USABILITY OF WEB-BASED SOFTWARE PRODUCTS

Usability evaluation methods and optimization techniques applied to web-based software

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ABSTRACT

Usability is having a large impact on many aspects of society including the business community, the computing industry, the entertainment industry and higher education. In current times, millions of people around the world consider technology as main part of their life. The advent of the Web 2.0, for instance, has brought to light new needs for standards in communication, since web applications now facilitate interactive information sharing, interoperability and user-centred design. In fact, the World Wide Web has changed technically, but it has also changed the way software developers and end-users use the Web.

Graphical user interfaces (GUIs) are the interfaces that allow the end-user to interact with the software, that can be a web application or also a simple program installed on the end-user's computer. Therefore, they have an impact on the quality and the usability of the resulting system. Thus, ensuring that developers can make the most out of them is an important challenge.

In order to evaluate the usability level of a system and its graphical user interface it is possible to apply standard usability evaluation methods as known from HCI (Human Computer Interaction). However, standard usability evaluation methods are several and very often it is hard to choose which one to adopt. In this research the most effective usability methods to evaluate software products' graphical user interfaces usability have been analysed and tested, including Heuristics Evaluation, Walkthroughs, and some other core Web Design principles, giving an important guideline to the developer that intends to optimize the usability of its software products. Since usability embrace many different areas of informatics, this research will focus on World Wide Web aspects of usability, from web applications to web sites development, evaluating the evolving design against user requirements.

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1 INTRODUCTION

The aim of this Bachelor's Thesis is to provide a general overview about usability as concept by defining practical, fast and low-cost tools in order to analyse the usability level of a certain product, in our case a software or even more specifically, a web-application.

At present, software has become considerably more complex and it is advancing step-by-step with technology evolution. Moreover, computer hardware is more powerful in performance terms and it is now more accessible to everyone. The enormous spread of computers, on both home and business levels, and consequently of the World Wide Web, has brought to a vast distribution of software applications and web services.

A software application is a commercial product like any other which to survive on a competitive market needs to fulfil certain criteria to buyer's eyes and therefore also, it needs to be a quality product. Quality is a very vast concept but this research process is lingered on usability, or better on the quality that is perceived from the user while utilizing web-based software. Several software are well-designed and they reveal to be very steady and efficient, but often what is neglected is the external part of it, which is in other words, the graphical user interface.

Although the software itself may be very complex and sophisticated, at least in its core, it has to present itself always like very easy to utilize. Nowadays, the end-user is a subject with very low technical skills but that cannot stop him from utilizing tools and software services. Thus, usability is becoming more influential in economic aspects since better quality software means more success on the market, therefore more profit. Likewise any investment also the study and application of usability has a cost. These costs depend from the knowledge and tools that are available.

1.1 Usability

In current times, technology plays a very relevant role in every possible field, whereas a product is manufactured or a service is provided, it facilitates everyday life by automatizing and accelerating several processes. It makes people feel updated and move with the times but very often it is easy to encounter the downside of technology. Technology is often designed by technologists and for this reason ordinary people find themselves in unpleasant situations. They often need to brainstorm in order to be capable of interacting with a certain product or service. Technologists think differently from ordinary people. Ordinary people could be a grandmother, a school student, a cashier at the supermarket. They do understand a bit the technology but surely they do not know it in such a detail like the person who has created a particular product. Often organizations bring to market products that reflect the technologist way of thinking. These devices reveal themselves to be a total failure not because of the technology they are made of, but for the really poor usability experience they offer. (Nielsen 1999, 16-19)

The word "usability" has to do with the ease with which a person can interact with an object (tool, software, product or service). In other words if something it is easy to use or not. To better understand the meaning of usability, when utilizing a product, if the answer to the question "Is it easy to use? Am I able to use it ?" results positive then the product is usable. If an object is easy to use, it means it has been designed purposely for that kind of user. For instance, t-strap baby shoes are designed to be used by babies. It means they have to be small, with no laces, and very fast to put on and take off. That is possible just with the strap that allows the baby to put them on by himself. In other words they have a good level of usability because the baby himself can use them since early age. (Nielsen 1999, 16-19)

Usability involves both psychology and physiology, thus designers have to keep count of both, how people think and how are made physically.

1.2 Usability definitions

While there are nearly as many definitions of usability as there are usability practitioners, a concise definition can be found in the ISO standards (ISO 9241: ISO Standard Part 11: Guidance on usability. Referred 11.05.2011.):

"*The standards body defines usability as the effectiveness, efficiency and satisfaction with which a specific set of users can complete a specific set of tasks in a particular environment.***"** (Sherman and Quesenbery, 2005)

The ISO definition implies that usable software must be accessible. Accessible means that for instance also people with disabilities utilize the software to a degree comparable to the one of people without disabilities. Even though accessibility is very important and it is a subcategory of usability, this research has been focused mainly on usability.

The quality model established in the first part of the standard, ISO/IEC 9126-1, 1998, classifies software quality in a structured set of characteristics and sub characteristics of which one about usability:

"A set of attributes that bear on the effort needed for use, and on the individual assessment of such use, by a stated or implied set of users." (ISO 9126: ISO Standard Part 4: Software Engineering - Product quality. Referred 11.05.2011.):

Usability is all about people, not products. If the intended users can use the product to accomplish their goals, then the product is usable. If they cannot, or cannot readily, use the product to accomplish their goals, then the product is not really usable. (Nielsen 1993, 26-32).

Usability is not a single, one-dimensional property of a user interface. Usability has multiple components and traditionally is associated with five usability attributes: learnability, efficiency, memorability, errors, satisfaction. (Nielsen 1993, 26-32).

Learnability is in some sense the most fundamental usability attribute, since most systems should be easy to learn so that the new users can rapidly get familiar with their user-interface. Certainly there are some systems that are not easy to learn and for which one can afford to train

users extensively to overcome a complex user-interface, but in most cases, systems should be easy to learn. (Nielsen 1993, 26-32).

Efficiency refers to the efficiency of the system intended as productivity, once a user has learned the system, a high level of productivity is possible. For example, there are some operative systems that are so complex that it takes several years to reach expert level performance. (Nielsen 1993, 26-32).

Memorability is meant to describe the ease for a user to remember the main functionalities of a given system. If the system is easy to remember, a casual user is able to return to the system after a period of time without having to learn it all over again. (Nielsen 1993, 26-32).

Errors is an attribute that refers to the low amount of errors a system should have. If the system has a low error rate, then the users will get accustomed to a certain type of error and will be able to recover from them independently. (Nielsen 1993, 26-32).

Satisfaction highlights that a system should be pleasant to use, so that users are satisfied when using and they become loyal to the software. If they like it, they will use it more. Especially for systems that are used in a nonworking environment such as home computing, games, social networks, creative painting is surely a fundamental attribute of usability that a system should not underestimate. (Nielsen 1993, 26-32).

1.3 Web usability

The World Wide Web counts about 255 million sites, as December 2010, with almost 2 billion global users. Although Internet has become the greatest source of information and surely the most used media of communication in the world, rarely web sites are built by strictly following web standards or by merely addressing those to its users. (Pingdom, 2010. referred 22.02.2011).

As a result of this overwhelming reality, users have become much more pretentious and impatient than before when surfing a web site. If they cannot find what they are looking for or if they do not think a webpage is functional, they leave. It is very easy to go elsewhere; all the competitors in the world are but a mouse click away. In fact, this is the reason why web usability has assumed a much more important role than before. (Nielsen 1999,10.)

When comparing web usability to traditional physical product development, it is noticeable that, customers experience usability of a web site before they have committed to using it and before they have spent any money on potential purchases. On the other hand in physical development customers experience usability just after they have actually purchased the product.
In the software industry there are slightly more motivations than the physical product industry to improve usability. Users have access to a support centre, to which they can call whenever they experience a problem. Each call to the support centre can be very expensive, from \$30 to \$100 per call and about half of the calls are due to the poor usability of the software. (Nielsen 1999,10.)

Although a company could invest in improving the user interface and thus improving usability avoiding support costs, it is not the main worry of the company. Shipping the product on time is what really creates cash flows. The World Wide Web projects people into a universe where communication and information sharing is based on the user and the user needs to test any web-product before becoming a loyal user or even a customer. On the web, users experience usability first and pay later. Thus usability rules the Web and this way attracts its users. (Nielsen 1999,10.)

2 OBJECTIVES

The research project's main objective is to analyze the most effective methodologies aimed to evaluate and optimize usability of web-based software products and to provide a useful set of rules and practical examples useful to web-developers. Another important objective is to increase the business activities through the improvement of a company's software usability. However, when the usability experience increases, more people will likely be using the software to generate further cash flows.

On the other hand, the objective of the practical framework was to prove the efficiency of such usability testing methodologies by participating in a real-life usability evaluation project for a web design company based in Oulu. Organizing all stages of the usability evaluation tests and facing many web usability related problems has been a great chance for gaining new experience and skills.

Summarizing, the research framework is made of three parts: Theoretical background on Usability planning, Theoretical Background on Usability Evaluation and Practical Usability Evaluation of an e-commerce software product.

2.1 Theoretical background: Usability planning

In the first part of the theoretical background useful common practices for improving usability of web-applications have been analysed. Applying few rules before the software implementation has started can improve the development of a web-based software product considerably. This section provides useful tips for avoiding common usability problems that can be encountered when building web-based applications.

When planning the usability of a software project is required to consider many different areas in which optimization is crucial. These areas include: page design, content design, page navigation, online documentation and users categories. A developer should always plan each area of optimization before the coding phase will start. Proceeding this way will be cost-saving and will eliminate many different usability issue before they arise.

2.2 Theoretical background: Usability evaluation

The second research part focuses on software usability evaluation and specifically aims on finding the most effective and cost-saving methods tools available to evaluate the usability of a given software product. This section focuses on usability testing methods for evaluating usability of web-based applications providing useful guidelines to follow when running usability tests.

The usability evaluation methods which will be analysed in detail include Heuristics usability evaluation, Thinking aloud, Cognitive Walkthrough and Pluralistic Walkthrough.
Combining these methods depending on the needs of the project commissioner will generate very accurate results and will help to build very usable software.

2.3 Implementation: Usability testing

The practical part of the research process was an opportunity to test in real-life the theories analyzed in the theoretical background by running the usability evaluation test for a web-design company placed in Oulu. For copyright reasons the name of the company cannot be published even though several screenshots of different testing stages have been attached in the practical framework of the Bachelor's Thesis.

In this section the web-shop user interface has been analyzed in detail, showing through the different GUI screenshots which were the main challenges of the implementation of the project. The implementation has been done mainly in the laboratories of Oulu University of Applied Sciences. The software used for the actual usability evaluation has been MORAE suite. Using MORAE has allowed to perform video-recording of each session and to analyze later each video for finding issues met by the evaluators.

3   USABILITY PLANNING

Usability planning provides an important means to avoid facing usability issues during the actual implementation of the project. It defines the scope of usability work required to produce a user-interface design that is efficient, effective and satisfying in use. Usability planning involves defining and managing user-centered design activities that will take place during the development of a product. Usability planning will enable relevant cost benefits and it will allow the developer to take into account of usability issues since the first stages of software development.

Jakob Nielsen has analyzed various aspects of web-usability; defining the most important areas to focus on when developing web sites and web-applications. These areas include page design, content design, links, online documentation, user categories, download speed and performance. During early stages of software development, the developer should take into account of these areas by applying principles that can improve the final usability experience. (Nielsen 1999, 25-28.)

3.1 Page design

According to Nielsen, page design is a crucial part of usability for any kind of web site or web application. With current browser technology, users surf a single page at the time (unless they are using large screens with multiple windows opened). Thus, the outlook of the graphical user interface of the web site is one of the key factors why a user will use an application and will not leave immediately. If a web site contained what the user is looking for and the navigation scheme was clear enough to let the user find it easily, then it would already pass one of the usability issues that affect most of the web sites on the World Wide Web. (Nielsen 1999, 22.)

Most of web sites are dominated from anything else but not the content. Often, the space used for navigation is overrated and the web site is not dedicated to the actual content sponsored on a search engine. As a rule of thumb, content should account for at least 50% of the page, or preferably closer to 80%. A very important rule in web design is to be as simple as possible: removing one by one all design elements present on the page, and then adding back only the

ones that are strictly necessary, it is an easy tip to bear in mind. Every superfluous element would add more time for the page to be downloaded and visualized by each visitor.
(Nielsen 1999, 23)

3.2 Content design

The content of a web site or a web application is what users are ultimately looking for. The content represents the mere substance in which users are interested in. The layout is also important but is secondary comparing to how the information is presented and organized. If someone had to visit a new restaurant, he/she would be interested in how it looks like but once having eaten there he/she would talk about how the food was and not so much about how was decorated inside. If the food was delicious then he/she would be satisfied no matter if the restaurant looked odd; page design helps also usability and contributes to make use of software enjoyable and pleasant but in the end what matters is the content. (Nielsen 1999, 99.)

When writing for the Web, it's important the way how the text is presented because it needs to capture the attention of a different kind of readers, the web readers. A web reader or web user has a different way of reading the text also because research has shown that reading from computer screens is 25 percent slower. The typical web user is like a person in a hurry that does not read slowly word by word but instead reads short blocks of text, scanning whereas there are headings, subheadings, bold text, links etc. A good way to write for the web is to limit the text to no more than 50 percent of what it would have been required to cover the same material in a print publication. (Useit.com: Why Web Users Scan Instead of Read. Nielsen, 1997. Referred 27.04.2011)

In other words, web users scan text and pick out keywords, skimming instead of reading the full text, choosing the parts of the text they like the most. Therefore, developers or designers that publish content on their pages should structure articles using **headlines** which are self-explanatory. Using **bullet-lists** to break the flow of uniform text-blocks and using **highlighting** and emphasis is an effective way for catching the user's eye. Moreover, using **homogeneity** when providing additional information about an element in a web site is always a good practice. If there are three elements and only two are shown as links, the third element may become invisible to the user.

When writing content for the web, it's important to realize that web users do not have time to read through a lot of material. Thus, it is better to present the most important material in front, using the so-called **inverted pyramid principle**. Users should be able to tell what the page is about in few seconds and how the page can be useful to them. (Useit.com: Inverted Pyramids in Cyberspace, Nielsen, 1996. Referred 22.02.2011)

FIGURE 1. The inverted pyramid technique

The inverted pyramid is a technique used in journalism to illustrate the placing of the most important information first within a text. It is so called because, like an inverted pyramid shape, information is represented in top-position for the most important and bottom position for the least important ones. This way, readers can leave the story at any point and understand what is about, even if they do not have all the details. On the web, the inverted pyramid becomes even more important since it is known from several user studies that users don't scroll, so they will very frequently be left to read only the top part of an article. Very interested readers will scroll, and these few motivated souls will reach the foundation of the pyramid and get the full story in all its gory detail. (Useit.com: Inverted Pyramids in Cyberspace, Nielsen, 1996. Referred 22.02.2011)

Many developers often wonder how to reduce a text without eliminating relevant parts of it which are considered too long to be published. It is simple to divide a longer text by dividing a page in more than one. This process is called **page chunking** and consists in selecting only the main parts for the first page connected by hyperlinks to a secondary or tertiary page that give further explanations about the topic. The main reason why it is important to keep the page short is that many users will make their selection based on whatever looks interesting on the visible part

without scrolling down the page. Users will have to make their choice basing it on even more options if they had to consider also the other part below. In other words, such practice is always bad for usability and increases the risk of errors. (Nielsen, 1999. 112.)

3.3 Page navigation

Links are the most important part of hypertext and they allow users to navigate through a web site creating an internal path within the web site. They capture curiosity of the user and they can add structure to a webpage. If links on a webpage are not working properly they can cause serious usability issues and the site navigation can become unpleasant. (Nielsen, 1999. 112.)

There are different types of links: structural navigation links, associative links, additional info links. **Structural navigation links** form the navigation menu of a webpage. Usually structural navigation links are the home buttons and all the other buttons representing the different subsection of the web site. **Associative links** are underlined text and connect to pages with more information about the text itself. Associative links are very useful because they make the text more scannable and easy to read. **See Also or Additional info links** are links provided to help users find what they want if they have not found it yet. They are like the last chance for a user to look for what they cannot find in a web site. (Nielsen 1999, 112.)

It is fundamental to describe links in a correct way, if not a user would not be able to understand where the link is going. The link description should not be too long so that the user can pick up its meaning while scanning the page. The use of "Click here" text as descriptions of links should be avoided and instead it would be much more helpful to provide further information on what the link is about. The developer should also remember to use a title to each link description to provide a further alternative explanation about the link. When the mouse will roll over on the link and rest there for few seconds, it will show the link's title. (Krug 2005, 73.)

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                    CODE EXAMPLE IN HTML

<a href=http://www.useit.com/jakob/ title="Author
Biography">Jakob Nielsen</a>
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FIGURE 2. HTML Code example of a link

Most browsers represent web links following a basic colouring standard, usually with only two different colours to display links. The colour of links that have not been visited yet will be blue, while for already visited links the colour will tend to be purple or red. It's important not to change this practice and to avoid editing links with different colours, and if making changes better keeping the same colour but change the shade of it instead. (Krug 2005, 73.)

3.4 Online documentation

If it were always possible, it would be better to design a webpage or a web application that would not need instructions or documentation. Since this it is not often possible, it is important to include a link with a F.A.Q. (Frequently Asked Questions) or Help link on the webpage. Usually users will not bother to read documentation unless they really need it. Therefore, developers should avoid designing an application exclusively thinking that the user will read this and that other function on the manual. Creating a user interface that will not require the use of the manual can be challenging but that is also what makes it usable. (Nielsen 1999, 129.)

It is good to mention Nielsen's First Law of Computer Manuals: "*People don't read documentation voluntarily".* (Nielsen, 1993). In fact users will read a manual only if in trouble or because cannot understand how to use the system. When including some online documentation it is possible to provide additional usability by posting screenshots of how the system should react to each interaction with the user. Screenshots make feel the user familiar with what is happening in a particular situation using the system. (Nielsen 1999, 129.)

The basic rules for online documentation are that documentation pages should be searchable and in case of an issue a clear example solution of how to fix it should be visible. Furthermore, using a step-by-step approach on the instructions is easier to understand. Finally, a developer should always include also some theory or diagram of how the different parts work together and a

glossary with the main keywords, while trying to be as brief and exhaustive as possible. (Nielsen 1999, 131.)

3.5 Users categories

It is fundamental to know which are the target users of a web site the same way it would be important to know which are the auditors during a speech at a very important conference. In other words, users that interact with any web-based software, also known as end-users, are not the users employed during the web site development or anyone that had or has any stake with the web site, but the users that will visit it and will interact with it at completed development. It is common that users that have been involved in software production are way too technical comparing to final end-user that have no training or such in how web site can be used or know anything on what is about. (Zaphiris & Kurniawan 2007, 3.)

An end-user can have different characteristics like age, gender, technical knowledge, experience with computer systems, cultural or aesthetical preferences, and also a different way of interaction; may also have physical or cognitive disabilities. Some of these characteristics can even decline with age, like memory or cognitive skills. For instance, considering the rule of **seven plus or minus two**, intended as the average number of items a human can hold in his working memory, it is not a universal rule because it is also dependant from the actual user's experience. If the user's experience is disturbed by other factors like noise, fatigue or time pressure for instance, it can limit even further the user's working memory. (Zaphiris & Kurniawan 2007, 4.)

There is not such an average user, every user is different and it is important to take it into account before starting the implementation of a project, user identity is important as much as the user requirements. Furthermore it is clear that when surfing the World Wide Web also the medium with which the user views a web site cannot be left apart. When designing any application for the Web, it's a good practice to take into account that each user that is utilizing it may have a different hardware and software setup. Some visitors could run the application on a very old computer with a small resolution screen for instance. Or they could try to utilize the application through their handheld portable device. (Zaphiris & Kurniawan 2007, 4.)

There are different ways to prevent visualization issues by knowing in advance which resolution or which browser they are using. Through PHP (Hypertext Pre-processor) or JAVASCRIPT

programming language for instance, one of the most common server-side programming languages for the web, it is possible to gather these details. Preventing such usability issues could improve the navigation experience for the end-users and therefore having a resolution-independent design is a key factor to maximize usability. Also, avoiding any obsolete or non-standard tag to a web site is suggested. Commonly not all browsers have same code interpretation features and while a user may be able to visualize correctly a web site on Mozilla Firefox, he/she may not be able to do the same on Internet Explorer or Google Chrome. However, one rule to follow as user or as developer, it is to have the software running on the computer always up-to-date, avoiding to install any beta version but opting for the stable releases instead.

3.6 Download speed and performance

Response time is a concept that should not be underestimated in web usability. Usability studies have shown that 8.6 seconds is the maximum time web users will wait for a page to download. (Webcredible: Web Usability: The basics. A.B.King 2003. Referred 24.04.2011)

Jakob Nielsen, in his research on Human Computer Interaction has shown that the user needs a maximum of one second when moving from one page to another and maximum 10 seconds is the limit for keeping the user's attention on the page. Therefore it is essential for optimal usability that a web site downloads quickly. There are some rules to follow for decreasing the download time of a web site or a web application and for improving considerably the usability experience. (Nielsen 1999, 44.)

In order to optimize the download time of a web site or a web application there are several optimization techniques that may be applied during the software implementation phase. An exhaustive guidelines has been attached to the research to improve the usability experience perceived with the download speed and performance. (appendix 3).

4   USABILITY EVALUATION

Usability evaluation is an important activity in the development of interactive systems and it typically involves usability experts and the users that will test the system. When the implementation phase of a software project has already brought to life a prototype or the software has already been released, it is possible to apply different usability evaluation methods to the software to test its usability.

There are several methods for evaluating usability of a web-based software product, that vary for cost, amount of users involved, type of medium used and technology to be tested. The second part of the research aims to find the most effective and cost-saving methods to evaluate the usability of a web site or a web application.

4.1 Heuristics evaluation

One of the most effective and well-known methods is the Heuristics Evaluation, introduced by Jacob Nielsen and Molich in 1990 and reviewed by Nielsen in 1994. Heuristic Evaluation is a method for structuring the critique of a system using a set of relatively simple and general heuristics and a small group of usability experts. Heuristic evaluation involves having a small set of evaluators examine the interface and judge its compliance with recognized usability principles. These heuristics should be general rules describing common properties of a usable interface. (Useit.com: How to Conduct a Heuristic Evaluation. Nielsen, 1994. Referred 22.02.2011).

In fact Heuristic evaluation is a very efficient and cost-saving method for finding usability problems, especially during at the beginning of a project. Usually many usability problems can be found with only few evaluators and a quite limited time. Each evaluator must go through the system interface alone and for several time, analyzing and comparing the various elements present with the set of usability rules. In addition, the user is allowed to consider other usability principles or to mention to the expert possible ideas for improving the user experience. (Useit.com: How to Conduct a Heuristic Evaluation. Nielsen, 1994. Referred 22.02.2011).

Usually the amount of users suggested by Nielsen should not be over five or six evaluators because this guarantees already to have about 75 percent of the usability issues being discovered. Increasing the amount of evaluators would not improve that much the findings but just raise costs of the inspections. Also is recommended to have minimum three evaluators using this method, especially if they have a really high level of expertise. Nielsen states also that even though is preferable to conduct an heuristic evaluation with usability specialists or evaluators with good domain knowledge, it is also possible to let people with no or little usability expertise to perform the tests. (Useit.com: How to Conduct a Heuristic Evaluation. Nielsen, 1994. Referred 22.02.2011).

Only after all evaluations have been completed the aggregation and analysis of the findings should be started. The results can be recorded as written reports from each evaluator. Using Heuristics Evaluation is particularly appropriate if the application about to be tested has a large number of serious usability problems, or if an application is not sufficiently mature for usability testing with real users. Performing an Heuristics Evaluation for identifying usability issues results in being much cheaper to conduct than formal usability testing and it can be completed in a very short period. The fact that it can be conducted at any stage of the design it is also a plus.
(Useit.com: How to Conduct a Heuristic Evaluation. Nielsen, 1994. Referred 22.02.2011).

Typical of other non-empirical methods are to be low-cost, safeguard reserved information, and to obtain from the experts detailed diagnosis and practical project-based solutions.
Like all other non-empirical methods there is no way to find out, if not using also real users, if the problems found from an expert will be a problem for the final user too. Furthermore, it is not granted that fixing an usability issue using the solution provided by the expert will bring real improvements to the application. (Useit.com: How to Conduct a Heuristic Evaluation. Nielsen, 1994. Referred 22.02.2011).

4.2 Thinking aloud

Thinking aloud is a usability evaluation method that derives from psychological research and it consists in making users to write down all their thoughts encountered during the execution of certain task or activities. In other words, recording and then analyzing what the user has said or written while performing certain tasks, like testing the functionalities of an application, it will allow the usability expert to evaluate and grade the usability of a product. (Kuniavsky 2003, 134).

It is also possible, instead of providing fixed tasks to the user, also to let him/her freely explore the system. During the session, the researcher can intervene, doing precise requests about the domain of the application or also more specifically about some of its functionalities. Naturally this method is useful in case of having ready working prototypes of which you would like to test the efficiency. Thinking aloud method allows acknowledging not only the user issues encountered while utilizing the product but also why these issues appear. (Kuniavsky 2003, 134).

Furthermore, it is a great way to gather a huge amount of information with a limited amount of users. It does not reproduce the typical usage environment of a system, in which the talking process is absent; besides the user is forced of doing two things at the same time. Another issue can make the mistake of giving too rational explanation to each one of their actions, not matching the real-world situation where users may take a decision instinctively. (Kuniavsky 2003, 134).

4.3 Cognitive walkthrough

Cognitive Walkthrough is a usability evaluation method meant to determine the level of usability for a web site, in which one or more usability experts "walk" through a set of the most typical user tasks supported by the web site, one-step-at-a-time. At each step in a task procedure, the evaluator(s) asks herself the following four questions about her expectations of users' behaviors:

1. Will the user try to achieve the right effect?
2. Will the user notice that the correct action is available?
3. Will the user associate the correct action with the effect to be achieved?
4. If the correct action is performed, will the user see that progress is being made toward solution of the task?

The evaluator(s) attempts to provide as realistic answers as possible to the questions and for those answers which appear to be negative will create a motivation list to explain why the user could not perform the task. These insights are then used to improve the usability of the web site or application. Since cognitive walkthroughs are often applied very early in development, the evaluators will often be working with mockups of interfaces such as paper prototypes and role-playing the part of a typical user. Evaluators are typically experts such as usability specialists, but the same basic technique can also be applied successfully in many different situations. (Usability First: Cognitive Walkthrough, 2002. Referred 21.01.2011).

Cognitive walkthroughs is an efficient method for identifying certain issues of a Web site, especially showing how easy or difficult it is to learn or to navigate without reading the documentation. The main disadvantage is that for more complex tasks it is a too time-consuming technique and it is usually used by making some modification to its core practices. For instance, instead of filling out an evaluation sheet at each step, the evaluation can be recorded on video and the evaluator can then verbally explain the actions at each step.
Cognitive walkthrough is a helpful method to find out interface issues that works particularly well together with a user-centered design approach. However, the approach can sometimes be time-consuming, and since reorganizing the interface is often expensive and difficult at later stages in development, the cognitive walkthrough is usually applied early in development. (Usability First: Cognitive Walkthrough, 2002. Referred 21.01.2011).

4.4 Pluralistic walkthrough

Another important typology of walkthrough is the pluralistic walkthrough, which involves three different categories of evaluators: final users, usability experts, software developers. In contrast to other walkthrough evaluation methods, in the pluralistic walkthrough all participants assume the same role of final users, and before performing any task on the graphical interface, these are written on paper in order to analyze in detail the interaction strategy with the graphical interface and to improve its usability. As with any inspection, the more people are looking for problems, the higher the probability of finding problems. Also, the interaction between the team during the walkthrough helps to resolve usability issues faster. The walkthrough is conducted by identifying primary tasks for the system and stepping through those tasks, identifying usability problems along the way. (Z.Zhang: Pluralistic Walkthrough. Z.Zhang, 2005. Referred 28.04.2011).

Applying the pluralistic walkthrough evaluation method can result in a complete and exhaustive evaluation of each graphical interface from different evaluator categories: usability experts, simple users and software developers. All these users categories collaborate and work together to achieve as much complete result as possible. Different evaluators categories have different technical skills and playing the same role of final user may not always produce realistic results. Furthermore, a cooperation between different user categories is usually more effective during design phases than at final product ready. (Z.Zhang: Pluralistic Walkthrough. Z.Zhang, 2005. Referred 28.04.2011).

5 USABILITY TESTING

In the practical framework methodologies shown in the theoretical part will be applied to a real-life e-commerce web application in order to evaluate its usability. The web application in question it is a web shop and it belongs to a company that operates in Oulu. For copyrights reasons its name will not be mentioned.

The web shop allows customers to buy pictures of babies and children that are taken in different environments. The pictures are sold in various formats and can be used to produce customized items (calendars, t-shirts, mugs, etc.). The main targeted customers are families.

The web shop had been previously tested for usability in 2009 and several usability problems were found, thus the company decided to redesign the software and modify completely the user interface of the web shop. The previous web shop did not offer a usable enough buying process to their customers. Therefore a subsequent usability evaluation was needed in order to make sure that those usability problems had been eliminated in the new version of the software.

Final results have shown that even though there had been a recent software redesign, the software still has different usability issues that have been discovered by running the actual tests part of the research process of this Bachelor Thesis.

5.1 Usability test planning

After a first meeting with the company the framework for the new usability evaluation of the web shop was established. Usability tests were planned and the main recommendations from the company on how to run the tests were:
- ✓ Test group of max 6 users
- ✓ Minimum age 25 years old for each test user
- ✓ Different technical background of each test user

The new version of the software was released only in the beginning of December 2010, thus the company requested a web based prototype in order to test how their template would have

behaved when ordering a picture. During next meeting with the company and delivering the prototype it was already easier to understand which functionality could have turned into a usability issue.

Test planning was facilitated since the requirements were already gathered from the previous meeting with the company. For instance, it was already known which is the targeted customer for the web shop, thus in order to build effective tests it was enough planning to evaluate the functionalities that allowed a user to buy a set of pictures in different formats.

The first test task to be included was the "Add" functionality that allowed a user to add some pictures to the cart. The second main task was the "Edit" functionality with which was possible to modify the items already added to the cart. The last task was the "Confirm order" functionality in which user had to enter his personal data and could complete the order.

The practical implementation of the tests included some lab session with the evaluators using MORAE, a usability evaluation software suite that allows to do any sort of software evaluation with the support of sound and video recording, graphs generation and reviews. In order to have a practical first experience with MORAE suite and with the new tests created, a pilot test session had been organized together with Matti Viitala in the laboratories of Oulu University of Applied Sciences. (appendix 2).

For this kind of web usability evaluation it is always better not to have deep knowledge of the application which is going to be evaluated. If the evaluators are chosen among a group of usability specialists, it is better to avoid choosing the ones that have been using already the application. Therefore the participants were chosen among new users which did not test the web shop before. In general, it is suggested to advice the evaluators about the purpose of the application, which are the targeted users and their domain knowledge and the context of use.

It is useful to prepare a working document for taking notes and to gather the first impressions and opinions from the evaluators. Paper notes or notes in digital formats are both valid, but it is important to organize the notes and attach the name of each task or heuristic violated before to add any comment. Also the severity level of the violation should always be included.
Once the evaluation will be finished it is fundamental to go through each of the issues found and explain them from a usability perspective. When finished to list the different issues, it can be

useful to use a **checklist** to make sure the web application have been considered in sufficient detail. Finally after all the possible issues found have been combined and printed, it is possible to compare the same ones from different evaluators. All the material gathered should be enough to start writing a report of usability issues found with the evaluation.

5.2 Reporting

When reporting the findings it is important to acknowledge the usability issues found in the evaluation but also the positive aspects of the application. The evaluation may be read from developers of the application as well, and it is better to give them some credits for the work done too. Each usability issue found should be analyzed in detail and then as much reasoned comments as possible should be included. After having included an exhaustive list of all usability issue found, it is better to provide a clear and detailed recommendation about how to fix the usability issues. In case the issue is too wide and not fixable with a single patch, a solution should be purposed. To help providing a clear and readable report it is useful to create a well-structured layout in order to avoid adding irrelevant opinions about the application. (Krug 2010, 85).

It is a good practice to target your report for a particular audience. Developers like as much detail as possible so a long report with the problem, rational, and possible solution in a table format would be appropriate. For a detailed report, consider using one long table to list usability problems. When analyzing data an option can be to use Post-It notes and write one usability problem on each Post-It. This reduces the time it takes to organize data for a report. (Krug 2010, 85).

If there is a clear solution to a problem and one is able to come up with an alternative screen design, one could consider of putting an illustration of the proposed solution in the document. When possible is always better to be quantitative, even if it is to have a table showing the number of low, medium, and high usability bugs. For instance, it is useful to list the number of people who have a particular problem. (Krug 2010, 85).

5.3 The web shop user interface

The user-interface has been completely changed since last version to increase the overall usability of the system and to facilitate the buying process for its users. To better understand the different tasks it is important to observe the user interface showed in figure 3.
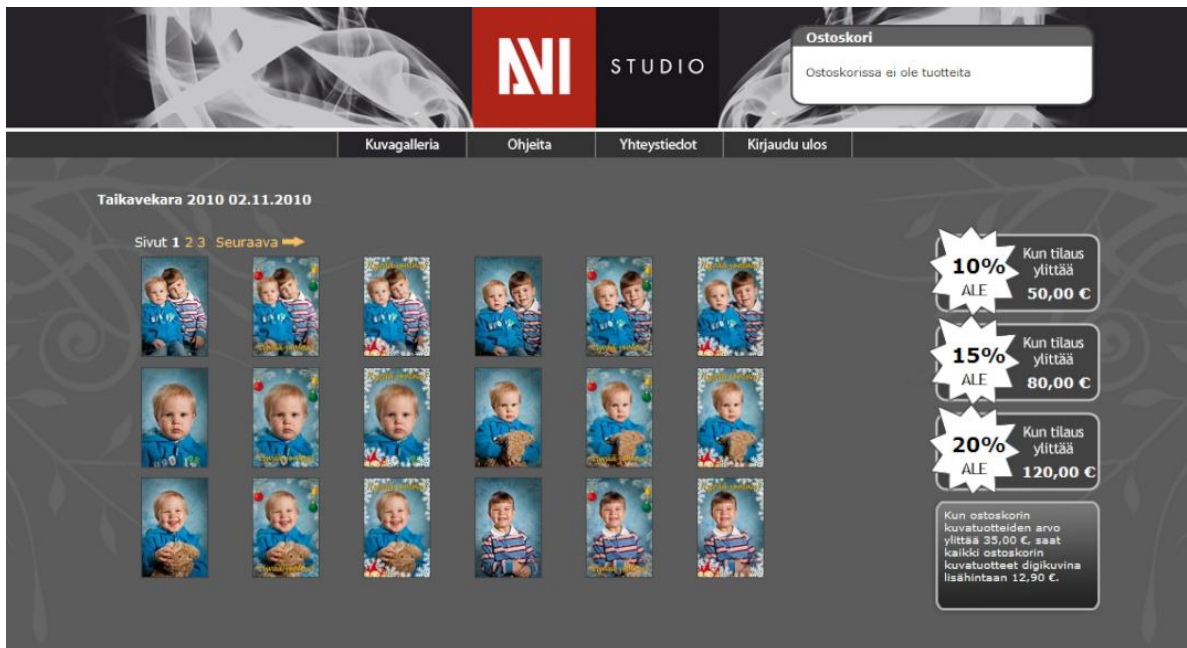

FIGURE 3. User interface overview

After selecting one of the pictures available from the thumbnails list, the user accesses the picture sub menu where is possible to order the selected picture in different formats and as different item (mouse-pad, mug, t-shirt etc.) as shown in figure 4.
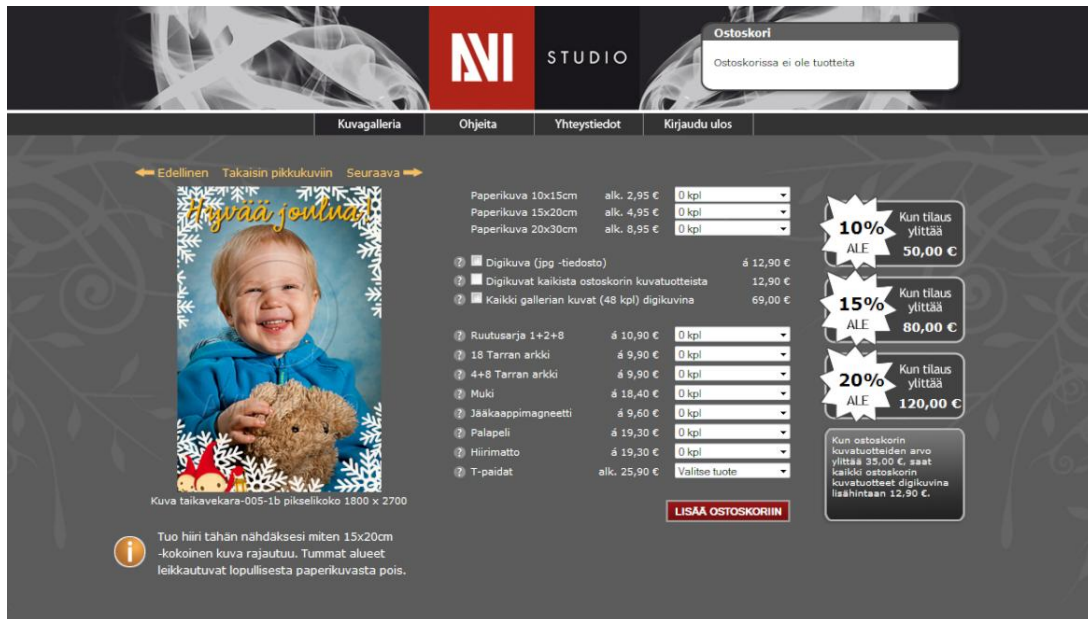
FIGURE 4. Selected picture sub menu

The picture sub menu area on the left shows further information about the selected picture.

FIGURE 5. The picture shows photo information for the picture selected with picture name and resolution.

In the middle of the sub menu is possible to select different formats and items where to print the selected picture, while on the right side are shown some discount offers are available like shows in figure 6.
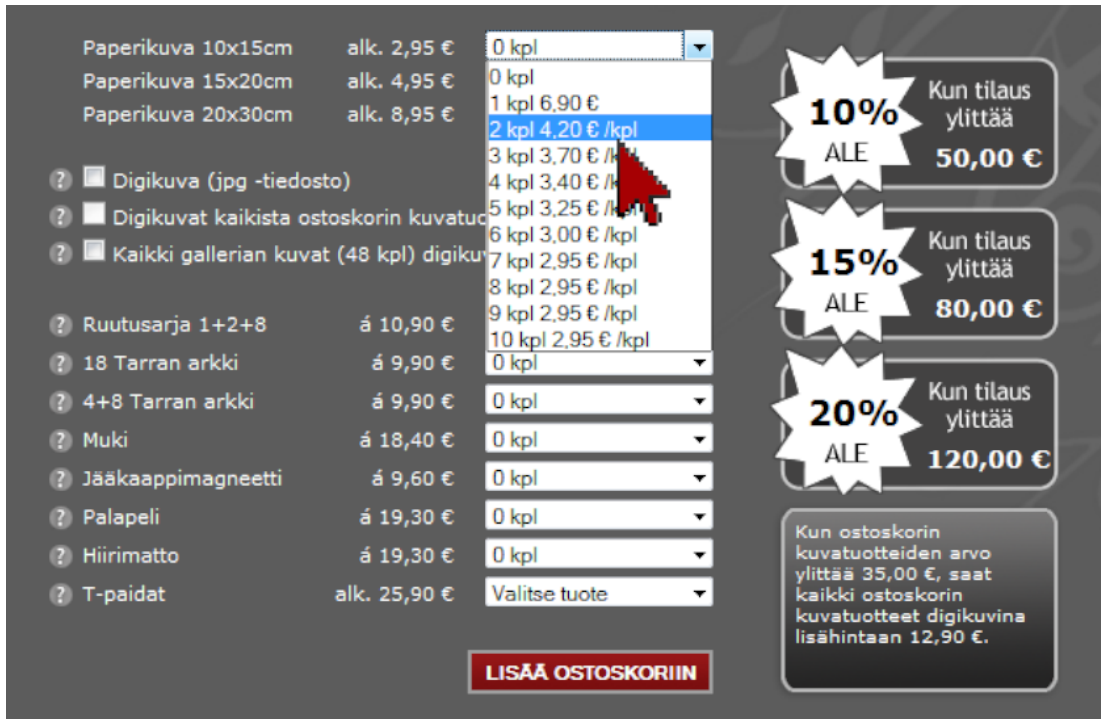

FIGURE 6. Adding item on selected picture sub menu

When adding an item to the cart by clicking on "Lisää ostoskoriin" the cart section placed in the top-right corner will be updated.

FIGURE 7. Cart updated

By clicking on "Ostoskorin sisältö" the page will be redirected to an edit cart sub menu where it is possible to edit all the items added to the cart.

In the edit cart sub menu it is possible either to delete all items correspondent to the selected picture or to simply modify the amount of the item added to the cart.
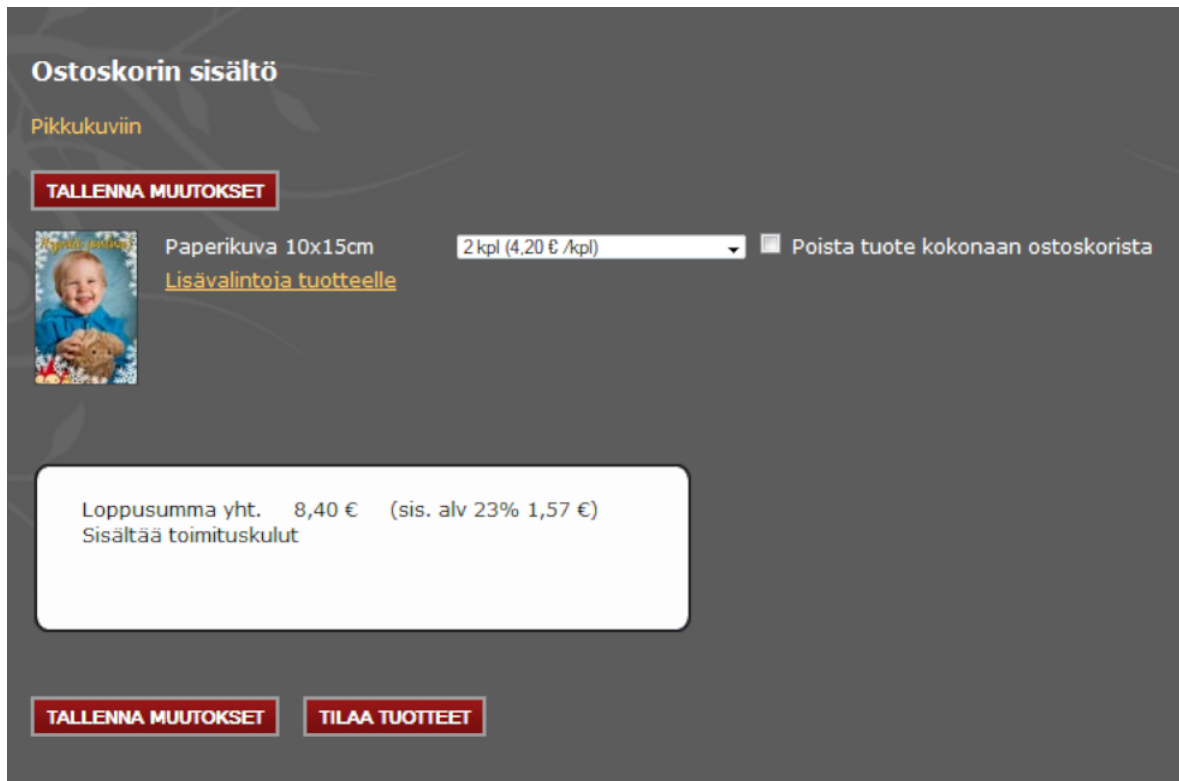

FIGURE 8. Edit Cart sub menu

For adding a different item for the same picture the user needs to click on "Lisävalintaoja tuotteelle". The same picture sub menu shown in figure 4 will be displayed. When clicking on "Pikkukuviin" the page will be redirected to the thumbnails menu shown in figure 9 and the user will be able to add more items from a different picture.
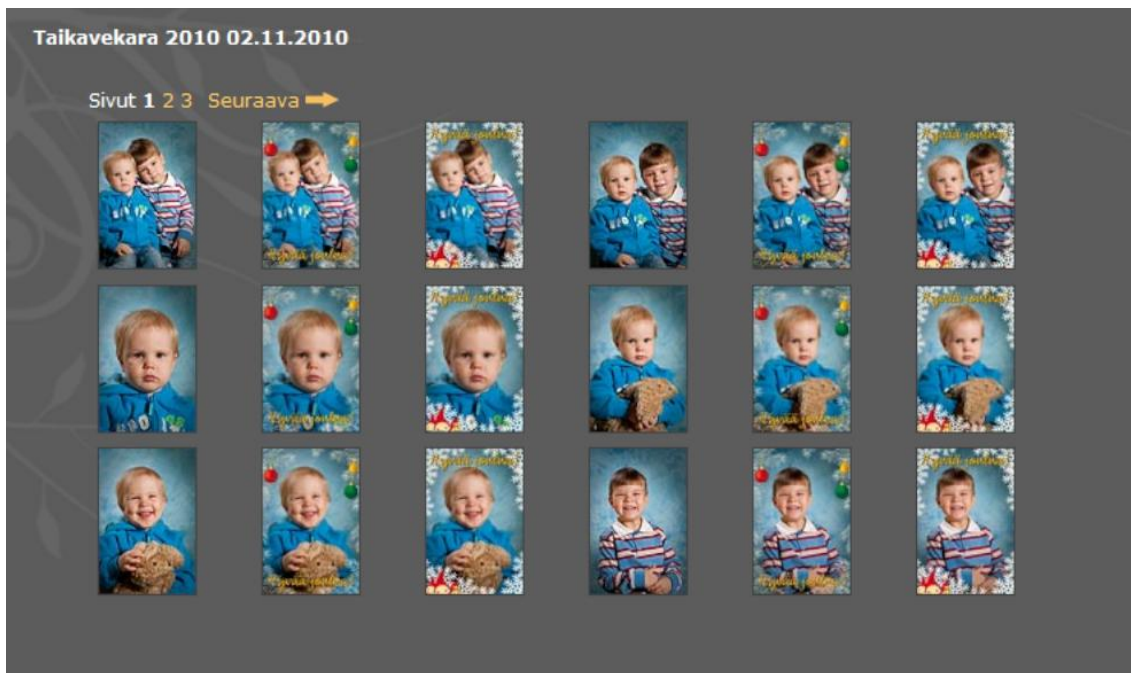
FIGURE 9. Thumbnails list that allows the user to select only one picture at the time.

After selecting a new picture, a new picture sub menu for adding different items will be displayed.

FIGURE 10. Picture sub menu example 2.

By clicking on "Tilaa Tuotteet" the user can confirm the items placed in the cart and proceed with the actual order. Then the user will have to enter his/her personal information and bank details like it is shown in figure 11.

FIGURE 11. Confirm order sub menu

In general the buying process has been rather simplified even though after the usability tests still some usability issues have been found. The usability test have been performed using MORAE, a usability software that allows the evaluator to watch in real-time the user's screen and find out which issue he/she has encountered while performing a given task.

5.4 MORAE usability software

MORAE is a software for analyzing the usability of a graphical user-interface and is made of 3 software components: MORAE Recorder, MORAE Observer and MORAE Manager. It allows to follow and review any usability test with the support of live video and sound recording.

MORAE Recorder must be installed on the user's computer and it allows recording a user's screen, while MORAE Observer must be installed on the evaluator's computer and it can connect to MORAE Recorder which can observe how the user is performing the usability tasks. These tasks are recorded through MORAE Observer while the evaluator can add comments on the fly on each usability issue encountered by the user.
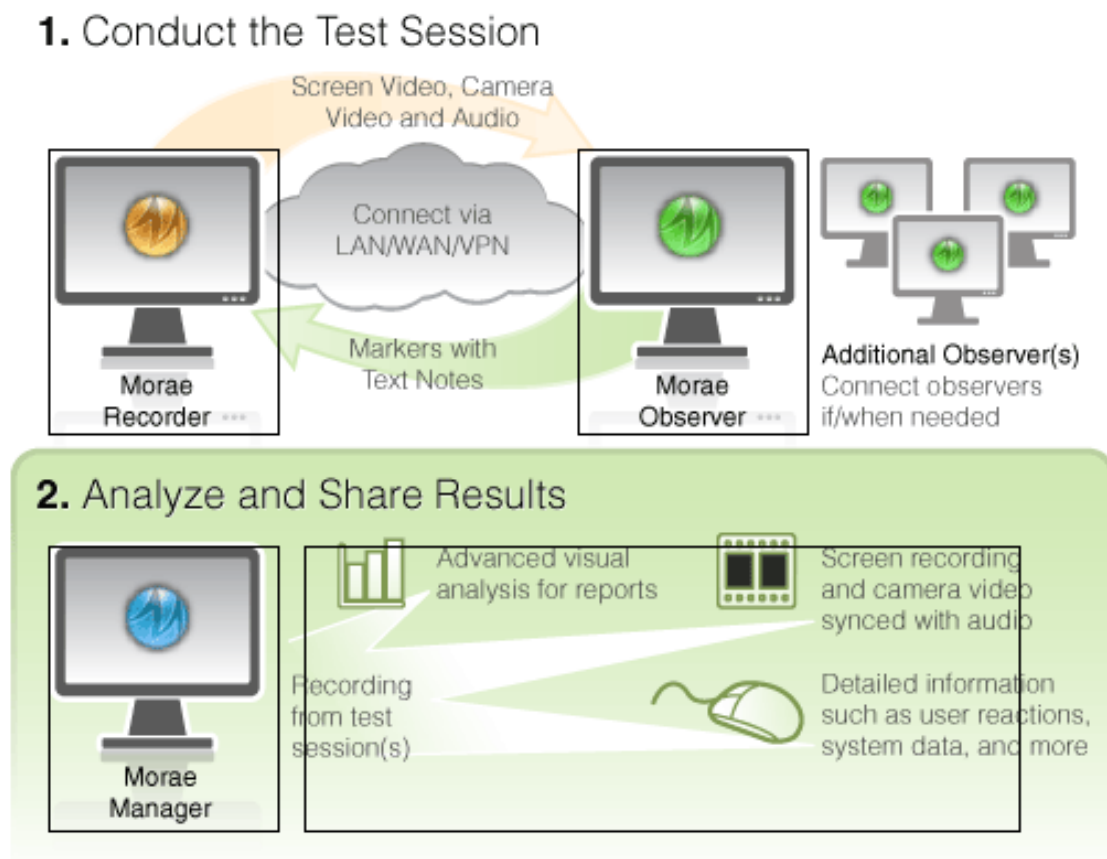

FIGURE 12.   How MORAE different components work (Softwarecasa.com: MORAE. Referred 11.05.2011).

Video files are automatically generated from MORAE OBSERVER and allow the evaluator to review the completed tasks for further analysis. The evaluator will be able to edit those files and manage them through MORAE MANAGER adding his own opinions on the issues encountered by the user. In figure 13 and 14 it is possible to see how MORAE MANAGER allows to manage the video-recorded sessions.

MORAE facilitates the evaluator to find out usability problems in software applications, web sites, prototypes, or mobile devices. The software can captures every nuance in each testing session. The evaluator can have a better feedback when observing a participant's face, hearing the frustration in her voice, and can discover hidden problems in a software product or web site. Furthermore, using MORAE it is possible to automatically calculate and graph standard metrics enabling the evaluator to produce very professional evaluations.

5.5 Usability test implementation

The usability tests have been planned in detail together with two executives from the company and have been performed in the multimedia laboratories of Oulu University of Applied Sciences. The test implementation has strictly followed the requirements gathered during the usability planning phase. The users that have been testing the web shop user-interface belonged to different user categories: students, teachers, software developers.

Some students from University of Applied Sciences have participated to the web shop usability evaluation producing interesting results.

The test participants were 6 people:
- ✓ one teacher
- ✓ 3 OUAS students
- ✓ 2 other people

The test is structured in the way that the three tasks are well clear to the evaluator and for each test session the test was briefly explained orally to the evaluator before the beginning of the video recording session.
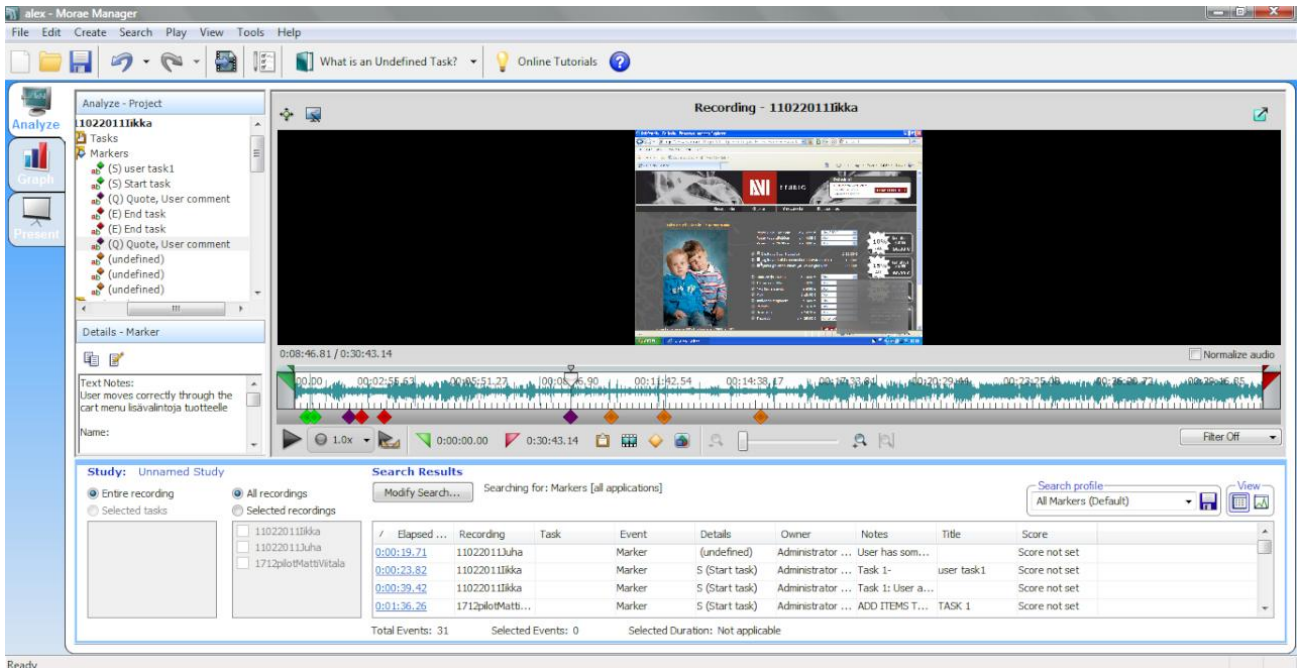
FIGURE 13. MORAE Manager Overview

Each test session involved one evaluator at the time, and it has been followed by using MORAE
Observer that was connected with the evaluator's machine running MORAE Recorder. Each user
followed a printed list of task to perform that is included to the research in the appendix. All the six
evaluators had no issue or relevant doubt and they managed to perform correctly all test tasks.
Each test session produced a video recording of the usability evaluation of about 1 hour time.
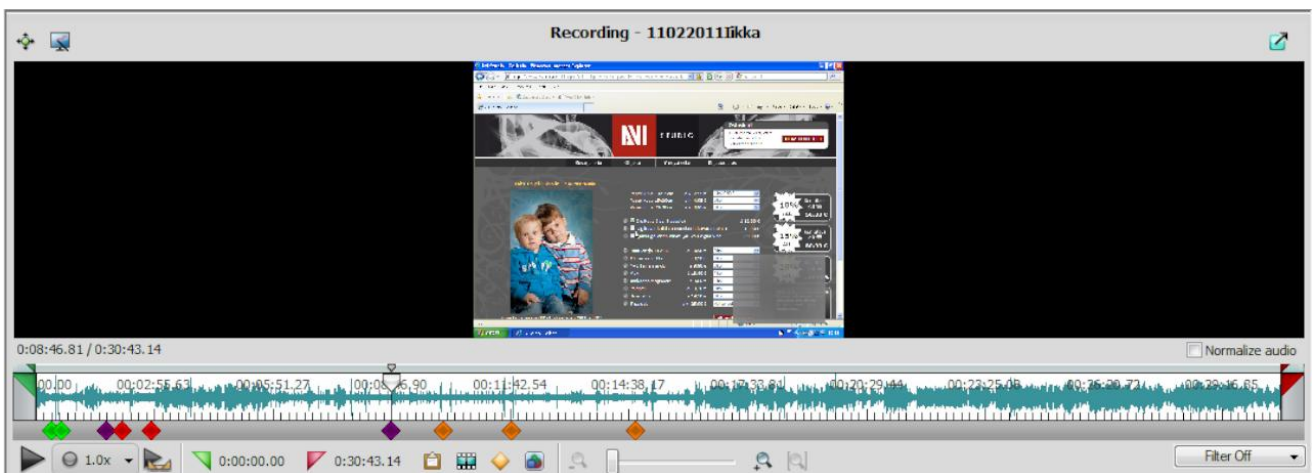
FIGURE 14. MORAE Manager analyzing recordings

During each test session, when recording a video a marker was added on each relevant usability event. E.g While performing a task, a user expressed his opinion about adding more than one

picture at once to cart. Thus, a marker was added to the video recording: "User suggests the possibility of ordering more than 1 picture at once".
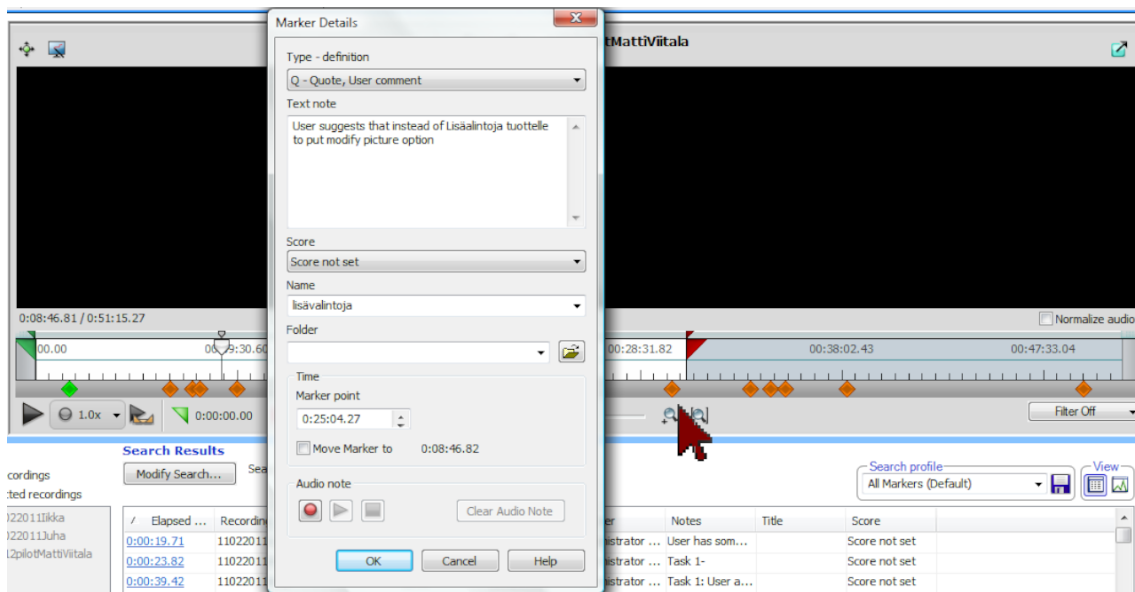
FIGURE 15. Analyzing markers added through MORAE Observer on the video recording

Markers have a very important role for a usability expert, they allow to analyze each video session highlighting when a user had an issue or even showed a moment of hesitation with a given task. MORAE allows further modifications to applied to the markers as adding a score for each usability issue found or to place the markers in a certain category in order to build a clear usability analysis. Very often, a usability expert does not have enough time to write such detailed information while the user is performing a test task.

In figure 16 it is more clear how a usability expert can utilize markers also to memorize user's opinions and provide such comment back to the company that has commissioned the usability evaluation project.
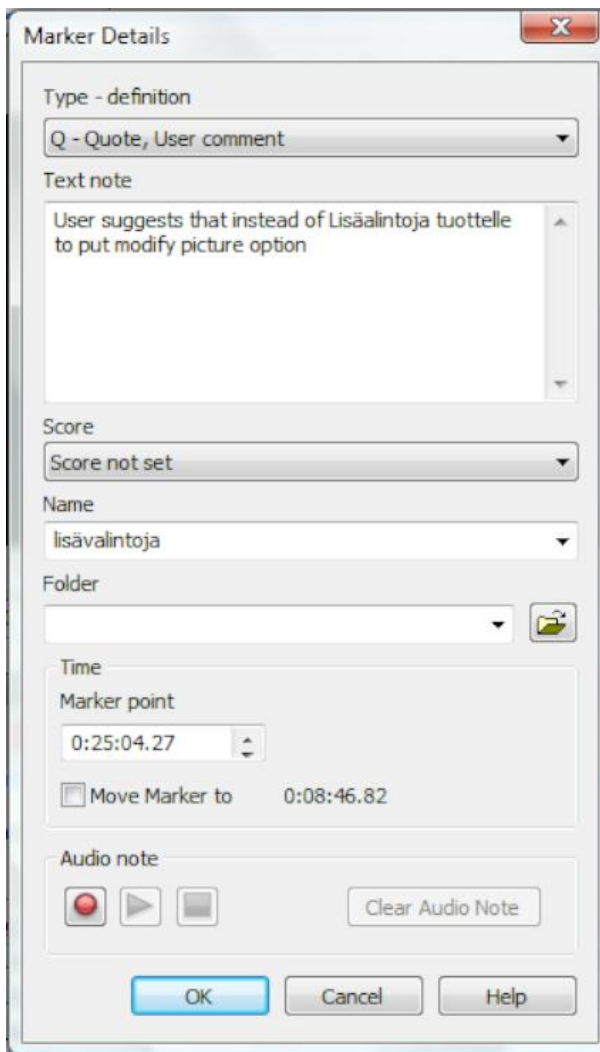
FIGURE 16. Edit marker for user's opinion

Another useful feature of MORAE software suite is to be able to create graphs and other types of statistics using the software inbuilt functions. For instance, the graph in figure 17 shows the average of how many mouse clicks have been done per each test session per user. A total average of 224 mouse clicks per session per user demonstrates how even the easiest buying process possible can be time-consuming and rather complex.

Calculating that each user was completely new to the web shop user-interface it is a quite acceptable average amount of mouse clicks per user. Although the tests were expressed in a very detailed way, including each picture name and position on the web pages, the users which participated in the testing process still needed their time to get accustomed to the graphical user interface.
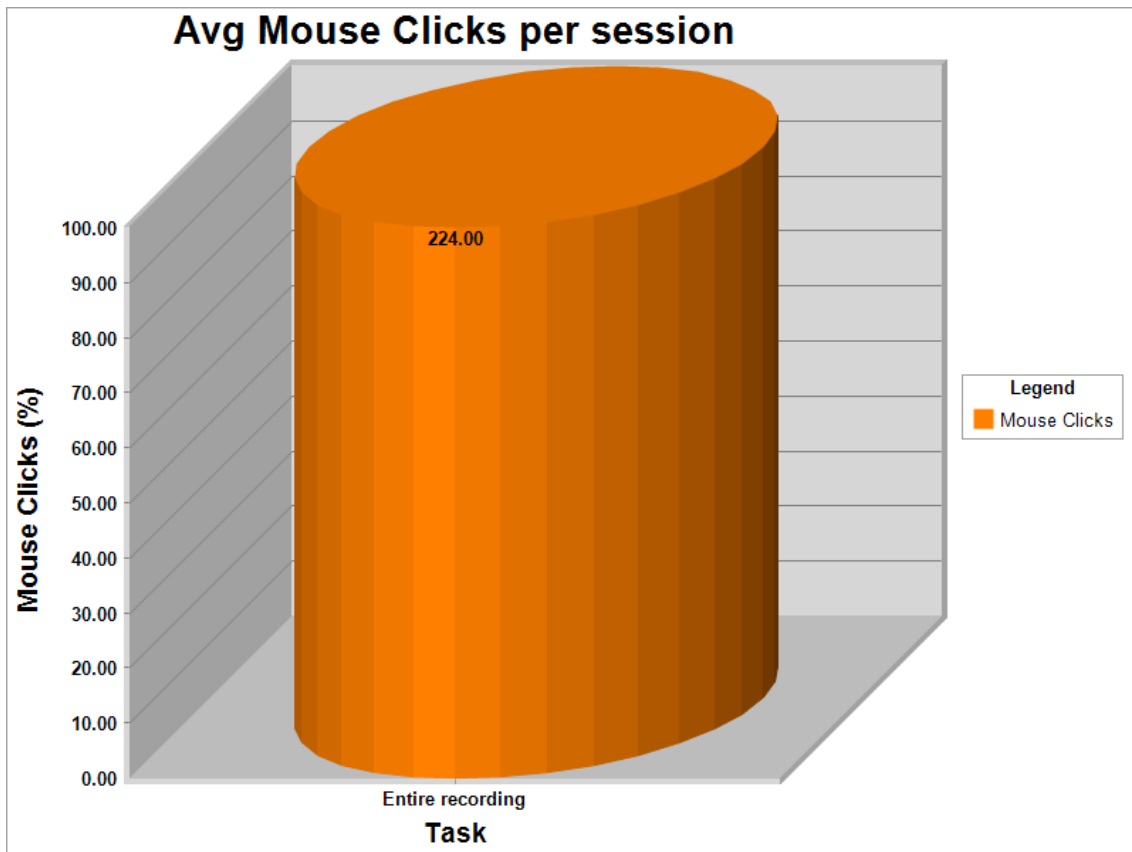
FIGURE 17. Average mouse clicks per user in order to complete the test session

On the other hand, the average amount of markers included in each video recording session was rather limited: only 10 markers per session per user. Another relevant fact to take into account for the usability analysis it is that being the second usability evaluation to be applied on the web shop, most of the crucial usability issues had already been removed from the software. The actual version of the software was born after having applied the first usability evaluation and having a brand new graphical user interface could not be immune to usability errors. In figure 18. a graph shows which is the average amount of markers utilized for each test session.
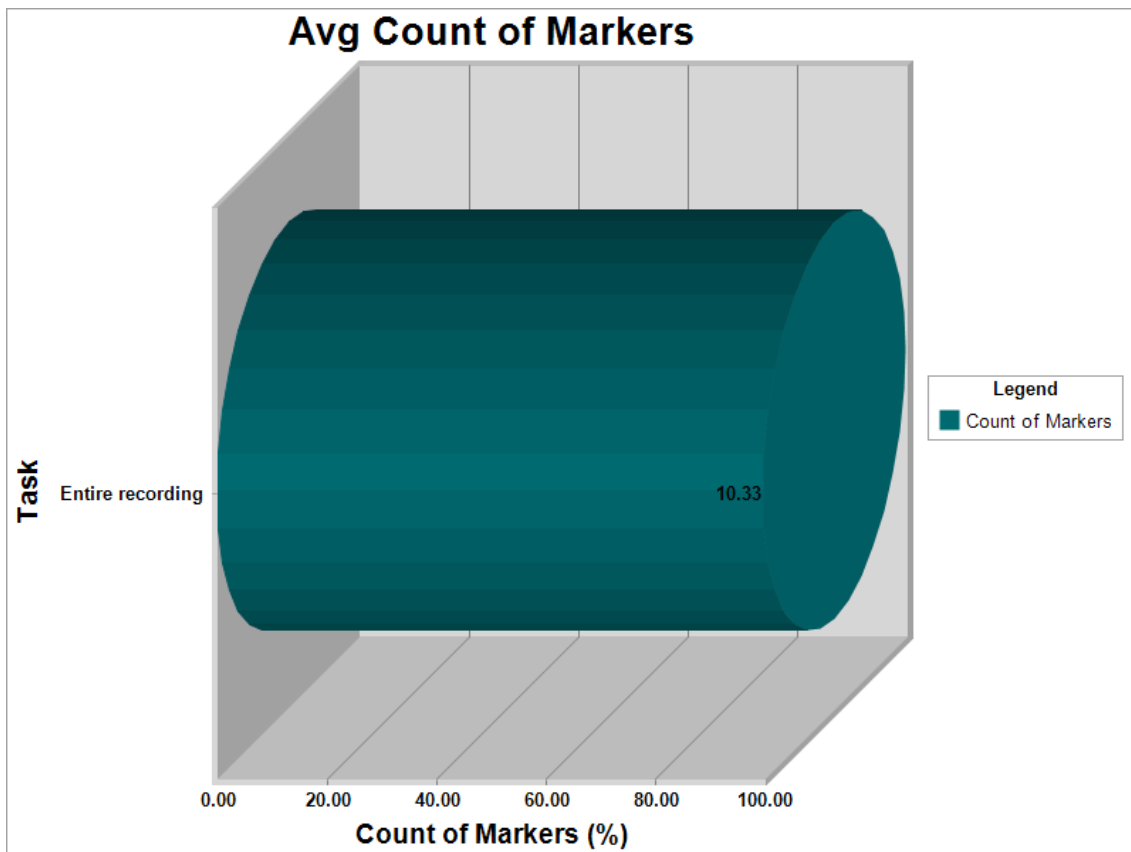
FIGURE 18. *Average count of markers by task to highlight each usability event*

5.6 Test results

In order to understand the test results better it is important to visualize the usability tests included in the research. (appendix 1) Each user had to fill a questionnaire at the end of each video recording session in which they had to express with a grade from 1 to 5 the overall usability experience of the web application. A couple of usability issues have been found while building the prototype to test the company's web shop new template.

The first issue found was that after adding a picture to the cart and then going back to the thumbnails gallery, a green check was showing on the top of the thumbnail picture of the picture added. When scrolling down with the mouse the check was moving because the position of the check image was set as absolute with CSS. The second issue found was that "Digikuvat kaikista ostoskorin kuvatuotteista" or "Order all pictures in the cart as digital format" was placed in the picture sub menu instead of being placed at the end of the order.

The six participants to the test sessions had quite different opinions about the web shop depending on their level of expertise in buying or ordering products online. In general the participants had shown to understand the software almost immediately and they all managed to perform the usability tasks correctly.

Summarizing in a nutshell the test results of the web shop usability evaluation:

User 1 had no problem in completing the test task successfully. He found the pictures listed in the test document on the web shop very quickly. He had no problem in editing the cart and adding the paper versions of the 4 pictures. Also he deleted all the items correctly from the cart.
User 1 graded the usability experience of the web shop with a total of 5/5. "The user experience was great and very intuitive":

User 2 enjoyed the usability experience but complained that when adding a picture to basket or editing a certain item, the page does not return to the main thumbnails list. Also he suggested that would be useful to add a multiple select function to select up to 10 pictures. Finally there is lack of descriptions applied to the pictures, when adding a picture to the cart, no image name is displayed.
User 2 graded the usability experience of the web shop with a total grade of 4/5. "In general the graphical user interface was quite pleasant and easy to use. Probably when adding a picture or editing it, the navigation should be checked to redirect the user to the right page".

User 3 has a great technical background on web development and over thought about software bugs losing the focus on which image to edit. After spending some time in studying the interface he completed all usability tasks correctly.
User 3 graded the usability experience of the web shop with a total of 5/5. "The design was very pleasant and it was rather easy to learn how to use the web shop".

User 4 affirmed that "Valitse tuote" could be a bit contradictory for a t-shirt. When adding a t-shirt is not possible to edit the amount. He also suggests the possibility of ordering more than a picture at once. The user suggested that instead of "Add more things to the picture" to put "Modify picture options" as link name. Finally he expressed his opinion about displaying the amount of items as 0 on the select box may be confusing and instead that should be a REMOVE item text.

User 4 graded the usability experience of the web shop with a total of 3/5. "The web shop offered a good usability experience but did not consider how to manage several picture at same time. For instance, when trying to order several t-shirts with different pictures would be better to be able to select all desired pictures at once and then select t-shirt as item for all the pictures. Also there is a lack of detail when choosing the pictures, such as no image name as mouse-over effect or no magnetizer tool to be able to zoom a certain area of the selected picture".

User 5 suggested that is hard to manage all the pictures it would be useful to be able to tick all pictures and then just adding the same item for all pictures selected. The user complained about the possibility of choosing which paper format for the pictures added to cart only at the end of the order and not for each picture. Furthermore he complained that when you add a picture to the basket the page refreshes but does not go back to the gallery.

User 5 graded the usability experience of the web shop with a total of 4/5. "It was easy to perform the test task but in certain situation the page was not redirected as expected. The software learnability was intuitive but the paper format selection placed at the final step of the order did not allow much choice. In case a user wanted to have different pictures in different paper formats, he should contact by email and modify the order manually".

User 6 thinks it is faster to edit items from the add items page. He has also suggested that adding a Magnifier tool on the picture to buy would help to select better the picture especially in the case of a group picture.

User 6 graded the usability experience of the web shop with a total grade of 5/5. "It was very easy to get accustomed to such a graphical user-interface. The page design offered a very good usability experience. The only design flaw is the possibility of selecting multiple pictures at once but probably it has not been implemented because the usual customer does buy only few pictures at a time".

6   CONCLUSIONS

The research project main objective of analyzing the most effective methodologies aimed to evaluate and optimize usability of web based software products was successfully reached. Also non-experts in usability could learn and apply usability methods for evaluating web based applications. Including also a practical framework based on a real work-life experience has deepened the knowledge needed to design and plan a reliable usability evaluation.

It has been a very challenging learning process that has brought to light tangible results by discovering new usability issues for the company's web shop that were totally new to the developers. The importance of usability in any software project is nowadays fundamental and cannot be left at last after the implementation. A bug free software does not exist, and the same stands with usability, there is no software with a perfect usability. To reach a very good usability level in an application, several usability evaluation methods have to be applied following the right criteria.

The second objective will be reached if the company will fix those all the usability issues found; the business activities will be increased when the usability experience of the web shop will be more intuitive and when it will not disappoint the user. If a user likes to utilize a graphical user interface and finds it usable then he will most probably come back often and in this case, will buy more pictures thus generating further cash flows.

The third objective has also been successfully reached. The efficiency of usability testing methodologies has been proved by participating in a real-life usability evaluation project and generating relevant results. Surely new skills have been gained and the overall process has been assimilated by doing it in practice.

However, such objective has not been so easy. While dealing with a real company many issues may arise, as deadlines not respected by the developers of the new version of the web shop or lack of communication by the company itself. These difficulties can become good motivations to manage the different stages of the research process in a more independent way. When there are many tasks to carry out and new tasks require further research, they could procrastinate the task

planned in advance in the research plan. Keeping everything on the schedule is one of the important key factors for success.

6.1 Problems and solutions

Research

One of the problems which may have affected the research implementation has been the fact that usability is a very wide research area, involving many different subtopics that can be undertaken with different approaches analyzed from different point of views.

A good solution for such a problem has been to narrow down the focus of the research on web based applications in the way to facilitate the research process. Also considering teachers opinions about how to structure the research has helped a lot.

Usability planning

Usability planning practices are different and can regard a small snippet of code or a complete different design style approach. The difficult part was to avoid of making the research look like a manual but instead to give good guidelines without losing the proper academic writing style and approach. Decreasing the sections inherent to download and performance as usability perceived by the user it has given more logical sense to the research and made things easier.

Usability evaluation

Usability evaluation techniques are several and choosing the right ones can be a challenge.

The research aims to provide the tools to perform a fast, cost-effective and reliable usability evaluation. Giving a practical example on how to organize a usability testing session can be very helpful to the reader.

Practical Framework

Applying different theories to a real project can be challenging. Practice is always totally different comparing to theory. The issue was to create very clear test documents to make the testing session easier also for the tests participants. Having several literature references also regarding practical evaluation processes can be helpful. Furthermore some teachers have been very glad to help out with the research.

6.2 Succession of the project

The project has been very challenging and stimulating so far, the evaluation results will be used to improve the web shop of the client in the next software releases. The project has shown to correctly follow each objective established at the early stages of the research. Organizing a usability evaluation will be a very useful experience to share with collegues in the next web development project. Also the time management was successful, each meeting with the client was productive and all the tasks have been carried out accordingly. Finally participating in this project has been a very formative experience in every possible way.

The research will proceed during the Master's Degree in Information Systems in the Department of Processing Science of Oulu University.   Studying at Master's level will provide also major motivations to deepen my knowledge in usability and web development.

7 DISCUSSIONS

This study showed that usability evaluation is a topic which can be crucial for enabling successful business operations in a given software market. When building usable applications we can expand enormously the size of our target market. If a user is content about utilizing certain software, he becomes loyal towards the software company who has developed it. Therefore, considering usability as one of the main requirements of software development will create more business opportunities.

I have really enjoyed carrying out this research because it made me realize how important is usability not only in software development but also in many other areas. Nowadays everything is becoming much more user-centered than before. Products, services, everything we buy is customized with our personal tastes and tends to be more usable, because more usable means people are buying it. If we are using a type of software that seldom need any support or helpdesk service because the user-interface is so easy to use, not only it makes us happy but also generates huge cost-savings for the company that developed the software.

During my research I had the opportunity to learn many new concepts about usability evaluation methodologies and I realized how performing an effective usability evaluation can be also almost costless. When planning the tests is very important to consider which category of users are going to test the application and what are the main issues they may encounter. This way you make clearer the explanation of the test tasks where those issues may arise and avoid misunderstandings, generating better test results.

Also I have to admit that participating in a project with a company to analyze their web application has been a very enriching experience, in which I had to practice all the things learnt so far. The results produced, I hope will help the company in their future business operations and will make their customer more satisfied. The readers of the research may benefit from the insights and the suggestions gathered in it and both developers and users could use it as guideline for developing usable web applications. I am very glad about the outcomes of my research and I believe it has reached all the objectives planned with success.

Understanding more how the Web works and how will become more user-oriented in the near future, it makes myself willing to go much further in studying usability and web development.

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APPENDICES

Appendix 1. A copy of the test used for the usability evaluation of the web shop.

Appendix 2. A document used to report the results of the pilot test to the company's executives.

Appendix 3. A guideline containing useful techniques for optimizing web usability.

Usability Test Tasks

TASK 1 – ORDER

You want to order the pictures from the list below that appears inside the photo gallery, as digiphotos. Also you would like to get a mug, a fridge magnet and a t-shirt (choose your size) for each one of the listed pictures:

On the first page

Kuva taikavekara-001-1 pikselikoko 2008 x 3011 (First picture top left)

Kuva taikavekara-006-1b pikselikoko 2080 x 3120 (Last picture bottom right)

On the second page

Kuva taikavekara-007-1 pikselikoko 1363 x 2043 (First picture top left)

Kuva taikavekara-179-1b pikselikoko 3504 x 2336 (Last picture bottom right)

Do the order and check what discount you get with this order.

You should be able to see it clicking on "Ostoskorin sisältö".

DO NOT COMPLETE THE ORDER BECAUSE THE ORDER WILL GO THROUGH

This scenario ends here, don't click TILAA TUOTTEET or JATKA TILAAMISTA

Don't close your web browser, but keep the page opened.

TASK 2 – EDIT

Now you have to edit your order. You also want to add 1 paper copy for each one of the pictures you ordered before. (choose the format you prefer: 10x15 or 15x20 or 20x30)

Go back to the gallery.

You want to order some other photo, choose other 6 pictures you like in this format:

- 2 photos in paper format of 10x15cm.
- 2 photos in paper format of 15x20cm.
- 2 photos in paper format of 20x30cm.

Now you want to delete all the items of the picture below that you ordered before:

On the first page

Kuva taikavekara-001-1 pikselikoko 2008 x 3011 (First picture top left)

You want to delete only the mug and the fridge magnet from the picture below that you ordered before, but keep the digital picture and the t-shirt:

On the first page

Kuva taikavekara-006-1b pikselikoko 2080 x 3120 (Last picture bottom right)

Now you want to edit these other pictures items that you ordered before and were on the second page of the thumbnails list:

On the second page

Kuva taikavekara-007-1 pikselikoko 1363 x 2043 (First picture top left)

Kuva taikavekara-179-1b pikselikoko 3504 x 2336 (Last picture bottom right)

Instead of the t-shirt you want to get a mousepad and one 18 stickers sheet for both of the photos.

This scenario ends here.

Don't close your web browser, but keep the page opened.

TASK 3 - COMPLETE ORDER

Click on "Digikuvat kaikista ostoskorin kuvatuotteista" and order digital format for all the pictures you have in your cart.

Click "TILAA TUOTTEET" and insert your personal information.

Choose the type of paper **Paperikuvien pinta** you prefer to print the paper pictures.

Evaluate the webshop service by giving a grade and leaving a written feedback in the text box.

Thank you!

Now please fill in the Usability Evaluation Survey.

Usability Evaluation Survey

1) Do you think the Web shop it's easy to use? Rate it from 1 to 5. (1 min, 5 max)

Your grade __/ 5

2) Did you learn quickly how to buy pictures with this Web shop ? Rate it from 1 to 5.
   (1 min, 5 max)

Your grade __/ 5

3) Are you satisfied with this Web shop layout (interface, colours, fonts) ? Do you really like it?
   (You may give some suggestion if there is anything you are not happy with.)

☐ Yes   ☐   No

Suggestion:

_____

_____

_____

_____

4) From 1 to 5, how much do you rate the Web shop usability?   (1 min, 5 max)

Your grade: __/5

Thank you for your time!

Pilot test results

In general the webshop has been redesigned well after the previous usability evaluation results and the improvements noticed were several.

This pilot test session was mainly done to test the usability software set up and the efficiency of my test tasks. It turned out to be quite good and there was no problem to run the test.

The average time to run the test should be around 50 minutes per person.

At the end I managed to correct few things and now it should be clear and well-understandable.

After today's pilot test session with Matti Viitala, we discovered only few usability problems:

- ✓ It's not possible to select **multiple pictures at once**, by highlighting those with the mouse.

- ✓ **Paperchoice** positioned on the confirm order page may limit the user. E.g. Let's say the user would like to get one picture with one paper format and one with another.

- ✓ The user interface has improved considerably even though there are probably **too many options** that could be grouped or divided between photos (formats, prints) and optional items (mug, mousepad, t-shirt). It may confuse the user to have so many options.

- ✓ **Lack of colours**: for instance a mouse over effect on the item you select could bring more focus to the choice you are looking.

- ✓ Same thing for the **Question marks** with info/preview, it's a good idea to have them but it's not granted that they will be noticed by the user. A mouse over effect with a change of colour could include the text and also the question mark icon for instance.

- ✓ Also it's not possible to **order more than 10 pictures**, or to manually insert the amount of items to be ordered.

- ✓ When editing an order, on the main picture page with the various options to order, there is not the **amount of t-shirts**. If there was the "0 kpl" listed, it could be easier to update the cart from there.

- ✓ Like we discussed in your office, a **magnetizer or zoom-in** functionality for group photos it is surely needed.

Marketing Issues

Probably you could contact some marketing expert in the Kilpa project and ask for a purposal on how to improve the discount process.

We also discussed that a 10% discount on 50 euros and also the others discount are not enough since the price of one picture it is rather high and you reach the amount even with 1-2 pictures and few more items.

Instead you could put a higher discount spending more money or an offer for every total amount of pictures you order you get one for free.

Also visually the discount does not attract so much the user without colour or highlightment.

Web usability optimization techniques

CSS for layout and presentation

Instead of setting all the attributes values of the HTML tags it is good practice to define those attributes and values for each HTML tag inside an external CSS file. Using CSS will increase portability by separating structure from presentation and also the code will result much cleaner and more professional. It will also enable a faster download since the file will be downloaded only once instead of loading much heavier HTML files with redundant values. It is always better to create a CSS external file and include it to an HTML page using the link tag between the <HEAD> tag like in the example shown in Figure 19.

```
CODE EXAMPLE IN HTML

<link type="text/css" rel="stylesheet" href="filename.css" />
```

FIGURE 19. How to include an external CSS file in HTML

It is possible to create an aesthetically pleasing navigation items also with CSS and not only using images. CSS is an incredibly powerful language and can be used to modify otherwise boring and lifeless menus. Usability is increased by loading faster the page that could be heavy when using images to create fancy menus. For example, it is very easy to create a basic HTML menu utilizing an unordered list but it would not be of great visual appeal.

```
            CODE EXAMPLE IN HTML

<ul>
<li><a href="#">Services</a></li>
<li><a href="#">About us</a></li>
<li><a href="#">Contact us</a></li>
</ul>
```

FIGURE 20. A simple unordered list only in HTML

It is possible to combine CSS and HTML together and create a fancy navigation menu. Adding a <div> selector tag with an id of such selector can be called by CSS to be able to select the entire list and format its presentation style like in Figure 21 and 22. The result is visible on Figure 23.

```
            CODE EXAMPLE IN HTML

<div id="nav-menu">
<ul>
<li><a href="#">Services</a></li>
<li><a href="#">About us</a></li>
<li><a href="#">Contact us</a></li>
</ul>
```

FIGURE 21. A fancy navigation menu and its HTML code with div tag and id selector

```
      CODE EXAMPLE IN CSS


#nav-menu ul
{
list-style: none;
padding: 0;
margin: 0;
}


#nav-menu li
{
float: left;
margin: 0 0.15em;
}


#nav-menu li a
{
background: url(background.gif) #fff
bottom left repeat-x;
height: 2em;
line-height: 2em;
float: left;
width: 9em;
display: block;
border: 0.1em solid #dcdce9;
color: #0d2474;
text-decoration: none;
text-align: center;
}


/* Hide from IE5-Mac \*/
#nav-menu li a
{
float: none
}
/* End hide */


#nav-menu
{
width:30em
}
```

FIGURE 22. An aesthetically pleasing navigation menu and its CSS code part

FIGURE 23. The output of HTML/CSS code of Figure 5 and 6.

Optimize multimedia files

Multimedia files can be very heavy to download if not optimized. When incorporating multimedia files or images to an application better to optimize them first using dedicated software. E.g. It's possible to optimize images for the web with Photoshop and compress videos and music with VLC media player.

When possible it is preferable to represent information with HTML or CSS code instead of images or other multimedia files. A developer should never, unless the design strictly requires it, use images to write text on a webpage. First of all, images can be very heavy to download and second if a user would like to copy-paste some text, it would not be able to do it.

Including stylesheets and scripts files

CSS and JAVASCRIPT files can be saved as external files and included in HTML files to reduce the size of each HTML file. Using this method a project will also have much clearer code that facilitates other developers to understand and modify the code.

To include an external CSS file on the HTML file follow a correct syntax: <link type="text/css" rel="stylesheet" href="filename.css" />

To include an external JavaScript file on the HTML file follow a correct syntax : <script language="JavaScript" src="filename.js" type="text/javascript"></script>

Another important guideline when including stylesheets in HTML documents is to place them at the top inside the HTML <head> tag. Frontend engineers who care about performance want to load a page progressively; that means to display whatever content of the page on browser as soon as possible. The important of giving visual feedback has been researched and documented by Jacob Nielsen in his article *"Response Times: The Three Important Limits"*.

Progress indicators have three main advantages: They reassure the user that the system has not crashed but is working on his or her problem; they indicate approximately how long the user can be expected to wait, thus allowing the user to do other activities during long waits; and they finally

provide something for the user to look at, thus making the wait less painful. This latter advantage should not be underestimated and is one reason for recommending a graphic progress bar instead of just stating the expected remaining time in numbers. (Useit.com: Response Times: The 3 Important Limits. Nielsen, 1993 Referred 22.02.2011).

When developing web applications, the HTML acts as page indicator. When the browser loads the page progressively, the header, the navigation bar, the logo at the top, all serve as visual feedback for the user who is waiting for the page. This improves the overall user experience. Therefore, it is highly suggested to place CSS files at the top, inside the HTML <HEAD> tag and to avoid including other CSS instructions in the middle or at the end of the HTML page. (Souders 2007, 41.)

On the other hand, when using scripts directly on the HTML page is more convenient to move them at the bottom since this enables progressive rendering and achieves a much faster download. It's possible doing this by enabling download parallelization. If the script is positioned at the top of the page, and it takes 10 seconds to load, all the other components of the page will not be downloaded before the script has been downloaded completely. Basically, each component will generate an HTTP request when the cache is empty and in some cases also when is not. (Souders 2007, 45.)

In the HTTP 1.1 specification, the browser is suggested to download 2 components in parallel per hostname. Therefore to speed up the page download it is possible to distribute a webpage across two hostnames, having four components to download in parallel (2 per hostname) would make a download twice as fast. It is not suggested to use more than 2 hostnames since it could heavily degrade performance.

Meta tags

The most important tags for search engine optimisation are the keywords and description tags; although due to mass abuse they have lost a lot of importance in recent times. When using these Meta tags the content should be kept for each tag **under 200 characters** - anything more increases the size of webpages. Lengthy Meta tags are not good for search engines anyway because they dilute keywords.

Web cache

A Web cache is a technique to store temporarily web documents, such as HTML pages and images, to reduce bandwidth usage, server load and the way the user perceives lag when surfing on a web site. In other words, a web cache stores copies of documents passing through it, allowing to satisfy HTTP requests from the cache if certain conditions are met. Basically, if there is another request for the same URL, it can use the response that it has, instead of asking the origin server for it again.

Web cache makes the Web more responsive since a HTTP request can be satisfied from the cache instead of the server, thus it takes less time to display the web site because server latency is reduced. Another advantage of using Web cache is that, reusing the cached documents, it saves the amount of bandwidth used by a client. Thus, the client can save a bandwidth amount to use it for other purposes.

All caches have a set of rules that they use to determine when to serve a representation from the cache, if it's available. Some of these rules are set in the protocols (HTTP 1.0 and 1.1), and some are set by the administrator of the cache.
(Nottingham: Caching Tutorial for Web Authors and Webmasters. Nottingham, 2007 Referred 21.01.2011).

GZIP components

If the amount of HTTP Requests has already been reduced by using Image Maps or CSS Sprites it does not mean it is not further possible to reduce the size of the HTTP Requests needed for viewing a webpage. This can be done by using GZIP and it can considerably decrease the size of HTTP Requests, decreasing the transfer time because fewer packets must travel from the server to client.

Usually web clients indicate support for compression with the Accept/Encoding header in the HTTP Request. (since HTTP/1.1). E.g. Accept-Encoding: gzip, deflate. When the web server sees the Header like in the aforementioned example of the HTTP Request, it may compress the response using one of the methods listed by the client. The user is notified like shown in the HTTP Response from the web server: **Content-Encoding: gzip.**

GZIP is the most popular and effective compression method in use nowadays. It is developed by the GNU project and standardized by RFC 1952. Another compression format available is deflate but is much less popular. It is important to use GZIP only with HTML, stylesheets and scripts files. Compress pdf or images must be avoided because they are already compressed and trying to do it would even increase their size. The general criteria to follow is GZIP only HTML, CSS and scripts if they are greater than 1 or 2K. Using GZIP can reduce a page weight up to 70% of its original size, reducing incredibly network response time and making a web application considerably faster. (Souders 2007, 29.)

Decrease HTTP requests

Only 10-20% of the end user response time is used to retrieve the HTML Document. The rest 80-90% of the time is spent making HTTP Requests for all components referenced in the HTML Document. A simple way to increase the performance of a web application is to reduce the number of components and, consequently, reduce the number of HTTP Requests. This can be done by optimizing the page navigation for example.

Using Image Maps or CSS Sprites could decrease the amount of HTTP Requests diminishing the number of components of the HTML page. For instance, with Image Maps it is very easy to create a navigation menu by using a single image instead of using five different images and that would generate only a single HTTP Request instead of five different ones. The response time is faster because there is less HTTP overhead.

FIGURE 24. Image Map menu: only one image forms the menu reducing the amount of HTTP Request.

Likewise Image Maps, CSS Sprites are another way to save in amount of HTTP Requests. CSS Sprites allow to combine images but in a much more flexible way. The name can be a little misleading, because sprites are not little images like it would be natural to guess, but a sprite is actually one big image. To explain it better, one could imagine where the "on" and "off" states of a

button are contained within the same image and are activated by shifting the background-position.

FIGURE 25. CSS Sprite: the button is made by one single image but it will show only certain part of it when activated by the mouse rolling over it.