusion. The section will present the reader with the specific methods for conducting the experiments, which is the Sternberg Memory Test, and Tapping Test. Furthermore the section will also establish who is going to be participating in the experiments as well as defining the errors that have been corrected in the pretest. The section will start off by explaining the two main frameworks, which are used to conduct the experiments.

5.1 Sternberg memory test

The idea behind the memory test is to establish if web users overspend time and attention on comprehending the provided information. The Sternberg memory test is often used in neuroscience studies, and the procedure normally requires participants to recall a sequence of digits in the correct order. The test is however modified in order to fit the requirement for this experiment. However the rules and guidelines are still similar to each other. The philosophy behind the Sternberg memory test is employed in experiment 1 (Hypotheses 1, 2, 4 and 5) to test whether or not a recall process can improve and strengthen the web usability test phase in the future for online companies.

5.2 Tapping tests

Using the tapping test is a very simple way to impose a secondary load on a user. Users are asked to tap with their hands at a given time speed. The tapping test is very simple, and the respondent will rhythmically tap every 1-second with their left hand. The tapping will require cognitive load, and will for this experiment reflect how online users will perform when reading and comprehending a text. If the participants go into

information overload during the experiment the participant will slow down on the secondary task to focus on the primary task, which in this case is reading the provided text on the website. When the usability issues arise, the cognitive load will automatically increase. Because the respondent wants to focus on the main task, the secondary task loses cognitive resources, and the respondent will then forget or slow down the tapping. Previous research argues that online users have little cognitive workload when presented with poor information presentation (Albers, 2011).

Børnefonden presents its user with stories from Africa about how to help improving the life of others. Users on this specific website, which are being investigated the multitasking experiment. The participants are required to read what seems like a small amount of information, but taking into account the attention span of a human might too much text. The tapping test will establish whether or not the provided amount of information will cause an information overload, making the user forget important information in order to make a correct decision.

Previous research done by Michael Albers has shown that the tapping test can in fact be used as a practical method when measuring the cognitive load. The research argues that by looking at the cognitive load with the help of a tapping test can potentially give the web designer enough data to look at specific redesign options, in order to strengthen the web usability test phase (Albers, 2011).

5.3 Population

The population represents a large amount of humans that serves to be the main focus for this report (Saunders et al., 2009). However, before establishing and choosing the most suitable sample, the relevant population in regards to this report must be found. As described in the purpose statement, this report aim to strengthen the web usability for online companies in Denmark, and thereby the population in this case I the total amount of the Danish population, which gives us a population of 5.678.348 million

(Dst.dk, 2015). A sample from the population has been chosen and is being described in the section below.

5.3.1 Sample

The participants can only be included in the experiment if they use the Internet on a daily basis. Research done by Danmarks Statistik establish that 82% of the Danish population in the age of 16-74 years uses the Internet on a daily basis (IT-anvendelse i befolkningen - 2014). The experiment will therefore only be done with participants that use the Internet on their PC on a daily basis. Participants that failed to meet the requirement will be excluded from the experiment. **54 men** and **48 women** in the age of 16-74 have in total been recruited. The average age of the participants was **27 years old**. The experiments were all conducted in small rooms at Copenhagen Business School. The participants were all provided with a small introduction about the purpose of the project without leading them on to any answers.

In order to minimize the Hawthorne effect the researcher did not interact with the participants during the test, and the participants were sitting alone in the research room the whole time during the experiment. Furthermore, the participants were told that honest answers were preferable over answers that the they thought were "correct", in order to seem smarter or more helpful. The researcher has on purpose chosen random participants in order to recruit participants that did not have an opinion about the experiment from the start. Self-selection can in some cases become a problem in the experiments phase since people that volunteer for studies might have an opinion about a certain study (Emanuel, 2013).

5.4 Pretest

Before the actual data collection was retrieved a pre-test was developed in order to test the experiments for any errors. 5 students from the cand.merc.it program from Copenhagen Business School were asked to test one experiment each, and thereby all

the experiments were tested. The pre-test participants was exposed to the website for an unlimited time, making the results very different. Therefore, it was decided to have a constant exposure time, aiming towards a higher internal validity. The exposure time was set to 30 seconds, since this is the amount of time the participants used in average, looking at the webpage.

The section below present a brief structure on how each experiment was carried out, in order to answer the hypothesis.

5.4.1 Experiment 1

The participants were all exposed to a website, which is one concerned with child welfare in Africa. The website can be found in appendix 1. The website has been transformed to fit the requirement of the experiment and has furthermore been translated into English. Unnecessary text and figures have been removed in order to create as little noise for the participants as possible. The participants were separated into two groups. One group was presented with the original website. The second group was presented with the exact same website, but here the text was reduced by 66%. Both groups were given the same information. After the 30 seconds of exposure to the website, a questionnaire was presented in order to test the cognitive load measurement. In total **26 men** and **24 women** participated in this experiment.

The second round of the first experiment aimed to investigate if humans tend to focus on faces, and the direction of their eyes. Two groups were again formed, and the first group was exposed to a website where the product picture was looking at the text. The second group was exposed to the exact same website, except a picture where the child was looking directly at the user. The participants were yet again presented with a questionnaire after the exposure time. The website layout can be seen in appendix 2. In total **23 men** and **19 women participated** in the experiment.

5.4.2 Experiment 2

This experiment had the purpose of investigating the cognitive load when multitasking. The participants were exposed to a text while doing the tapping test, to test whether or not the cognitive workload was increasing and thereby leading to information overload. After the exposure time the participants were presented with a questionnaire to test how much information the participants could remember in order to test the consequences of information overload. The layout of the website and can be found in appendix 3. In total **5 men** and **5 women** participated in the experiment.

5.4.3 Experiment 3

The report has been focusing on the process fluency from the theoretical background, and the third experiment aimed to discover whether or not the participants would rate websites more reliable and sufficient when exposed to the same websites as in experiment 1, hypothesis 1 and 2. The findings from these experiments have been collected from the questionnaire presented in experiment 1.

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5.5 Experiment 1 (Hypothesis 1 and 2)

Hypothesis 1 had the aim to investigate whether or not websites with more unnecessary text require a higher cognitive load than websites with less unnecessary text. In order to reject or accept the hypothesis a t-test was conducted. The groups have equal variance, and a two-tailed t-test is chosen, since the aim is to find out of the first mean is different from the second mean. The significance level (P) is set to 0,05 and gives us an idea about the probability that the hypothesis will wrongly be rejected to the null hypothesis. The calculation of the t-test is presented below, and the answers from the survey can be found in appendix 4.

	Full Text	66% reduction
Mean	3.56	4.12
Variance	0.84	0.36
Stand. Dev.	0.9165	0.6
N	25	25
T	-2.556	
Degrees of freedom	48	
Critical value	2.011	

Figure 5.0 – t–test results. Created by the author

The working memory in the theoretical background argued that the human is not capable of storing much information and keep on to this information for a longer period of time. Therefore, information after this point will cause information overload and decrease the quality of the decision. The full text experiment showed that the participants I total knew 72% of the answers, leaving the last 28% to wrong answers. When looking at the 66% reduction experiment, the participants were able to answer correct on 83.2% of the questions, leaving 16.8% to wrong answers. In total, the participants from the 66% reduction experiment had 13.5% more correct answers.

Based on the information from the experiment and the theoretical background, it can be argued that the amount of information has an impact on the cognitive load. When

participants were exposed to a longer product text, the cognitive load seems to be higher resulting in increased cognitive workload or information overload. Furthermore, the final conclusion from the t-test shows that the calculated t exceeds the critical value (2.556>2.011), which means that there is significantly difference. We can from these calculation end experiment **accept** H1, and conclude that *websites with more unnecessary text require a higher cognitive load than websites with less unnecessary text.*

Hypothesis 2 had the purpose to investigate if users will remember more information from a website if a picture of a human is looking directly at the respondent instead of looking directly at the product text. The layout of the experiment was equal to the "full text" experiment from hypothesis 1, but the pictures were different, and can be found in appendix 2. The theoretical background argued that the human spend around 40% of their time focusing on the face, and especially the direction of the eyes and that the human furthermore tend to visualize in pictures. This information was tested to discover if companies can strengthen their online usability test phase by employing faces along with the product text, and if so, where the direction of their eyes should be focusing. Again, a t-test was conducted I order to reject or accept the hypothesis. The calculations for the t-test can be seen below, and the answers from the survey in appendix 5.

	Face looking at user	Face looking at text
Mean	3.57	4.7
Variance	0.56	0.61
Stand. Dev.	0.75	0.78
N	21	21
T	0.6049	
Degrees of freedom	40	
Critical value	2.021	

Figure 5.1 – t-test results. Created by the author

The experiment shows that participants who were presented with a picture of a human looking directly at the user in average were able to answer correct on 71.4% of the answers, leaving 28.6% to the wrong answers. Participants who were presented with the exact same webpage but with a face looking at the product text where able to answer correct on 74.3% of the questions, leaving 25.7 to the wrong answers. Participants presented with the face looking at the product text on average had 3.8% more correct answers.

The t-test, however for this experiment showed that the value of t is smaller than the critical value (0.6049<2.021), which means that there are no significantly difference. Based on the experiment we can **reject** hypothesis 2 meaning that *users do not remember more information from a website if a picture of a human is looking directly at the respondent instead of looking directly at the product text.*

5.6 Experiment 2 (multitasking investigation)

The investigation about multitasking was in the first places developed because of the importance of multitasking in newer time. The theoretical background argued that only a limited part of humans have the capability to multitask. This information increases the curiosity of investigating how and if the cognitive load will increase when multitasking while perceiving product information from a website. In order to present the findings descriptive statistic will form the basis of presenting the findings. This kind of statistic creates a simple summary about the sample as well as the measurement. The table below presents the reader with the data retrieved from the experiment. A complete showing of the data processing as well as pictures and answers from the survey can be found in appendix 6.

	1	2	3	4	5	6	7	8	9	10
Reading time	1min. 21sec.	1min. 1sec.	1min. 24sec.	1min. 47sec.	59sec.	1min. 32sec.	57sec.	1min. 13sec.	1min. 11sec.	1min. 38sec.
Time before error	17.40sec	N/A	42sec.	37sec.	N/A	1min. 15sec.	33sec.	N/A	N/A	1min. 11sec.
Correct answers	2	3	2	3	4	2	2	3	2	3
Wrong answers	3	2	3	2	1	3	3	2	3	2
Gender	Female	Male	Male	Male	Female	Female	Female	Male	Male	Female
Profession	Master student	Master student	Master student	Full time job	Bachelor student	Master student	Master student	Master student	Master student	Master student
Age	33	35	27	30	24	27	26	28	28	27

N/A= no errors in the tapping phase

Figure 5.2 – statistical research from multitasking experiment. Created by the author

This particular experiment showed some interesting information. On average the participants used 1 minute and 18.3 second to read the provided text, while performing the tapping test at the same time. According to research done by Forbes, a high level student reads 575 words per minute (Nelson, 2012). The total amount of words from the experiment equals to 229 words. This means that a high level student should be able to read this specific text in 23,90 seconds (575/229=2,51. 60sec/2,51= 23,90 seconds). The experiment showed that the participants in average used an extra 54.4 seconds on reading the text. 40% of the participants completed the tapping test without stopping the actual tapping and the remaining 60% had inconsistencies after an average of 45,9 seconds when reading the text. Furthermore the experiment also showed that the participants on average answered incorrectly on 48% of the answers, leaving the last 52% to the correct answers. This specific research shows that humans in this case underperform when multitasking and have a hard time concentrating on multiple jobs. From this research and the information provided we can thereby conclude that *the cognitive load of a website user increases when multitasking on a website.*

5.7 Experiment 3 (Hypothesis 4 and 5)

The following two hypotheses had the purpose to investigate if participants when presented with the full text experiment and the 66% reduction experiment rated the processing fluency more reliable and/or sufficient. A chi-test examine whether or not the occurrences observed in this experiment is different from the occurrences that are

expected if the null hypothesis is correct, which in this case is 0.05. There are two types of variables, which yield two types of data: numerical or categorical. The report will use categorical variables because they yield data, such as "yes" or "no". The question in which the chi-test will be working with is: "I felt the website was reliable?" And "I felt like the website was sufficient enough, and I was provided with the right amount of information." These are questions in which the participants could either answer "yes" or "no". The following section presents the results from the experiments and the chi-test.

Reliability

Reliability - observed		Full text	66% reductic	Total
Reliable		14	20	34
Not reliable		6	4	10
Don't know		5	1	6
Total		**25**	**25**	**50**
Reliability - expected		Full text	66% reductic	Total
Reliable		17	17	34
Not reliable		5	5	10
Don't know		3	3	6
Total		**25**	**25**	**50**

Figure 5.3 – chi-test results. Created by the author

In this experiment the reliability in cases where the participant is presented with a 66% reduction text is significant (chi-square= 0.227, *p*>0.05). The experiment further more showed that when provided with the 66% reduction text a whopping 80% of the participants rated the provided text as being reliable. 16% did not find the text reliable, and the remaining 4% did not have an opinion. When exposed to the full text 56% of the participants found the website and the provided information to be reliable. 24% of the participants rated the provided text as being unreliable and the last 20% didn't have an opinion. From this information we can **accept** hypothesis 4 and conclude that *websites with less unnecessary information is rated as more reliable than websites with more unnecessary information.*

Sufficiency

Suffiency - observed		Full text	66% reductic	Total
Sufficient		16	8	24
Not sufficient		8	14	22
Don't know		1	3	4
Total		25	25	50
Suffiency - expected		Full text	66% reductic	Total
Sufficient		12	12	24
Not sufficient		11	11	22
Don't know		2	2	4
Total		25	25	50

Figure 5.4 – chi test results. Created by the author

The second factor to investigate was the sufficiency. The hypothesis argued that websites with less unnecessary information are rated as more sufficient than websites with more unnecessary information. The calculations from the chi-test show no signification (chi-square= 0.038, $p<0.05$) since the calculated p is smaller than the null hypothesis. The findings furthermore show that when presented with the 66% reduction text, 32% of the participants rated the website as being sufficient and 56% rated the website as being insufficient. The last 12% didn't have an opinion. When exposed to the full text 64% found the website sufficient, 32% rated the website as insufficient, and the last 4% did not have an opinion.

From the experiment and the calculation, we can **reject** hypothesis 5 which means that *websites with less unnecessary information is not rated as more sufficient than websites with more unnecessary information.* This information only emphasize that when the information was reduced the participants in general rated the website more reliable. When it comes to the sufficiency of the websites the participants is however torn. After analyzing the data from the experiments, a summary from the findings is presented below.

5.8 Summery from the findings

The findings section was divided into three experiments. We found hypothesis 1 and 2 in the first experiment, the multitasking experiment was tested in experiment 2 and hypothesis 4 and 5 was tested in experiment 3. The first experiment found that participants indeed were able to answer correct on 11,2% more questions, when presented with a 66% reduction text. The experiment furthermore found out via a t-test that hypothesis 1 was accepted. A t-test, however showed that hypothesis 2 was rejected, which means that users do not remember more information from a website if a picture of a human is looking directly at the respondent instead of looking directly at the product text. The second experiment established that the participants used an extra 54,4 seconds when reading the provide information while doing the tapping test. The experiment alto established that 60% of the participants had inconsistencies after an average of 45,9 seconds into the text, and thereby went into information overload. Thereby the investigation about multitasking was acknowledged, which means that that the cognitive load of a website user will increase when multitasking on a website.

The third and last experiment a chi-test confirmed and accepted hypothesis 4, which meant that websites with less unnecessary information is rated as more reliable than websites with more unnecessary information. The experiment concluded that a whopping 80% of the participants rated the provided text as being reliable when presented to the 66% reduction text. The experiment further more rejected hypothesis 5, which mean that websites with less unnecessary information is not rated as more sufficient than websites with more unnecessary information. The findings from this experiment also showed that 56% of the participants rated the 66% reduction as being insufficient and 64% rated the website sufficient when exposed to the full text.

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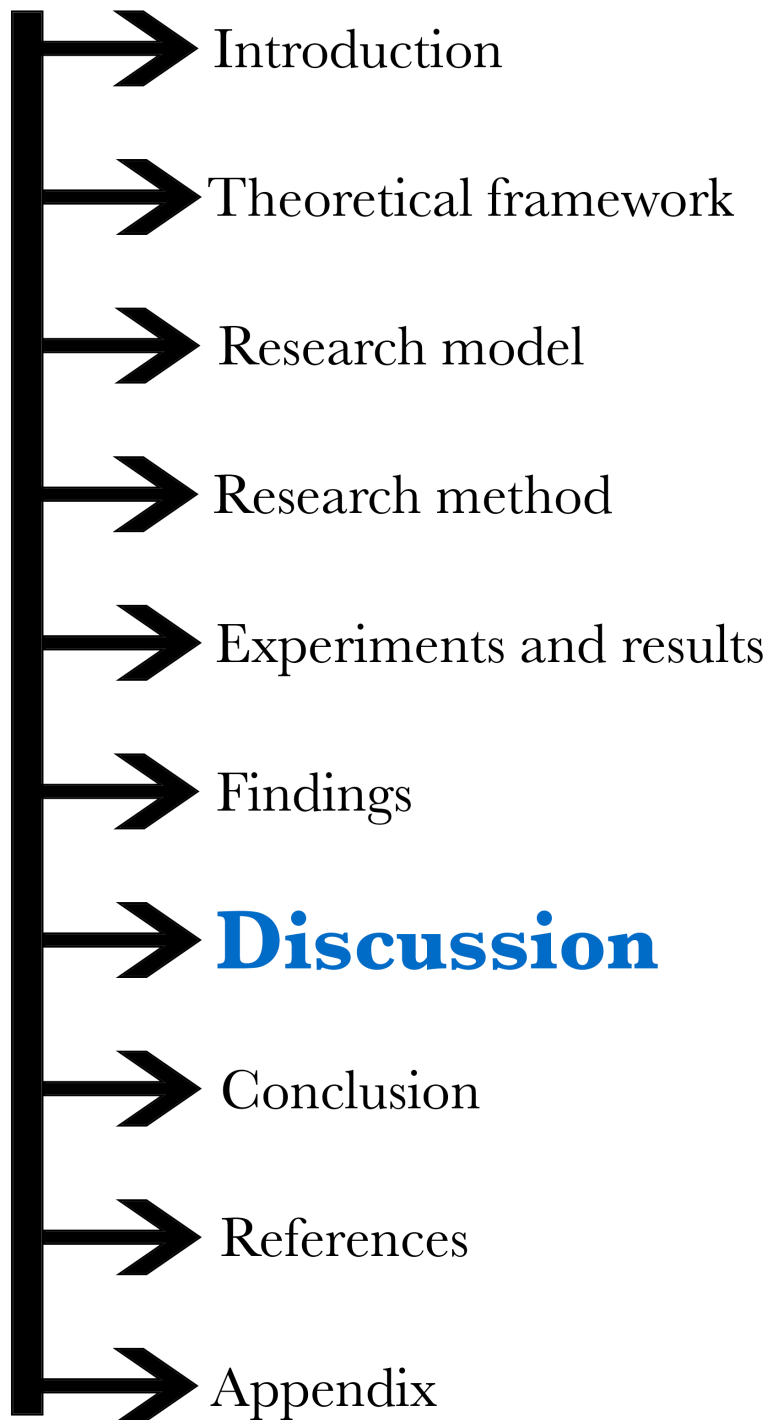
We found from this report that the amount of information provided as well as visual content does affect the cognitive workload. Moreover, we found that participants from this report had difficulties in multitasking while performing a primary and secondary task. This highlights the issue that a lot of Danes multitasks when surfing around for information. Even though this report did not accept hypothesis 2 is emphasized that humans after all tend to focus around the gaze and direction of the eyes. This information could possibly be used in future usability tests when improving the point of gaze for online web users. We also found that when the information is reduced, the reliability increases. However the sufficiency decreases and this is something online-based companies must take into account when providing users with information.

The section below aim to highlight and start an objective discussion and perspective on how the information from this report can change the way companies look at usability test nowadays.

6.1 People become more impatient

The report has among others been focusing on the multitasking aspect, and what happens to the working memory when users a presented with too much information. The report established that numerous participants had a hard time remembering the provided information when multitasking.

Microsoft has just released a new report on the same topic, which showed very interesting conclusions, which this report can benefit from. Researchers in Canada have through EEG scans of more than 2.000 participants found out that since the year 2000, around the mobile revolution the average attention span has dropped from 12 seconds to a whopping 8 seconds, which means that 4 seconds has been lost in the past 15 years (Gausby, 2015). So what will our attention span be in only 30 years? The research furthermore conclude that "multi-screener's" have problems when trying to filter out irrelevant information and stimuli, just like the results from this experiment

shows, and additionally 77% of the participants replied "yes" when asked "When nothing is occupying my attention, the first thing I do is reach for my phone". This is a quote directly from the report (Ibid). The report has also good news. Humans keep increasing their ability to multitask, which means that researchers are not too worried about this tendency. However, this information can be used in usability test phases when making sure not to overwhelm users with unnecessary information, and thereby prevent multitasking problems such as information overload. Microsoft also establishes that marketers can utilize this information in terms of being clearer and to more quickly get to the point, and thereby cut all unnecessary information to give a clear message to the end-user.

This information leads to methods that are rather new in the usability industry. The report has been focusing on the unconscious rather than the conscious, and by utilizing neuroscience, companies might get a better and more accurate picture of the human brain, and what really happens in the decision-making process.

6.2 Utilizing neuromarketing in the usability industry

To begin with neuroscience was concerned with the study of the nervous system. This field collaborates among others with the cognitive science, which focuses on how information is processed and transformed in the human brain. In newer time the word "Neuromarketing" has been developed and combines today consumer behavior with neuroscience. Neuromarketing deals with methods that directly analyze the brain without demanding any conscious involvement (Morin, 2011). Various researches have been proven to back up the theories, making this field very interesting to investigate. Research done in the field takes usability testing to the next level, when interviewing the brain instead of the actual human.

Martin Lindstrøm, author of "Buyology" has done several studies on the conscious and unconscious mind and one of the most surprising findings was about the warning labels that can be found on every cigarette pack. When test subjects were asked in a

focus group if the warning labels worked, most said "yes". This was according to Mr. Lindstrøm the conscious answer. After testing this hypothesis the test subjects underwent an fMRI scan and found that the warning labels in fact activated a certain place in the human brain that intrepid "craving spots", showing that the warning label actually made the test subjects wanting to smoke more, and not less. (Lindström, 2008). This research further more confirms the usability test 2.0 section, which deals with methods in which companies have begun to take advantage of. Various methods are already in use and have the opportunity to create a precise definition of the decision-making process.

This report could well have used devices like an eye-tracker in order to create more valid information. The device work as a sensor technology that makes it possible to know exactly where the eyes of a human are focussing. The technology provides information and insights about consumer behavior, and helps to create a better usability phase when it comes to the web-design. The eye-tracking device could among others have been used in experiment 1, hypothesis 2 to locate the fixation point of the provided pictures. The technology can possibly be used in further research within the scope of this report. Using these methods could in some ways have improved both the internal and external validity, since the device provides a more accurate result and thereby a more valid conclusion.

The following sections aims to present the reader with reflections on how companies can leverage from some of the findings as wells as some additional research.

6.4 Companies adopts videos

This report has among others been investigating the multitasking concept, and what happens to humans when performing multiple jobs at the same time. Companies have I newer times discovered the possibilities of implementing videos instead of videos. Ph.D. Susan Weinschenk argues that humans are programmed to pay attention to faces (Rosensteel, 2015). We gather information when looking at faces, and

therefore a video can provide the customer with important information, and make sure to grab the attention of the online user. Moreover the research argues that the voice of a human conveys information into content that are meaningful to online users (Ibid). Reading a simple text can often be straightforward, but providing the user with a video gives the company a chance of using body language. Although researchers disagree on the exact percentages of the body language, we know that body language has the power to deliver a message better that using words only. The report has also been focusing on the concept of emotions, and this concept could well be used in order to strengthen the usability test phase, and to reduce the cognitive workload of an online user.

The discussion was intended to frame how the hypothesis has been demonstrated and how the research has contributed to a certain change in which online companies in this case can take advantage of.

4.5 Attention to multitasking

The report has been investigating the multitasking concept and has in the discussion been arguing for the attention span of the human. The purpose of the report was in the first place to provide online companies with some guidelines on how to strengthen the web usability with the workload of an online user in centrum. Resent research has as well been investigating multitasking among web users and found that multitasking happens in 81% of all the tested sessions (Lehmann et al., 2013). Furthermore the research shows that from a survey, 92% of the participants had accessed around 2 to 8 sites to perform tasks (Ibid). This research, as well as the previous section about videos might improve the urge to multitask since the web user must pay attention to the video in order to retrieve information. The question is, however if the consumers have the patience to watch the movie?

Even though the report had some interesting conclusions, and might be useful to some online-based companies the methods and the process have several limitations, which will be presented in the last section of this report.

6.3 Limitations

Because every human is different, it is a very complex process when trying to strengthen the usability test phase by looking at the cognitive workload of a web user. Measuring the cognitive load has the possibility to categorize specific trouble spots like the chosen experiments from this report, where we among other where looking at text, and text accompanied with product pictures. It has however not the power of measuring the overall usability phase of a website as a whole. When investigating the unconscious mind we need to take into account the well being of the human when conducting the experiments. Factors like lack of sleep, stress level and time pressure are all factors that could contribute to errors when investigating the cognitive load measurement (Albers, 2011). Moreover, we must take into account the difficulties when altering a specific behavior. The report has been investigating the multitasking factor when receiving information, and when surfing in private we must assume that people are doing several unrelated things while surfing the Internet. When creating usability tests, the researcher has the full attention of the participant, which might give unreliable conclusions, since the researcher does not operate in the natural environment of the participant. Moreover, we often surf the Internet in order to receive an assigned motivation, like a new pair of jeans, etc. This assigned motivation will not be present when conducting usability tests, since the participants are pretending to make a purchase.

The following section presents the conclusion of the report. This is where the reader can get an overview of the report.

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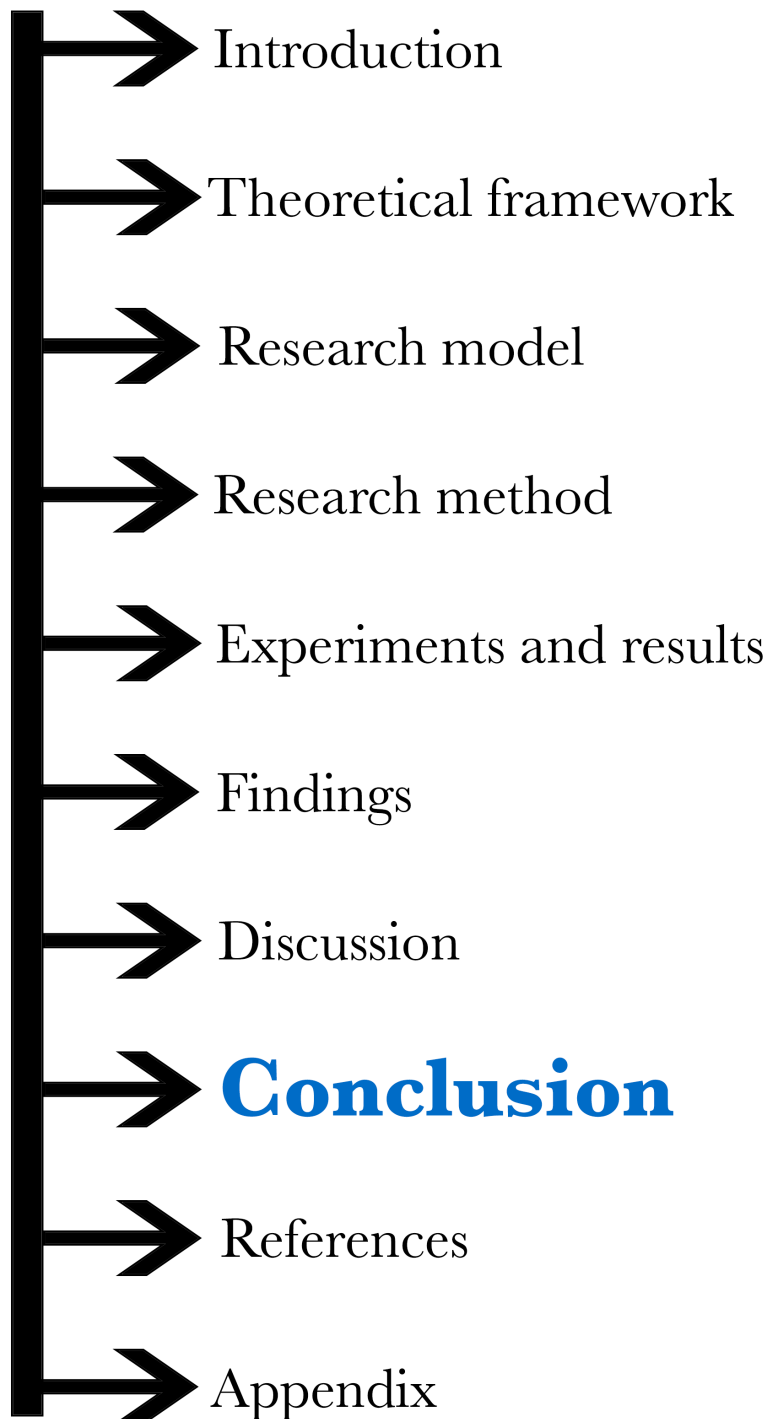
The report sets out to investigate how online-based companies can strengthen the web usability test phase by looking at the cognitive workload of an online user? Through a positivistic orientated report with predefined hypothesis, the report has based on relevant methods reached conclusions that could potentially help businesses in the usability test phase in the future. The report argued that even professional usability laboratories have problems defining the same problems when conducting usability tests. The report has been focusing on the future strategies of conducting usability tests, and it can from the report be concluded that online companies is moving from a traditional consumer persuasion process to an individual persuasion process in order to track specific stimuli on the individual level.

The report further more concluded that because humans are not programmed to store much information in storage, users tend to go into information overload, and thus miss important information in the further decision-making process, both when reading a product text and when multitasking. From the experiments the report can conclude that participants who were presented with a reduced product text in average had 11,2% more correct answers from the questioners, and that the hypothesis concerning this aspect was then accepted.

The report also found that the workload of a web user increased dramatically when performing a secondary task along with the primary task. The report can conclude that 60% of the participants had inconsistencies when performing the multitasking test, and that the hypothesis therefore has been accepted, concluding that the cognitive load of a website user increases when multitasking on a website.

From the discussion and perspective the report found that companies today have started to employ videos into the current web design, because humans are programmed to faces and visual content, that catches the attention of a human, and thus lay down the importance of considering the workload of an online user, in order to strengthen the usability test phase, when it comes to workload. It is obvious to see

that the process fluency has an important factor in the increasing engagement on online platforms, and the report can conclude that humans keep learning to filter irrelevant information, and thereby improve the process fluency.

The report highlighted the visualization of a human begin and the report found that the visual part of the brain takes up 50% of the processing power. The report can from the experiments however reject the hypothesis concerning the visual aspect since it can be concluded that participants from this experiments did not remember more information when introduced to a picture of a human face looking at the product text.

This report has by looking at workload theories as well as conducting experiments found that online companies can improve the online usability test phase by investigating the workload of an online user.

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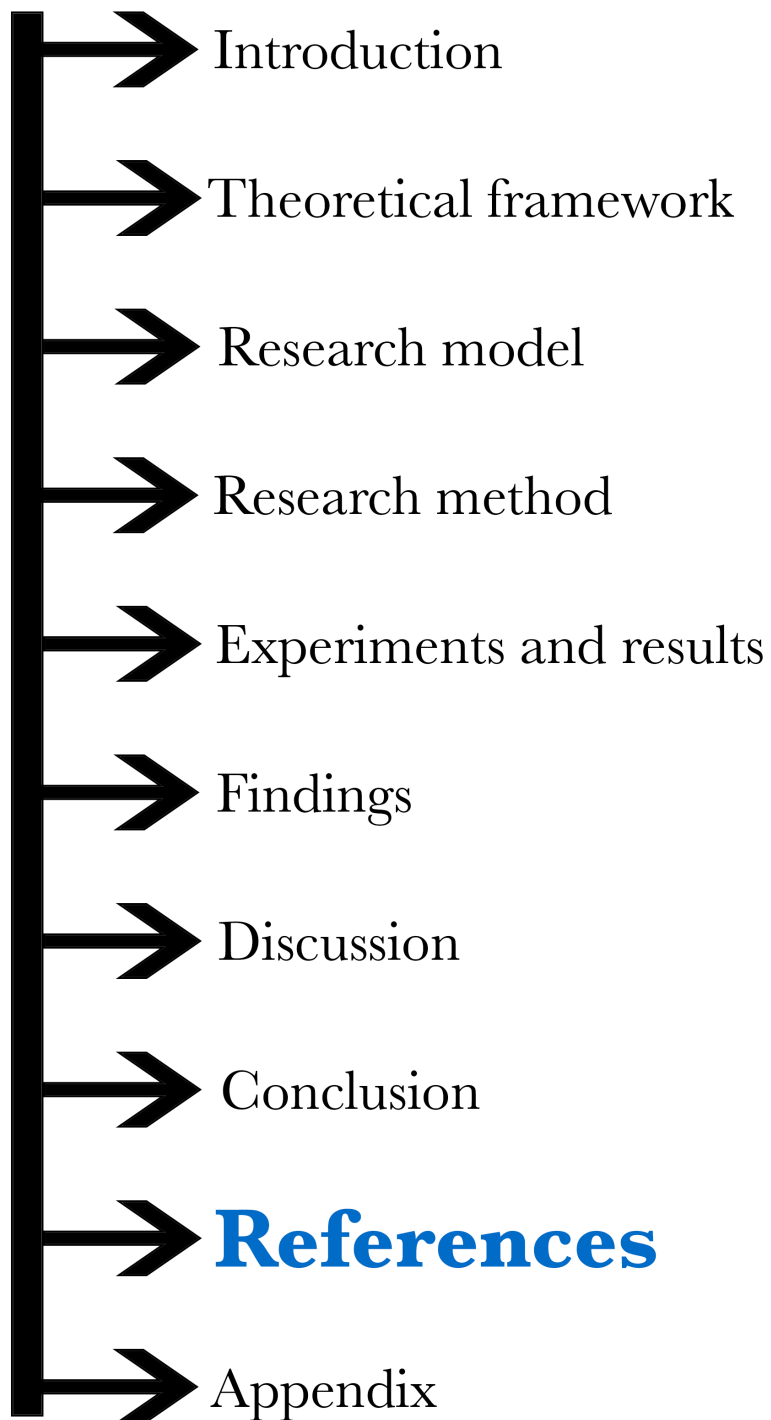
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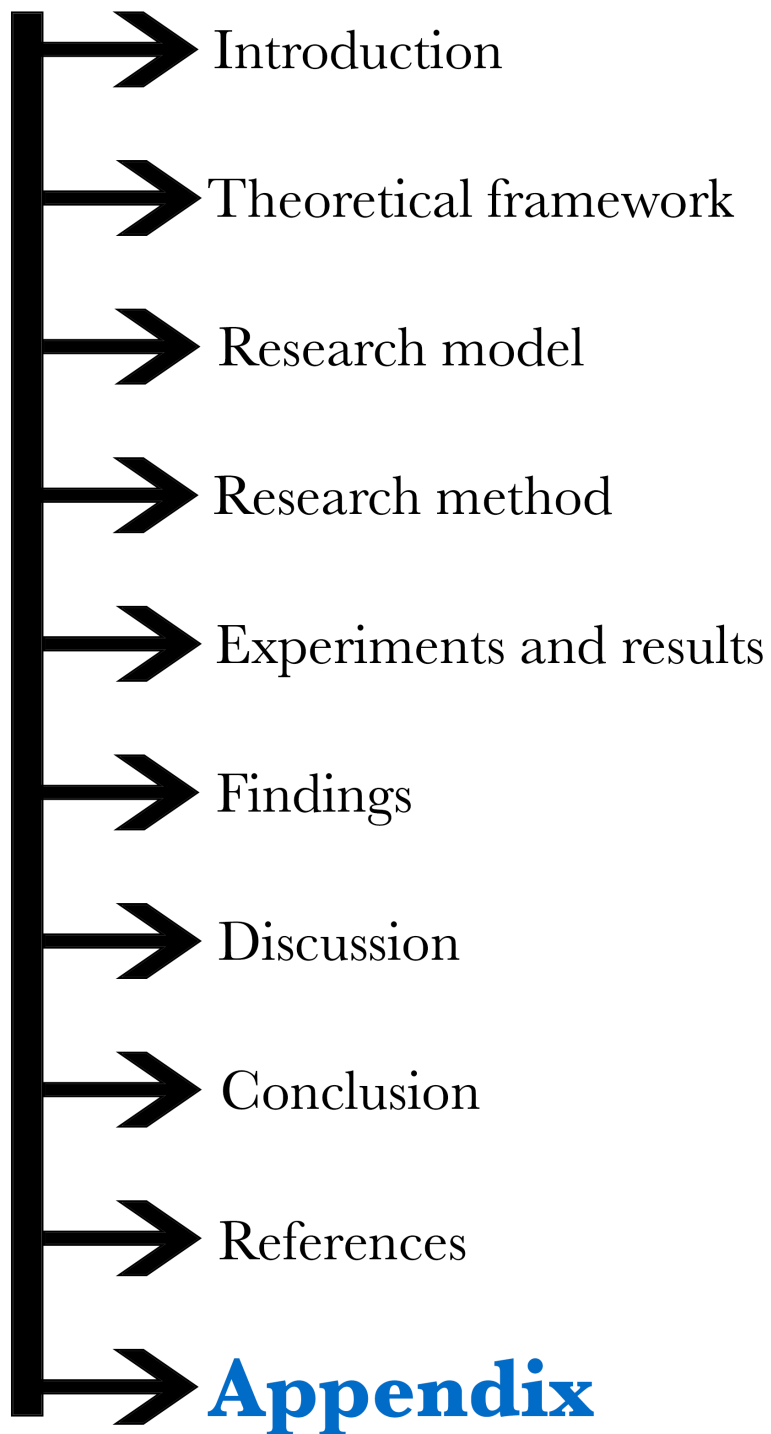- Dux, P., Ivanoff, J., Asplund, C. and Marois, R. (2006). Isolation of a Central Bottleneck of Information Processing with Time-Resolved fMRI. Neuron, 52(6), pp.1109-1120.
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Introduction

Theoretical framework

Research model

Research method

Experiments and results

Findings

Discussion

Conclusion

References

Appendix

9.1 Appendix 1 – Experiment 1

9.1.1 Full text

BØRNEfonden   We do   You can   Shop

Toys for kindergarden

Give the children in togo the opportunity to play and develop with toys.

kr. 250,00

Gift certificate - print at home

1   +   -

Add to basket

More information   Gift certificate   FAQ

Games and sports are good for children. By purchasing this product, you help to equip a kindergarden in Togo with tools like a rollercoaster, cars and dolls or coloring books, balls and bricks.

The toys are purchased locally and the correct content of each toy package depends on what the staff of the kindergarden chooses.

The toys will help to give children the opportunity to play and learn at the same time prepare them for future schooling.

9.1.2 66 % reduction

Toys for kindergarden

Give the children in togo the opportunity to play and develop with toys.

kr. 250,00

Gift certificate - print at home

1

+

-

Add to basket

More information   Gift certificate   FAQ

Help equip children in Toga with rollercoaster, cars and dolls or coloring books, balls and bricks. Products are purchased locally and prepare the children for school.

BØRNEfonden   We do   You can   Shop

9.2 Appendix 2 – Experiment 2

9.2.1 Face looking at text
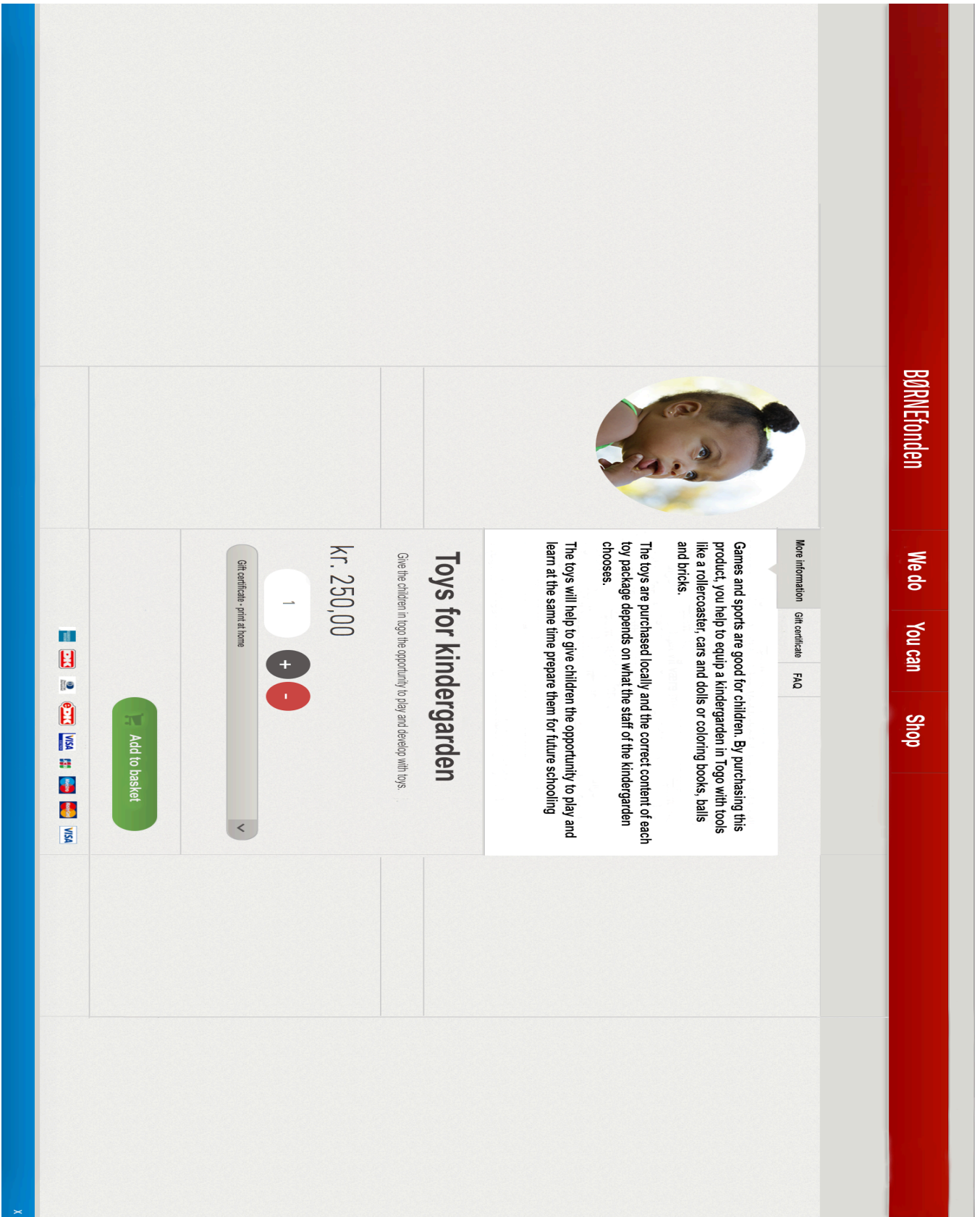
BØRNEfonden

We do   You can   Shop

More information   Gift certificate   FAQ

Games and sports are good for children. By purchasing this product, you help to equip a kindergarden in Togo with tools like a rollercoaster, cars and dolls or coloring books, balls and bricks.

The toys are purchased locally and the correct content of each toy package depends on what the staff of the kindergarden chooses.

The toys will help to give children the opportunity to play and learn at the same time prepare them for future schooling

Toys for kindergarden

Give the children in togo the opportunity to play and develop with toys.

kr. 250,00

Gift certificate - print at home

1   +   -   <   Add to basket

9.2.2 Face looking at user

BØRNEfonden

We do **You can** **Shop**

More information Gift certificate FAQ

Games and sports are good for children. By purchasing this product, you help to equip a kindergarden in Togo with tools like a rollercoaster, cars and dolls or coloring books, balls and bricks.

The toys are purchased locally and the correct content of each toy package depends on what the staff of the kindergarden chooses.

The toys will help to give children the opportunity to play and learn at the same time prepare them for future schooling

Toys for kindergarden

Give the children in togo the opportunity to play and develp with toys.

kr. 250,00

Gift certificate - print at home

1

+
-

Add to basket

9.3 Appendix 3 – Experiment 3

BØRNEfonden

We do | You can | Shop

Etiopien

Ethiopia is a landlocked country with no direct access to the coastal areas, which means that the population is highly dependent on a successful harvest. This also means that far too many children and families are burdened by malnutrition and poverty. Therefore our partner ChildFund decided to help over a million Ethiopians with agricultural training, tools and programs in health and education.

In order to prevent the serious health problems that are in the country, malnutrition and HIV / AIDS, ChildFund volunteers coaches the citizens in home hygiene, nutrition and medication that they disseminate to families on home. At the same time ChildFund cooperate with community leadersand parents about intervention and prevention. Within education builds and improves ChildFund educational institutions and offers school and student materials, and training of teachers. ChildFund further informs parents in hygiene, care and support of children, while schoolchildren may get a tutor or financial help.

These activities helps to provide increased access and admissions to schools and improved care as well as support for young children to ensure a declining death rate for children under 5 years. In addition, agricultural activities are intended to guarantee an improved harvest.

Children Foundation supports through ChildFund Alliance children, families and communities in 24 of the world's poorest countries. In BØRNEfondens own program countries: Benin, Burkina Faso, Cape Verde, Mali and Togo we ourselves are responsible for all activities.
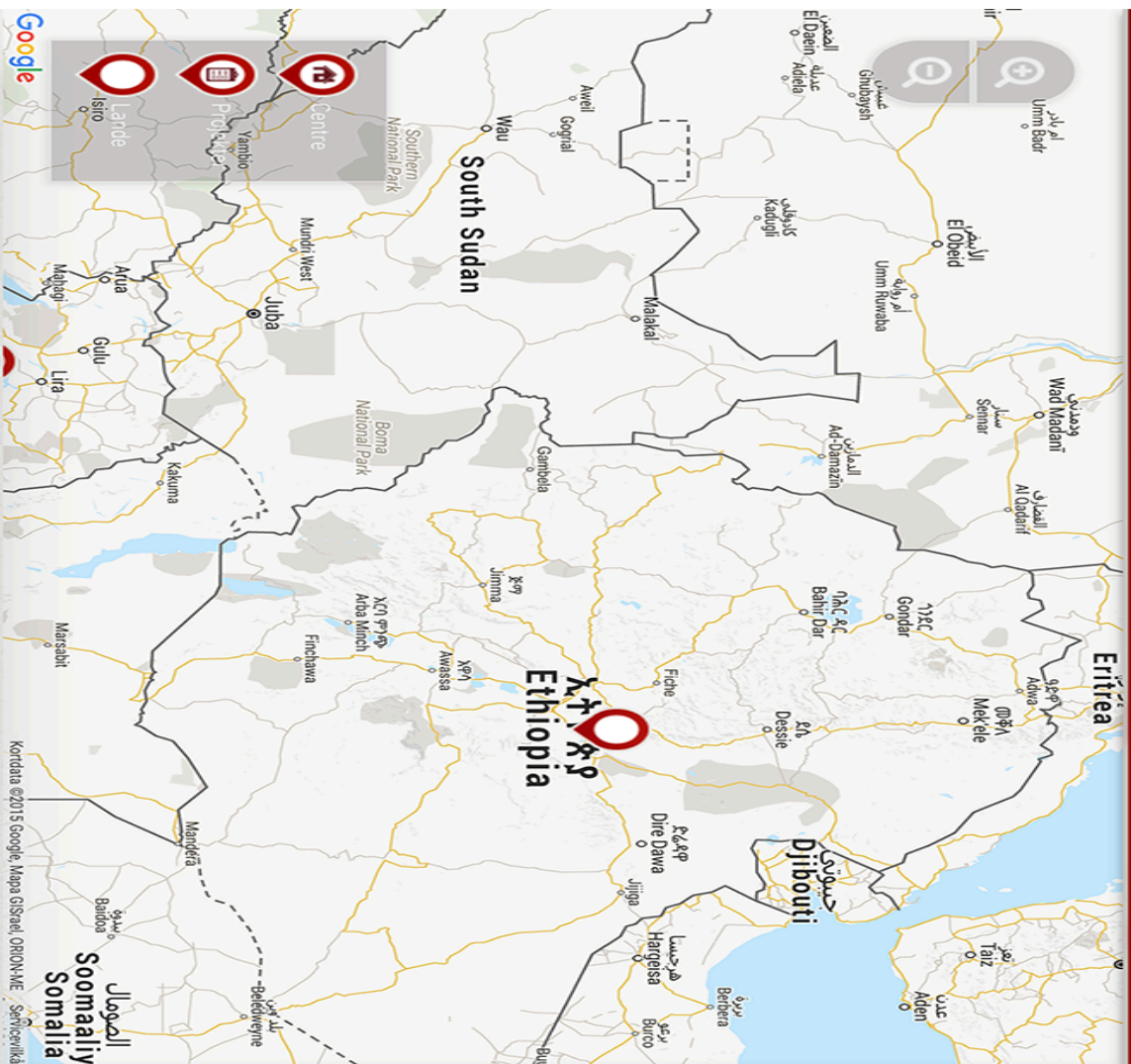
9.4 Appendix 4 – Calculations from the t-test and answers from the survey (Hypothesis 1)

9.4.1 Calculations

Full text										66% reduction							
4	5	3	3	5	4	5	3			4	3	4	4	3	5	3	4
3	3	3	3	3	5	3	5			5	4	5	4	4	5	4	4
3	4	3	3	2	5	3	3			4	4	4	4	4	4	5	5
3										4							

Summary

	Full text	66% reduction
Mean	3.56	4.12
Variance	0.84	0.36
Stand. Dev.	0.9165	0.6
n	25	25
t	-2.556	
degrees of freedom	48	
critical value	2.011	

Calculation of t value and degrees of freedom

$$\overline{X_1} \approx 3.56$$

$$t = \frac{\overline{X_1} - \overline{X_2}}{S_{X_1 X_2} \cdot \sqrt{\frac{2}{n}}}$$

$$\overline{X_2} \approx 4.12$$

$$S_{X_1}^2 = \frac{1}{n-1} \sum_{i=1}^{n} \left(X_{1i} - \overline{X_1} \right)^2 \approx 0.84$$

$$S_{X_1 X_2} = \sqrt{\frac{1}{2} \left(S_{X_1}^2 + S_{X_2}^2 \right)}$$

$$S_{X_2}^2 = \frac{1}{n-1} \sum_{i=1}^{n} \left(X_{2i} - \overline{X_2} \right)^2 \approx 0.36$$

$$d.o.f = 2n - 2$$

$$S_{X_1 X_2} = \sqrt{\frac{1}{2} \left(S_{X_1}^2 + S_{X_2}^2 \right)} \approx 0.7746$$

After substituting the t value is

$$t = \frac{\overline{X_1} - \overline{X_2}}{S_{X_1 X_2} \cdot \sqrt{\frac{2}{n}}} = \frac{3.56 - 4.12}{0.7746 \cdot \sqrt{\frac{2}{25}}} \approx -2.556$$

Degrees of freedom $\qquad d.o.f = 2n - 2 = 2 \cdot 25 - 2 = 48$

The critical value is found via a table (degrees of freedom= 48 and α)
Critical value is set to= 2.011
The value of t exceeds the critical value (2.556 > 2.011), which means that there are a significantly difference

9.4.2 Survey answers from "full text experiment"

Eksporter ▾

How much did you remember from the website? If you don't know the correct answer, please leave the box empty.

Besvaret: 25   Sprunget over: 0

Svarvalg		Besvarelser	
In what country is Børnefonden helping?	Besvarelser	52,00%	13
What does Børnefonden equip the children with?	Besvarelser	96,00%	24
Where are the products produced?	Besvarelser	68,00%	17
Who where the help aimed towards?	Besvarelser	96,00%	24
How much was the price?	Besvarelser	48,00%	12

Sp. 2

Tilpas   Eksporter ▾

I felt the website was reliable.

Besvaret: 25   Sprunget over: 0

Svarvalg		Besvarelser	
▾	Yes	56,00%	14
▾	No	24,00%	6
▾	Don't know	20,00%	5
I alt			25

Kommentarer (4)

Sp. 3

Tilpas   Eksporter ▾

I felt like the website was sufficient enough, and I was provided with the right amount of information.

Besvaret: 25   Sprunget over: 0

Svarvalg		Besvarelser	
▾	Yes, the website was sufficient enough	64,00%	16
▾	No, the website was not sufficient enough	32,00%	8
▾	Don't know	4,00%	1
I alt			25

Kommentarer (3)

Sp. 4

Tilpas   Eksporter ▾

Would you consider buying this product in the future?

Besvaret: 25   Sprunget over: 0

Svarvalg		Besvarelser	
▾	Yes	32,00%	8
▾	No	44,00%	11
▾	Don't know	24,00%	6
I alt			25

81

Tilpas | Eksporter ▾

How old are you?

Besvaret: 25 Sprunget over: 0

Sp. 6

Tilpas | Eksporter ▾

What is your current profession?

Besvaret: 25 Sprunget over: 0

Svarvalg	Besvarelser	
▾ Bachelor student	36,00%	9
▾ Master student	40,00%	10
▾ Highschool student	0,00%	0
▾ In a full time job	24,00%	6
▾ Unemployed	0,00%	0
I alt		25

Sp. 7

Tilpas | Eksporter ▾

What is your gender?

Besvaret: 25 Sprunget over: 0

Svarvalg	Besvarelser	
▾ Male	48,00%	12
▾ Female	52,00%	13
I alt		25

9.4.3 Survey answers from "66% reduction experiment"

Sp. 1

Tilpas   Eksporter ▾

What is you gender?

Besvaret: 25   Sprunget over: 0

Svarvalg ▾	Besvarelser ▾
▾ Male	56,00%	14
▾ Female	44,00%	11
I alt		25

Sp. 2

Tilpas   Eksporter ▾

I felt the website was reliable.

Besvaret: 25   Sprunget over: 0

Svarvalg ▾	Besvarelser ▾
▾ Yes	80,00%	20
▾ No	16,00%	4
▾ Don't know	4,00%	1
I alt		25

Kommentarer (3)

Sp. 3

Tilpas   Eksporter ▾

I felt like the website was sufficient enough, and I was provided with the right amount of information.

Besvaret: 25   Sprunget over: 0

Svarvalg ▾	Besvarelser ▾
▾ Yes, the website was sufficient enough	32,00%	8
▾ No, the website was not sufficient enough	56,00%	14
▾ Don't know	12,00%	3
I alt		25

Kommentarer (11)

Sp. 4

Tilpas   Eksporter ▾

Would you consider buying this product in the future?

Besvaret: 25   Sprunget over: 0

Svarvalg ▾	Besvarelser ▾
▾ Yes	32,00%	8
▾ No	24,00%	6
▾ Don't know	44,00%	11
I alt		25

How old are you?

Besvaret: 25   Sprunget over: 0

18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39

What is your current profession?

Besvaret: 25   Sprunget over: 0

Bachelor student

Master student

Highschool student

In a full time job

Unemployed

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Svarvalg	Besvarelser	
▾ Bachelor student	20,00%	5
▾ Master student	64,00%	16
▾ Highschool student	0,00%	0
▾ In a full time job	16,00%	4
▾ Unemployed	0,00%	0
I alt		25

What is you gender?

Besvaret: 25   Sprunget over: 0

Male

Female

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Svarvalg	Besvarelser	
▾ Male	56,00%	14
▾ Female	44,00%	11
I alt		25

84

9.5 Appendix 5 – calculations from the t-test and answers from the survey (Hypothesis 2)

9.5.1 Calculations

Face looking at user	Face looking at text
3 5 3 3 4 3 3 4	5 4 4 4 3 4 4 4
3 5 3 4 4 5 3 3	3 3 4 3 3 5 4 2
3 4 3 3 4	3 5 4 4 3

Summary

	Group 1	Group 2
Mean	3.5714	3.7143
Variance	0.5571	0.6143
Stand. Dev.	0.7464	0.7838
n	21	21
t		-0.6049
degrees of freedom		40
critical value		2.021

Calculation of t value and degree of freedom

$$t = \frac{\overline{X_1} - \overline{X_2}}{S_{X_1 X_2} \cdot \sqrt{\frac{2}{n}}}$$

$$S_{X_1 X_2} = \sqrt{\frac{1}{2}\left(S_{X_1}^2 + S_{X_2}^2\right)}$$

$$d.o.f = 2n - 2$$

$$\overline{X_1} \approx 3.5714$$

$$\overline{X_2} \approx 3.7143$$

$$S_{X_1}^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(X_{1i} - \overline{X_1}\right)^2 \approx 0.5571$$

$$S_{X_2}^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(X_{2i} - \overline{X_2}\right)^2 \approx 0.6143$$

$$S_{X_1 X_2} = \sqrt{\frac{1}{2}\left(S_{X_1}^2 + S_{X_2}^2\right)} \approx 0.7653$$

After substituting the t value

$$t = \frac{\overline{X_1} - \overline{X_2}}{S_{X_1 X_2} \cdot \sqrt{\frac{2}{n}}} = \frac{3.5714 - 3.7143}{0.7653 \cdot \sqrt{\frac{2}{21}}} \approx -0.6049$$

The degrees of freedom is:
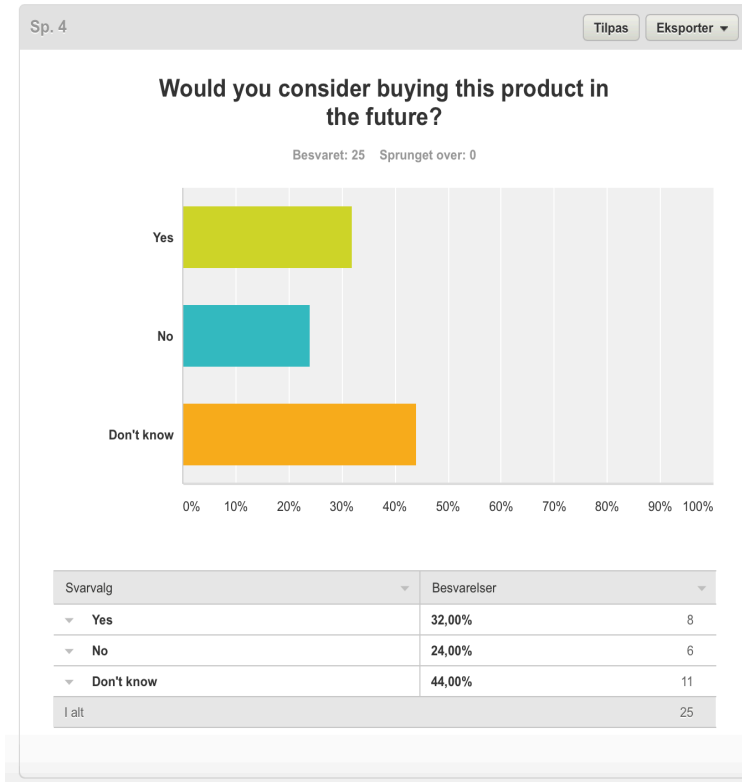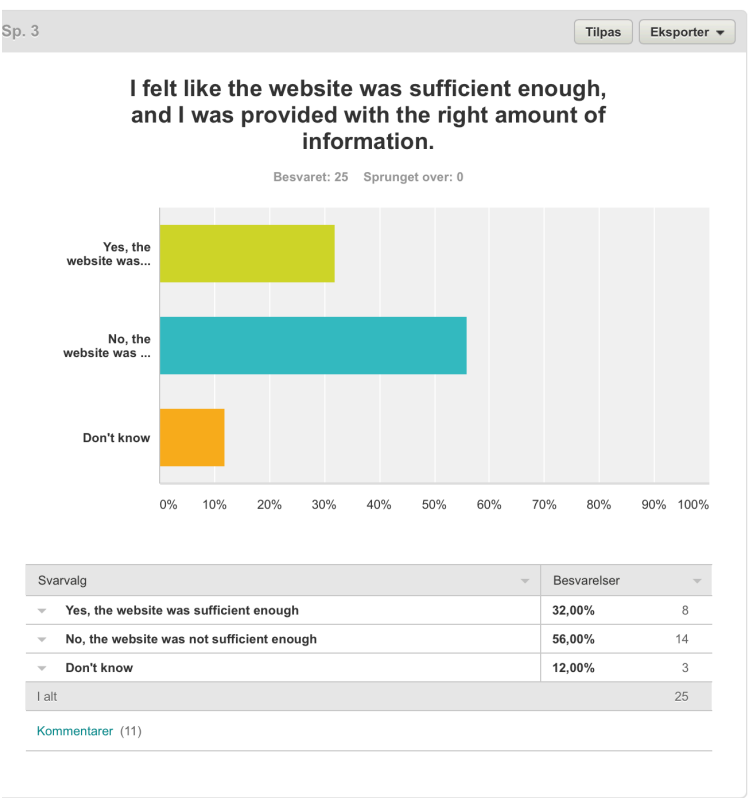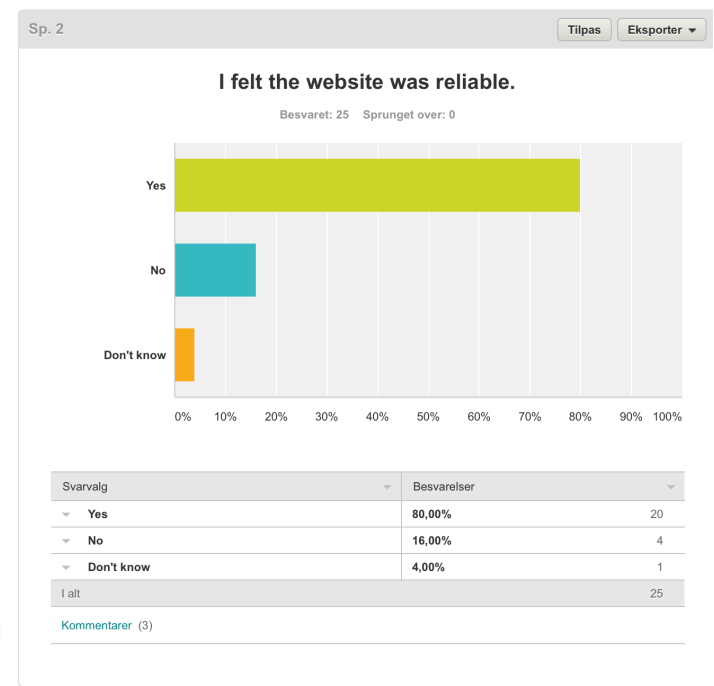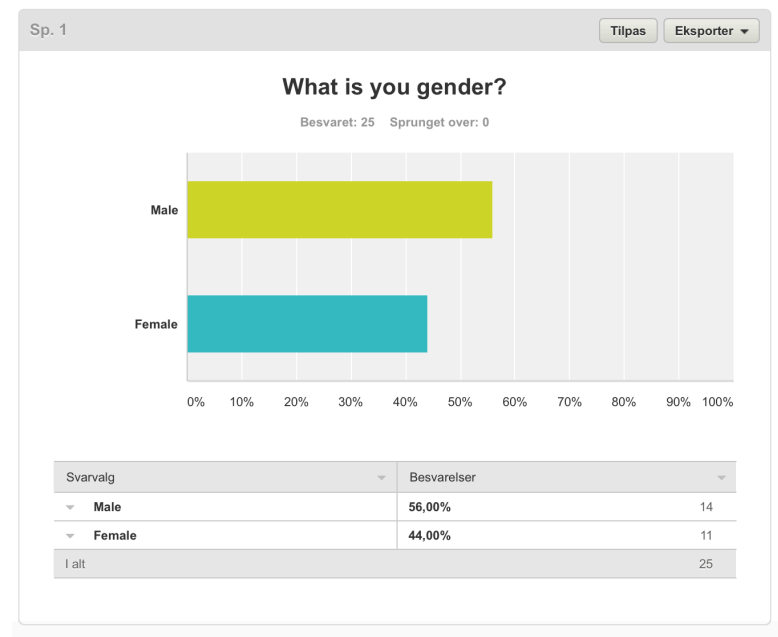
$$d.o.f = 2n - 2 = 2 \cdot 21 - 2 = 40$$

The critical value is found via a table (Degrees of freedom= 40 and α)

Critical value is set to= 2.021

The value of t is smaller than the critical value (0.6049 < 2.021), which means that there are not significantly difference

9.5.2 Survey answers from "face looking at user"

Sp. 1

Eksporter

How much did you remember from the website? If you don't know the correct answer, please leave the box empty.

Besvaret: 21   Sprunget over: 0

Svarvalg		Besvarelser	
In what country is Børnefonden helping?	Besvarelser	57,14%	12
What does Børnefonden equip the children with?	Besvarelser	95,24%	20
Where are the products produced?	Besvarelser	57,14%	12
Who where the help aimed towards?	Besvarelser	90,48%	19
How much was the price?	Besvarelser	57,14%	12

Sp. 2

Tilpas   Eksporter

Would you consider buying this product in the future?

Besvaret: 21   Sprunget over: 0

Svarvalg		Besvarelser	
	Yes	28,57%	6
	No	33,33%	7
	Don't know	38,10%	8
I alt			21

Sp. 3

Tilpas   Eksporter

What is your gender?

Besvaret: 21   Sprunget over: 0

Svarvalg		Besvarelser	
	Male	57,14%	12
	Female	42,86%	9
I alt			21

Sp. 4

Tilpas   Eksporter

How old are you?

Besvaret: 21   Sprunget over: 0

86

What is your current profession?

Besvaret: 21   Sprunget over: 0

Svarvalg		Besvarelser	
▾	**Bachelor student**	**14,29%**	3
▾	**Master student**	**66,67%**	14
▾	**Highschool student**	**0,00%**	0
▾	**In a full time job**	**19,05%**	4
▾	**Unemployed**	**0,00%**	0
I alt			21

87

9.5.3 Survey answers from "face looking at text"

Eksporter ▼

How much did you remember from the website? If you don't know the correct answer, please leave the box empty.

Besvaret: 21   Sprunget over: 0

Svarvalg		Besvarelser	
In what country is Børnefonden helping?	Besvarelser	57,14%	12
What does Børnefonden equip the children with?	Besvarelser	100,00%	21
Where are the products produced?	Besvarelser	57,14%	12
Who where the help aimed towards?	Besvarelser	95,24%	20
How much was the price?	Besvarelser	61,90%	13

Sp. 2   Tilpas   Eksporter

Would you consider buying this product in the future?

Besvaret: 21   Sprunget over: 0

	Svarvalg		Besvarelser	
▼	Yes		47,62%	10
▼	No		28,57%	6
▼	Don't know		23,81%	5
	I alt			21

Tilpas   Eksporter ▼

What is your gender

Besvaret: 21   Sprunget over: 0

	Svarvalg		Besvarelser	
▼	Male		52,38%	11
▼	Female		47,62%	10
	I alt			21

Sp. 4   Tilpas   Eksporter ▼
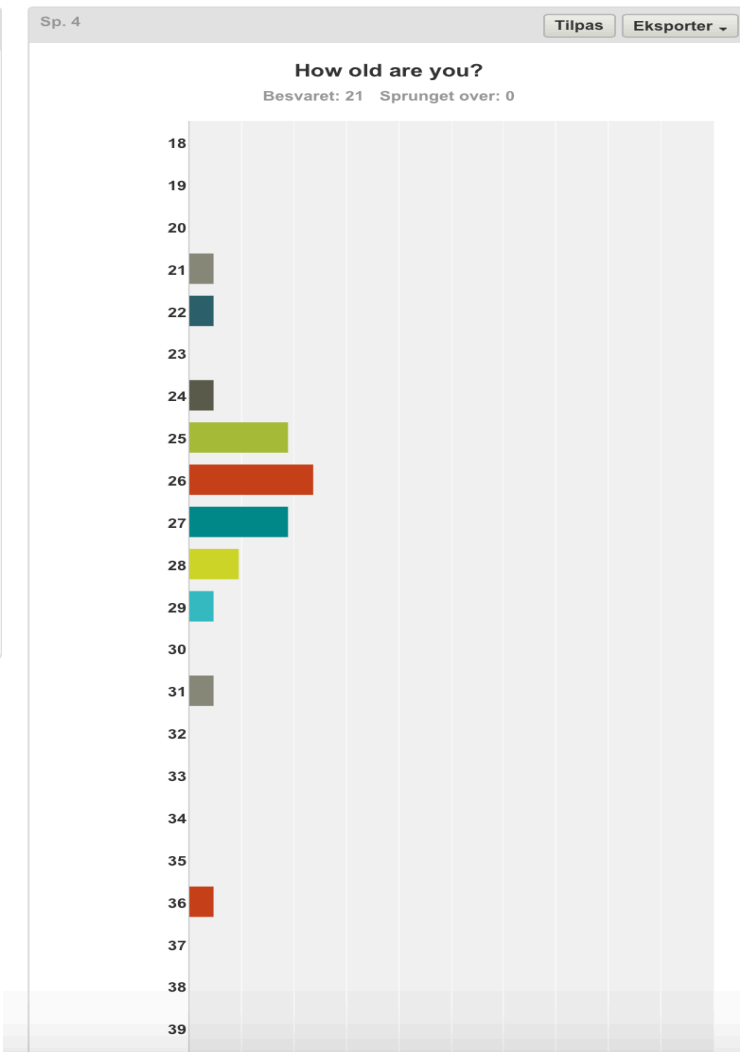
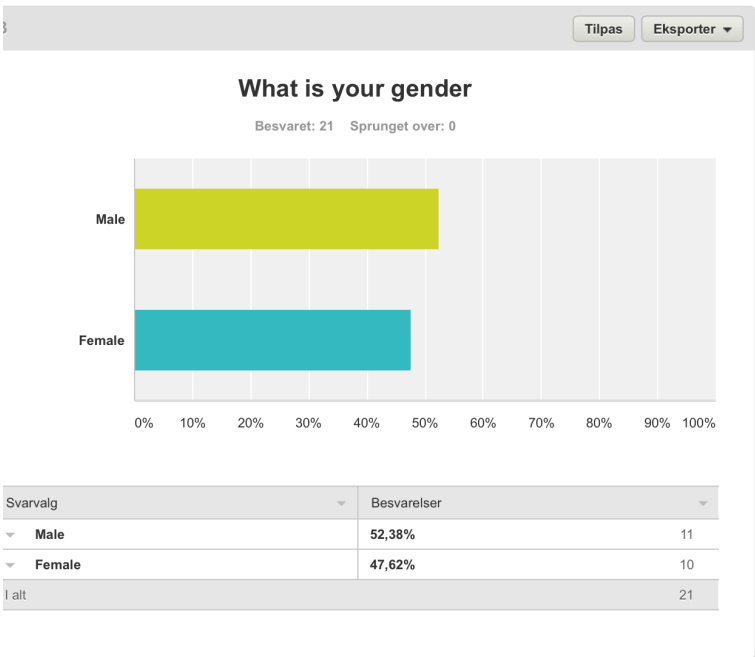### How old are you?

Besvaret: 21   Sprunget over: 0

88

What is your current profession?

Besvaret: 21   Sprunget over: 0

Svarvalg	▼	Besvarelser	▼
▼	Bachelor student	19,05%	4
▼	Master student	52,38%	11
▼	Highschool student	0,00%	0
▼	In a full time job	28,57%	6
▼	Unemployed	0,00%	0
I alt			21

9.6 Appendix 6 – descriptive data from multitasking investigation, and answers from survey

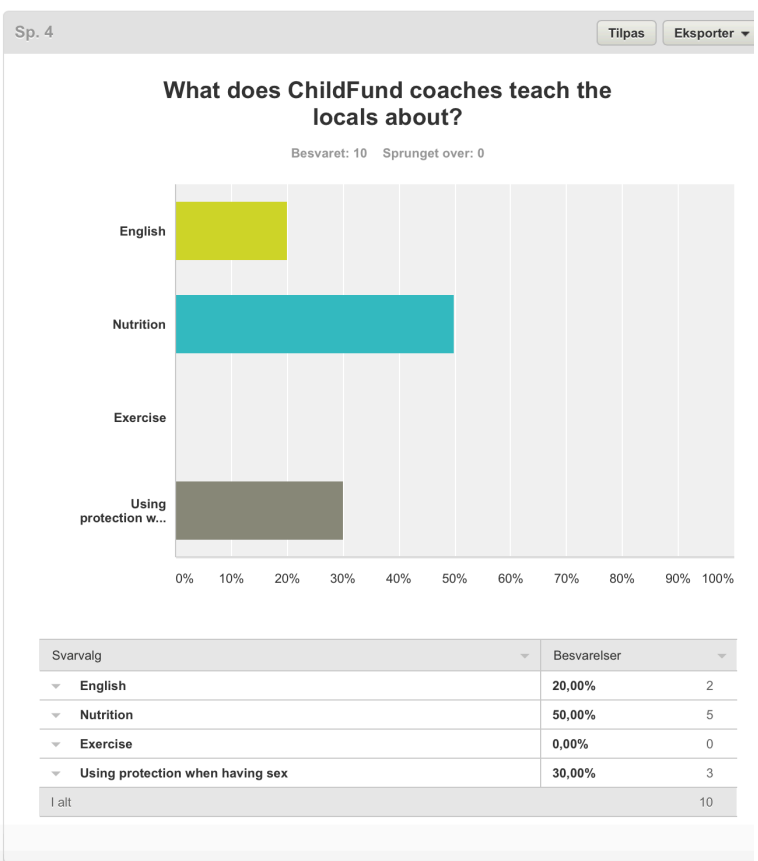|	1	2	3	4	5	6	7	8	9	10
Reading time	1min. 21sec.	1min. 1sec.	1min. 24sec.	1min. 47sec.	59sec.	1min. 32sec.	57sec.	1min. 13sec.	1min. 11sec.	1min. 38sec.
Time before error	17.40sec	N/A	42sec.	37sec.	N/A	1min. 15sec.	33sec.	N/A	N/A	1min. 11sec.
Correct answers	2	3	2	3	4	2	2	3	2	3
Wrong answers	3	2	3	2	1	3	3	2	3	2
Gender	Female	Male	Male	Male	Female	Female	Female	Male	Male	Female
Profession	Master student	Master student	Master student	Full time job	Bachelor student	Master student	Master student	Master student	Master student	Master student
Age	33	35	27	30	24	27	26	28	28	27

N/A= no errors in the tapping phase

9.6.1 Survey answers from "multitasking experiment"

Sp. 1 — Tilpas | Eksporter ▾

Does Ethiopia have access to the coastal areas?

Besvaret: 10   Sprunget over: 0

Svarvalg	Besvarelser	
Yes	10,00%	1
No	70,00%	7
Don't know	20,00%	2
I alt		10

Sp. 2 — Tilpas | Eksporter ▾

What are Ethiopia very dependent of?

Besvaret: 10   Sprunget over: 0

Svarvalg	Besvarelser	
Cold water	10,00%	1
A good harvest	40,00%	4
Rain	30,00%	3
Access to school	20,00%	2
I alt		10

Sp. 3 — Tilpas | Eksporter ▾

What does ChildFund help with?

Besvaret: 10   Sprunget over: 0

Svarvalg	Besvarelser	
Providing the country with water	20,00%	2
Agricultural training	20,00%	2
Helping to pay for school	40,00%	4
Provide the children with toys	20,00%	2
I alt		10

Sp. 4 — Tilpas | Eksporter ▾

What does ChildFund coaches teach the locals about?

Besvaret: 10   Sprunget over: 0

Svarvalg	Besvarelser	
English	20,00%	2
Nutrition	50,00%	5
Exercise	0,00%	0
Using protection when having sex	30,00%	3
I alt		10

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What does the work and activities help with?

Besvaret: 10 Sprunget over: 0
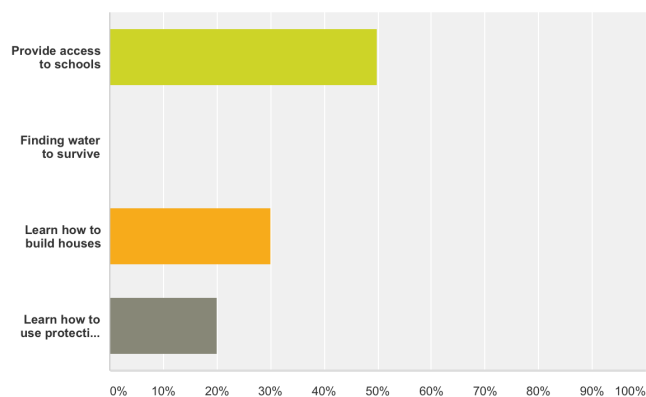
Svarvalg	▾	Besvarelser	▾
▾ Provide access to schools		**50,00%**	5
▾ Finding water to survive		**0,00%**	0
▾ Learn how to build houses		**30,00%**	3
▾ Learn how to use protection when having sex		**20,00%**	2
I alt			10

How old are you?

Besvaret: 10 Sprunget over: 0

What is your current profession?

Besvaret: 10 Sprunget over: 0
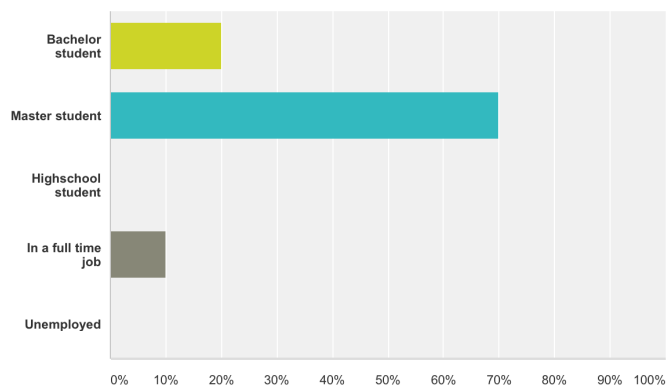
Svarvalg	▾	Besvarelser	▾
▾ Bachelor student		**20,00%**	2
▾ Master student		**70,00%**	7
▾ Highschool student		**0,00%**	0
▾ In a full time job		**10,00%**	1
▾ Unemployed		**0,00%**	0
I alt			10

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Tilpas   Eksporter ▾
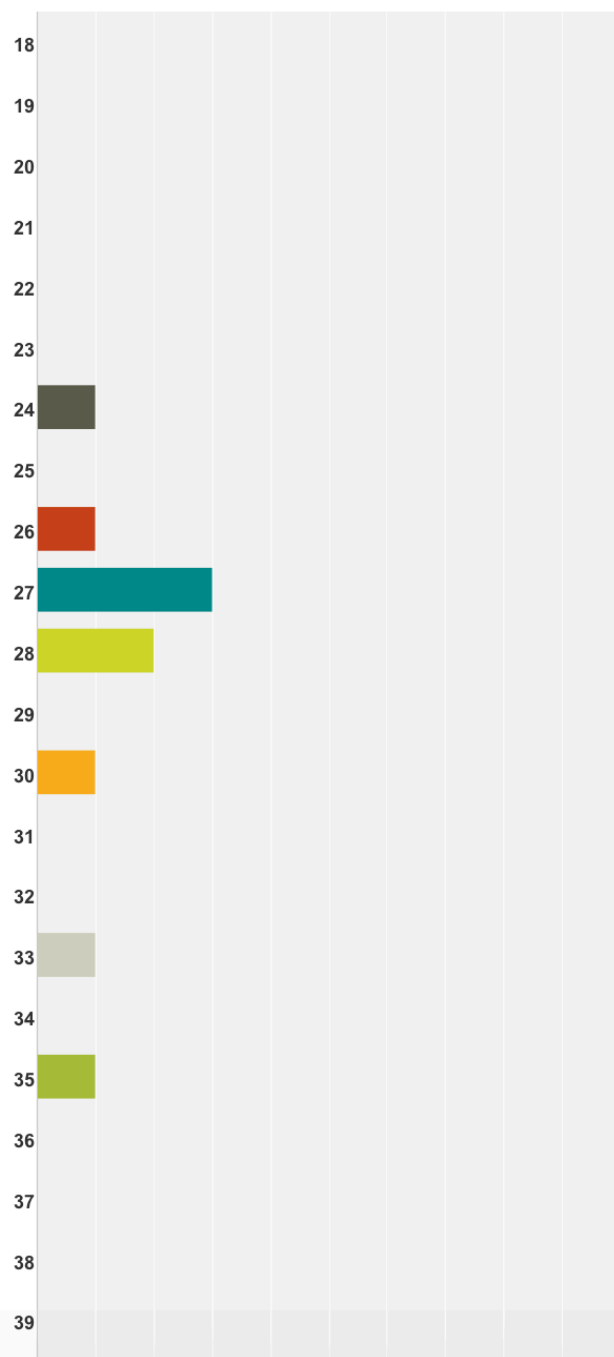
What is your gender?

Besvaret: 10   Sprunget over: 0
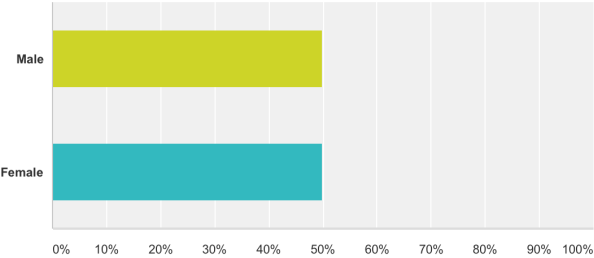
Svarvalg		Besvarelser	
▾	**Male**	**50,00%**	5
▾	**Female**	**50,00%**	5
I alt			10