HELSINKI SCHOOL OF ECONOMICS (HSE)
Department of Management

USABILITY EVALUATION OF THE HELSINKI SCHOOL OF ECONOMICS WEBSITE

Information Systems Science
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Anne Sunikka k19389
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Johanna Bragge & Matti Rossi

Abstract

Because of the increasing usage of computers it has become more important that information systems not only function well but also are usable. More than 50 % of Finnish households have computers at home and 45 % of households have Internet connection. Wider user group presents new demands to computer software and to website usability. Because the variety of choices has increased the users have grown more demanding. Users want products and services to function – and to function well.

This thesis presents usability as a concept and studies different usability evaluation methods and the special characteristics of each method. Usability evaluation is an essential step in the human-centred design, the principles and activities of which are listed in this study. The usability evaluation methods are divided into empirical user testing and usability inspection without user involvement. The third group of usability evaluation methods is automatic evaluation, which is outside the scope of this study. Different methods serve different evaluation purposes and reveal different problems. Therefore, several methods should be used as a complement to each other.

In the theory part of this study issues that are relevant in designing websites are described, i.e. technical environment, content design, visual design and information architecture. This background knowledge was needed in the empirical part of the thesis – in the usability evaluation of the Helsinki School of Economics website. Four usability methods were used in the empirical part of the study. The first method was a focus group meeting and it was realized with the help of group support software. Nine representatives of personnel took part in the meeting stating their opinions about the HSE website. The second method was a web-questionnaire to inquire the opinions of the HSE students on the HSE website. The questionnaire was posted in the HSE website for two weeks in spring 2003. There were 67 students who answered the web-questionnaire. The third usability method was usability testing, in which six students and four members of personnel conducted test tasks in the HSE websites. Finally, a heuristic evaluation was conducted with two evaluators. Two lists were used in the evaluation: Nielsen's ten usability heuristics and a list gathered by an Australian usability expert Gerry Gaffney. Both usability tests and heuristic evaluation revealed several usability problems. Possible solutions to these problems were listed.

The most severe problems in the HSE website are a difficult structure and navigation and an ineffective search- function. Especially students commented that the HSE website does not work at all during many weekends. Members of personnel wished more discipline in the updating of the HSE website. The positive elements of the HSE website are vast amount of useful information, quick downloads and a calm and pleasing visual image.

Keywords:
Usability, usability evaluation, usability testing, usability inspection, HSE website

Tiivistelmä

Informaatiojärjestelmien käytettävyyden (usability) merkitys on korostunut toimivuuden (functionality) ohella tietokoneiden käytön yleistymisen johdosta. Yli 50 % suomalaisissa kotitalouksissa on tietokone ja 45 % kotitalouksista on Internet yhteys. Laajentunut käyttäjäkunta asettaa uudenlaisia vaatimuksia tietokoneohjelmien ja verkkosivujen käyttäjäystävyydelle. Koska valinnanvara on kasvanut, ovat käyttäjätkin tulleet vaativimmiksi, tuotteiden ja palveluiden on toimittava – ja niiden on toimittava hyvin.

Tämä työ käsittelee käytettävyyttä käsitteenä ja tutkii eri käytettävyyden arviointimenetelmiä sekä menetelmien erityispiirteitä. Käytettävyyden arviointi on ihmiskeskeisen suunnittelun olennainen osa, siksi ihmiskeskeisen suunnittelun periaatteet ja toimenpiteet käydään läpi. Käytettävyyden arviointimenetelmät voidaan jakaa kokeellisiin käyttäjätesteihin ja ilman käyttäjiä tehtäviin asiantuntija-arvioihin. Kolmas arviointimenetelmien laji on automaattisesti tehtävät arvioinnit, joita ei kuitenkaan käsitellä tässä työssä. Eri menetelmillä on omat käyttötarkoituksensa ja eri menetelmät tunnistavat erilaisia käytettävyysongelmia. Suositeltavinta onkin käyttää useita menetelmiä, sillä menetelmät täydentävät toisiaan.

Työn teoriaosassa käydään läpi lyhyesti verkkosivustojen suunnitteluun liittyviä asioita, kuten tekninen ympäristö, sisällön suunnittelu, visuaalinen suunnittelu sekä informaatioarkkitehtuuri. Näitä taustatietoja tarvittiin työn empiriaosassa, Helsingin kauppakorkeakoulun (HKKK) sivuston käytettävyyden arvioinnissa. Sivuston arviointia varten järjestettiin focus-ryhmä tapaaminen ryhmätyöohjelmiston avustamana. Yhdeksän henkilökunnan edustajaa osallistui tapaamiseen ja kertoi mielipiteensä HKKK:n sivustosta. Opiskelijoiden mielipiteitä tiedusteltiin kyselylomakkeella, joka sijaitsi HKKK:n sivustolla pari viikkoa keväällä 2003. Yhteensä 67 opiskelijaa vastasi kyselylomakkeeseen. Kolmas käytettävyysmenetelmä oli käytettävyystestit, joissa kuusi opiskelijaa ja neljä henkilökunnan edustajaa suorittivat kahden skenaarion avulla suunniteltuja tehtäviä HKKK sivustolla. Lopuksi suoritettiin asiantuntija-arvio, jossa kaksi henkilöä kävi läpi HKKK:n sivustoa Nielsenin heuristiikkojen sekä australialaisen käytettävyysasiantuntijan Gerry Gaffneyn listan avulla. Sekä käytettävyystestien että heuristisen arviointien tuloksena lueteltiin HKKK:n sivustolla esiintyviä ongelmia sekä ongelmien mahdollisia korjauskohteita.

HKKK:n sivuston suurimmat ongelmat ovat sivuston hankala rakenne ja navigointi, tehoton haku-toiminto sekä varsinkin opiskelijoiden mielestä sivuston kaatuminen viikonloppuisin. Lisäksi henkilökunta toivoisi selkeämpiä sivuston päivitysvastuita. HKKK:n sivustoa pidetään kuitenkin nopeana ja visuaaliselta ilmeeltään rauhalliselta ja miellyttävältä ja sivuston sisältämä informaation on käyttäjien mielestä hyödyllistä.

Avainsanat:
Käytettävyys, käytettävyyden arviointi, käytettävyystestaus, asiantuntija-arvio, HKKK:n verkkosivusto

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1 Introduction

How many times have you encountered an error message stating "Error 404" and nothing else while working on your computer, got lost in a website trying to find an important piece of information or wanted to close a deal in a website without a success. All these problems fall under the heading "Usability problems".

In an everyday language usability can be said to be about producing products and systems that are easy to use and perform the function for which they were designed. Usability is a vital feature of both tangible and intangible products. In this paper the emphasis is on the usability of computer software, and especially on website usability. The importance of usability has increased and I will justify my claim of increasing importance of usability with the help of the following figures.

The number of computers, used not only at work but also at home, has risen significantly. According to Statistics Finland 57 % of households had a computer at home and 45 % of households had an Internet connection in spring 2003. In companies employing more than five employees 97 % of employees used computers in everyday work and 94 % of these companies had an Internet connection (Niemi, 2003). Thus, the user group of computers, computer software and websites has grown considerably.

The usability of computer software and websites has become especially important during the Internet era since "the competition is only a click away". During the Internet hype the expectations of a spectacular growth of the e-commerce were high. However, the reality has been different. Lately, however, the value of e-commerce and the amount of people who have bought on-line has grown as the following table shows. Even though the €-amount of purchases is not very large, more than half a million people have used Internet as a purchase channel. It is likely than many more people have used Internet to collect information on products and prices and used this information to make the purchase decision.

Table 1: Value of E-Commerce in Finland and the Number of Internet Buyers

Year	Value of E-Commerce in €	Number of people who had bought something in Internet during the 3 past months
2001	566 000 €	340 000
2002	830 000 €	430 000
2003	830 000 €	530 000

Source: Statistics Finland, in the presentation by Casals, 2003

The number of Internet users is big especially in the younger age groups as the following table depicts. However, only people in the age group from 50 to 59 years old use Internet considerably less than young adults. The difference in gender is noteworthy in the age group from 60 to 74 years old in which men use Internet much more than women.

Table 2: Usage of Internet by Gender and Age Group in Autumn 2002, % of Users

Gender	15-19	20-29	30-39	40-49	50-59	60-74	All,%	All, number of people
Women	90	86	80	75	48	8	61	1 205 000
Men	94	87	80	76	53	28	68	1 324 000
Together	92	87	80	76	50	18	65	2 529 000

Source: Nurmela & Parjo, 2003

A more detailed analysis reveals the following facts of the business to consumer Internet commerce in Finland:

- 64% of the 15 – 74 year old consumers had used Internet in the beginning of 2003
- 48% had been window shopping (approximately 1,8 million people)
- 14% had made a purchase from Internet
- 7 % had paid in Internet
- 22 % had made a mail-order purchase (Statistics Finland, in the presentation by Casals, 2003)

Internet users are increasingly changing into broadband services, in summer 2003 approximately half a million Finns accessed Internet through broadband connection whereas a year earlier only 200 000 users had a broadband connection (Kauppalehti, 14.8.2003). However, from the amount of Internet users surfing in the e-commerce sites only 14% make a purchase. Especially a couple of years ago the reason might not have been only the lack of willingness to buy on-line, but also the lack of usability of the e-commerce sites which made purchasing online difficult or even impossible.

Usability is one of the focus areas of HCI, the Human-Computer Interaction that is trying to bridge the gap between people and machines. Usability is a concept that is implicitly understood by most people. However, usability goes often unnoticed since we do not appreciate efforts that have been made in designing something that functions well, but quickly notice if products, equipments, websites etc. are poorly designed and thus, difficult to use.

From the user's perspective usability is important because it can make the difference between performing a task accurately and completely or not at all, and enjoying the process or being frustrated. From the developer's perspective usability is important because it can mean the difference between the success and failure of a system. From a management point of view software with poor usability can reduce the productivity of the workforce to a level of performance worse than without the system. In all cases, lack of usability can cost time and effort, and can greatly determine the success or failure of a system. Given a choice, people will tend to buy systems that are user-friendlier. (Usability first website)

My first encounter with usability was in autumn 2001 while I attended the Decision Support Systems lecture series held at the Helsinki School of Economics. I appreciated the human point of view to the information

systems and the multidisciplinary approach of usability. I became more familiar with usability as a concept and with some usability methods in summer 2002 during Information Technology Program/Digital Media Track. In spring 2003 I was looking for a subject for my thesis. At the same time the IT advisory board of the Helsinki School of Economics (HSE) that was chaired by Professor M. Rossi, a Professor at the Faculty of Information System Science, decided that the HSE website should be tested for usability. Hence, I was eager to start the usability evaluation of the HSE website in March, 2003.

1.1 Objective and Limits of the Study

How to take usability into account in the actual design and production process of computer software is an important question. I will not, however, concentrate on this aspect of usability but will only present an overview to the subject. Even though usability concerns not just software but tangible products as well, I will concentrate on website usability in this paper. I will touch briefly subjects like visual design (fonts, typography, colors, pictures etc.) and technical aspects of the website creation. Furthermore, I mainly concentrate on issues that are relevant for information rich websites, like the HSE website is. Thus, I do not write a lot about issues more relevant to e-commerce sites or entertainment sites.

Since I wrote my theses for the IT advisory board and the Faculty of Information Systems Science, my main research question was set in advance by them: Is the Helsinki School of Economics website usable and what should be done to improve the user experience. Other research areas of interest were to find out:

- Do results of different usability evaluation methods emphasise different aspects of usability.
- Do different target groups find the same areas on HSE website areas usable/not usable.

My personal objective and interest in writing this paper and conducting the research was to get familiar with different usability methods and to try them in practice.

I wrote the theory part of my paper from March to April, 2003 and carried out the empirical research from April 2003 to June 2003. I used different usability evaluation methods in order to find out what different user groups of the HSE website think about the service provided in the HSE website. The methods used in the research were:

- Focus group meeting with the help of the Group Support System software for the HSE personnel.
- Survey questionnaire posted in the HSE website for the HSE students.
- Usability tests and interviews with both the HSE personnel and students.
- Heuristic evaluation by two evaluators.

The emphasis of the study was not to get quantitative but qualitative information on the user experience. Especially the web questionnaire collected also quantitative information, but it was mainly used to get background facts (e.g. operating system, browsers and connection speeds) on the target users of the HSE

website. The background information was needed in order to determine which of the usability problems are more severe than others. In addition, the results of the web-questionnaire and focus group provided the basis on which the test tasks of the usability tests were built on.

I limited the scope of the study to the three main areas of the HSE website: Studying at HSE, Research and Teaching and Corporate co-operation. The English version of the HSE website was not a subject of the study. The interest groups that were asked for they opinion in the empirical part of the research were Finnish speaking students and personnel (both faculty and administrative personnel).

In addition to my thesis I wrote three reports in Finnish to the Faculty of Information Systems Science and to the Communications department of the HSE in July and revised some of the reports in August (Sunikka, 2003a, Sunikka 2003b, Sunikka 2003c). These reports described the results of the usability evaluation and contained very little or no theory. I shortened and translated the reports into English and added them into the empirical part of my thesis. The fact that I conducted my research in Finnish and report the empirical results in English posed some difficulties. I solved the problem by translating the most common navigation elements to English. Those parts, e.g. navigation paths that had to be in Finnish in order for the reader to be able to follow the navigation path, were left in Finnish or are presented both in Finnish and in English.

1.2 Structure of the Study

There are several definitions to usability, some of which I will explore in this thesis. I will briefly describe what usability means in general and explain how usability issues should be taken into account in information system projects in Chapter 2. In Chapter 3 I will list various usability evaluation methods that can be roughly divided into three categories: those that gather data from actual users (user testing), those that can be applied without actual users present (usability inspection) and automated methods. The main emphasis of this study is on website usability and the special issues that have to be taken into account in building usable websites. Chapter 4 concentrates on these issues and looks at the unique features of website development. These four chapters build the theoretical framework of the study. The theoretical part consists mostly of best practices and advice on how to reach a better user experience.

In the empirical part I examine how well/badly the case website, Helsinki School of Economics website, has followed the best practices of usability. Chapter 5 introduces the case website and explains in detail the methods and the results of the usability study. This part of my thesis is based on the written reports that I delivered to the IT advisory board in the summer 2003. In addition, chapter five includes practical advice and hints on how to improve the HSE website usability. My subjective part of the evaluation is delivered through heuristic evaluation, which I conducted with a usability expert. The three other usability methods – focus group meeting, web-questionnaire and usability tests - ensured that 13 members of the personnel and 73 HSE students had a chance to say their opinion about the HSE website usability. Chapter 6 concludes my thesis.

My idea was to write this thesis in as user-friendly way as possible, i.e. using simple language, groupings and listings with bullet points, bold font to emphasise important things, tables and figures etc. I had to abandon my idea since scientific writing has standards of its own and these standards do not encourage using e.g. groupings or tables. However, I used tables and listings when reporting the empirical results since I found that table-formats make the reader's job easier compared to the situation when I used a scientific style in reporting the results.

1.3 Definitions

The source of all these definitions is Whatis.techtarget/definitions website.

Cognitive Modelling a computational model for how people perform tasks and solve problems, based on psychological principles.

Graphical User Interface (GUI)
is a graphical (rather than purely textual) user interface to a computer. Elements of a GUI include such things as: windows, pull-down menus, buttons, scroll bars, iconic images, wizards, the mouse etc. With the increasing use of multimedia as part of the GUI, sound, voice, motion video, and virtual reality interfaces are likely to become part of the GUI for many applications. A system's graphical user interface along with its input devices is sometimes referred to as its "look-and-feel."

Human – computer interaction (HCI)
is the study of how people interact with computers and to what extent computers are or are not developed for successful interaction with human beings. One important HCI factor is that different users form different conceptions or mental models about their interactions and have different ways of learning and keeping knowledge and skills.

Usability Engineering studies the elements of the users' experience.

User Centred Design is an approach that supports the entire development process with user-centred activities, in order to create applications, which are easy to use and are of added value to the intended users.

User Interface (or human-computer interface) refers to the parts of a hardware and/or software system that allow a person to communicate with it. This includes

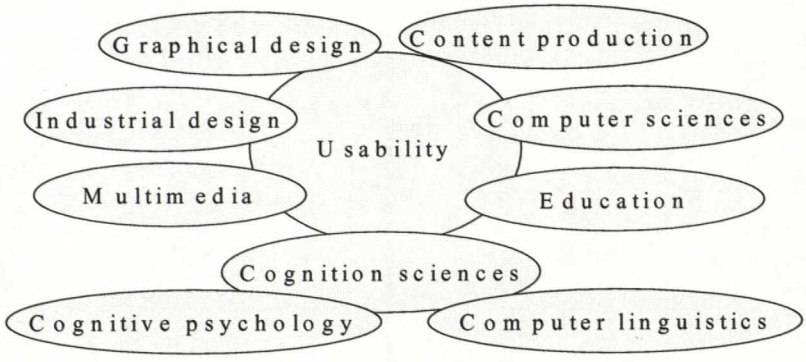
output devices (the way the computer talks to a user) and input devices (the way a user talks to the computer). (Whatis.techtarget/definitions.com website)

2 Usability

Chapter two consists of definitions of usability, methods of measuring usability attributes according to Nielsen (a well-known usability expert) and user-friendly design principles to be followed in information systems projects.

Usability is a multidisciplinary area. In order to fully understand what usability means in different circumstances, skills from many disciplines are needed as Figure 1 depicts.

Figure 1: Usability as a Multidisciplinary Area of Study



Source: Melakoski-Vistbacka, spring 2003

Most of these areas will be touched upon in this paper. Since the attention of this study is on website usability, the main emphasis is on the "rules" of graphical design and content production. Multimedia is not a subject in this paper since the case website does not include multimedia elements. Cognitive psychology and computer linguistics are parts of cognition sciences and form the theoretical basis for the methods that are used in usability evaluation. Computer sciences provide tools in building usable systems and products. Education and learning concentrate on how people learn to use different computer systems and software.

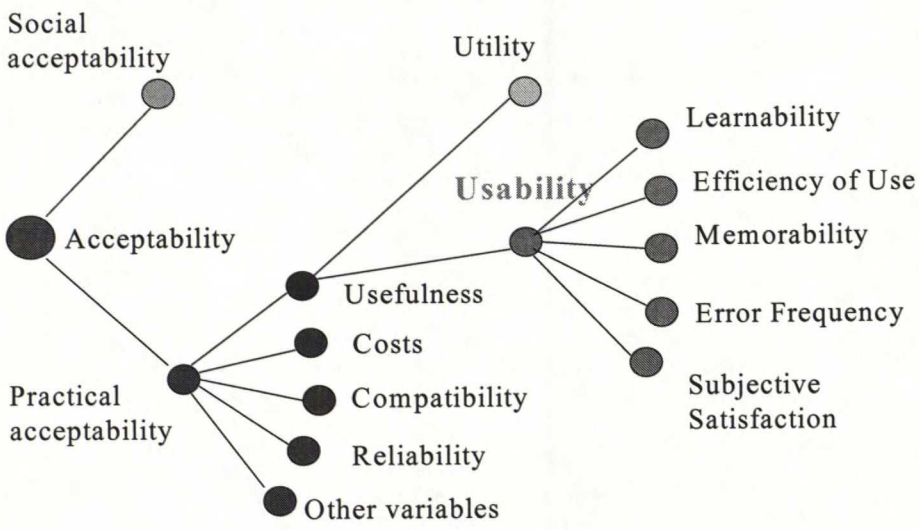
In order for users to accomplish their tasks with information systems, necessary functions have to be available. But functionality is not enough. The determinants of system acceptance are *functionality* (the degree in which the system provides the functions the users need to do their task) and *usability* (ease of use, a user-related and a task-related concept). According to Benbunan-Fich complete functionality cannot be achieved if the system is not usable. Thus, "usability must be elevated to the same priority as functionality". (Benbunan-Fich, 2001)

As a precise concept usability is difficult to define, as many aspects of a product contribute to how it is perceived. What adds to difficulty is that usability is an attribute of the way that a person interacts with a product rather than being something, which can be assessed independently of usage. A device which one person finds usable might be impossible for another to operate. (Stakes website). Usability addresses the relationship between tools and their users. In order for a tool to be effective, it must allow intended users to accomplish their tasks in the best way possible. The same principle applies to computers, websites, and other software. (Usability first website)

2.1 Components of Usability

The two main definitions of usability are Jacob Nielsen's – "the uncrowned king of usability" – definition and ISO's definition of usability. Nielsen defines usability as a measure of the quality of the user experience when interacting with a web-based or a traditional software application (Nielsen, 2000). According to Nielsen usability is a sub concept of acceptability. Usability is the quality of a system that makes it easy to learn, easy to use, easy to remember, error tolerant, and subjectively pleasing. The figure below describes the hierarchy of acceptability (Nielsen, 1993)

Figure 2: The Attributes of System Acceptability



Source: Nielsen, 1993, p. 25

Acceptability is a question of whether the system is good enough to satisfy all the needs and requirements of the users and other potential stakeholders. The *overall acceptability* is divided into *social acceptability* - does the user approve the purpose of system - and *practical acceptability* - is the system compatible with other systems, is the price right etc. *Usefulness* answers the question whether the system can be used to achieve some desired goal. (Nielsen, 1993)

Usefulness can again be broken down into utility and usability. *Utility* means that the functionality of the system in principle can do what is needed. *Usability*, on the other hand, is the question of how well users can use that functionality. Usability applies to all aspects of a system with which a human might interact, including installation and maintenance procedures. It is difficult to find a computer feature that has no user interface components. (Nielsen, 1993)

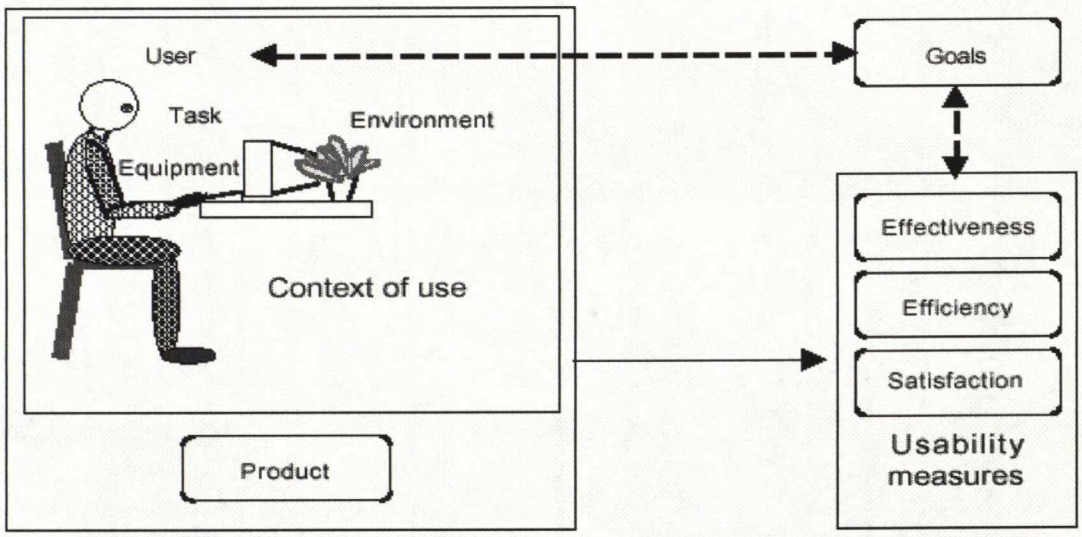
Nielsen (1993) defines usability with the help of five usability attributes:

- *Ease of learnability* means that new users should easily learn to use the system.
- *Efficiency of use* means that the system should be efficient to use once the user has learned to use it.
- *Memorability (ease of remembering)* means that the system should be easy to remember even after some period of not using it.
- *Error frequency* means that the system should have a low error rate and the users should easily recover from possible errors.
- *Subjective satisfaction* means that the system should be pleasant to use

The last variable refers to a fundamental feature of usability: Usability has to be studied in the right context, from the point of view of the user. The right question to be asked is: How well a system fulfils the objectives of the specified user? Thus, usability depends on who uses the system, in which context and with which objectives.

The usability of a product is defined in International Standard Organization's - ISO 9241, part 11 (the standard giving guidance on usability) as: "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (Nectar website). In the following figure the usability framework according to ISO-9241-11 is depicted.

Figure 3: Usability Frameworks According to ISO 9241-11



Source: Riihiaho (2000)

- The *effectiveness* of a system is an indication how well the user accomplishes the goals they set out to achieve using the system.
- *Efficiency* is more related to the use of resources in performing activities answering to the question how many resources are consumed in order to achieve the goals of users. Efficiency could include time taken to perform given activities and a lack of errors made in use. Clearly it could be possible to have systems, which were efficient without being effective i.e. in the situation where a product was easy to use, but did not perform a useful activity.
- The concept of *satisfaction* addresses subjective responses to use. This is different from the more objective measures that can be used to assess efficiency and effectiveness, and is also harder to define in a precise manner. (Stakes website)

2.2 Measurement of Usability Attributes

There are several methods of measuring usability and a listing of different methods can be found in Chapter 3. In this section some ways to measure the Nielsen's five usability attributes are described. It is important to measure the attributes that constitute usability i.e. learnability, efficiency, memorability, error rate and subjective satisfaction. How it can be done?

Learning is considered to be a long-lasting change in human behavior (Sinkkonen, 2002). It is in some sense the most fundamental usability attribute, since the first encounter a user has with a system is learning to use it. Initial ease of learning is fairly simple to measure – one simply picks some users who have not used

the system before and measures the time it takes them to reach a specified level of proficiency in using it. With the increasing use of computers, a focus has shifted from testing people with no computing experience to people who have a "normal" computer experience but no experience with the system being studied. (Nielsen, 1993)

The most common way to measure learning is to state that the users have either been able or not been able to complete a certain task successfully. Another way of measuring learning is to set a certain time limit and state that the user has learnt the system if he/she has been able to complete a predetermined task in a given time limit. Another important measurement of learnability is to see how long it takes a user to achieve a sufficient level of proficiency to do useful work since that is the way users usually start using systems. Their aim is not the complete mastery of system but skills in those areas that they need. (Nielsen, 1993)

Efficiency of use refers to expert users' steady state level of performance at the time when the learning curve flattens out. Experienced user can be defined in a couple of ways. Firstly, a user can declare him/herself an experienced user or secondly, test users can use the system so long that they can be nominated experienced users. Experience can be determined more scientifically by continuously measuring user performance and after the performance does not increase, the user is assumed to have reached the steady-state level of performance for that user (Nielsen, 1993). According to Sinkkonen an expert has worked 8000 to 12 000 hours on a certain task, has an ability to see the whole picture and realizes his/hers limits regarding the task. (Sinkkonen, 2002)

A typical way to measure efficiency of use is first to decide on some definition of expertise, to get a representative sample of users with that expertise and to measure the time it takes for the user to perform some typical test tasks. (Nielsen, 1993)

Memorability of a system concentrates on the needs of casual users. Casual users have used a system before, they do not need to learn it from scratch, they just need to remember how to use it based on their previous learning. Employees who return from holiday or who, for some other reason, have not been using a system for some time, can be seen as casual users (Nielsen, 1993). According to the most common theory on memory, (the three stage information processing model) memory is divided into three parts: i) sensory registry – the input is primarily from sight and sound and must go to short term memory for actual processing, ii) short term memory (STM) or working memory – has a limitation of 7+/- 2 items which can be increased by chunking, i.e. placing items into subcategories that are remembered as single units and iii) long term memory (LTM) – information for future reference is stored in LTM. (Sinkkonen, 2002) In order for a person to remember how to use a system, the long tem memory has to be involved in the process.

There are two ways of testing memorability of a system. One is to perform a standard user test with casual users and measure the time they need to perform some typical test tasks. Another way is so called memory test: After the users have finished a test session, they are asked to explain the effect of various commands or to name the command that does a certain thing. The interface's score for memorability is then the number

of correct answers given by users. According to Nielsen the first method is better in measuring memorability since graphical interfaces are designed in such a way that as much as possible is visible to the user. Hence, users do not need to remember e.g. the contents of the menu when they are away from the system. It is enough that they can use menus when they return to the system. (Nielsen, 1993)

Error is defined as any action that does not accomplish the desired goal, and the system's error rate is measured by counting the number of such actions made by users while performing some specified task. Error rates can thus be measured as part of an experiment to measure other usability attributes. (ibid.)

Depending on the nature of the error, errors are measured differently. Some errors are corrected immediately by the user and have no other effect than to slow down the user's transaction rate somewhat. These errors are included in the measurement of efficiency. Only errors, which are more catastrophic in nature, either because they are not discovered by the user and leading to a faulty work product or such errors that destroy the user's work, should be give special attention. (ibid.)

Subjective satisfaction can be found out by using certain objective measures e.g. pupil dilation, heart rate, blood pressure. Unfortunately the situation is then far from natural as the user has to be wired and thus, relaxed atmosphere is impossible to achieve. Another way is to ask the user for their subjective opinion. When the sample size is big enough it is possible to reach an objective measure of the system's pleasantness. (Nielsen, 1993)

Short questionnaires with Likert scale options where users would indicate their degree of agreement on a 1 to 5 scale are typically used in measuring subjective satisfaction. Statements like "It was very easy to learn how to use this system" or "I worry that many of the things I did with this system may have been wrong" can be used. The trouble with subjective ratings is that the rating of difficulty is more closely related to peak difficult than to mean difficulty because the difficult episodes are the most memorable. Thus it is not advisable to relay solely on user ratings if the goal is to improve overall system performance. (Nielsen, 1993)

2.3 Benefits of Usability

Good design results in products and systems that are attractive to potential buyers. Usability engineering and user-centred design help designers to determine who the potential users of their product are and helps to ensure that their product or system will meet the needs of the users for whom it is intended thus improving usability. If usability is not taken into account in the development stages of planning and design, the result might be – and most likely is – a poorly specified product that does not achieve its maximum potential in the market place or is not used the way it was intended to be used. (Stakes website). The user-centred design process is described in detail in Section 2.4.1.

Designing good products is not easy, since people often do not behave as designers expect them to behave. The problem is one of anticipating how another person will operate products and feel about using them, and what may appear obvious to a designer may seem very unusual to an inexperienced user. Designers usually have difficulties seeing the world through inexperienced eyes. (Stakes website)

The attention to usability -approach typically entails involving users in the design and testing of the system so that their feedback can be obtained. Following this process of developing software can result in a number of significant advantages by producing software which:

- Is easier to understand and use, thus reducing training costs.
- Improves the quality of life of users by reducing stress and improving satisfaction.
- Improves the productivity and operational efficiency of individual users and consequently the organisation. (Stakes website)

Initially it may seem that the user-centred approach complicates the software development task, due to the need to make iterative refinements to the software in light of user feedback. However, the benefits to be gained are considerable. As well as the advantages listed above the process promotes communication between users, managers and those developing the software and identifies difficult issues early on in the development process when it is much cheaper to implement changes.

2.4 Usability in Software Projects

The key principle for maximizing usability is to employ iterative design, which progressively refines the design through evaluation from the early stages of design. The evaluation steps enable the designers and developers to incorporate user and client feedback until the system reaches an acceptable level of usability.

Achieving a high level of usability requires focusing design efforts on the intended end-user of the system. There are many ways to determine who the primary users are, how they work, and what tasks they must accomplish. The best way to design usable products is to ask the user. However, most of the time, clients' timetables and costs involved can prevent this approach. When a full-scale usability evaluation cannot be achieved, "*discount usability*" that can be achieved with limited resources using alternative methods (user testing on system prototypes and a usability inspection conducted by experts and cognitive modelling) comes to rescue. (Nielsen, 1993)

Usability depends on a number of factors including how well the functionality fits user needs, how well the flow through the application fits user tasks, and how well the response of the application fits user expectations. Design principles and design guidelines can be learnt but a highly usable system can only be created through a process that involves getting information from people who actually use the system. (Usability first website)

There are several usability methods that can be employed in different stages of an information system development project. The following figure presents a framework of different phases of an information system project and usability methods that can be practiced in these phases.

Table 3: Usability Methods in a Software Development Project

Planning and Feasibility	Requirements	Design	Implementation	Test and Measure	Post Release
Getting started	User Surveys	Design Guidelines	Style Guides	Diagnostic Evaluation	Post Release Testing
Stakeholder meeting	Interviews	Paper Prototype	Rapid Prototyping	Performance Testing	Subjective Assessment
Analyse content	Contextual Inquiry	Heuristic Evaluation		Subjective Evaluation	User Surveys
ISO 13407	User Observation	Parallel Design		Heuristic Evaluation	Remote Evaluation
Planning	Context	Storyboarding		Critical Incidence Technique	
Competitor Analysis	Focus Group	Evaluate Prototype		Pleasure	
	Brainstoriming	Wizard of Oz			
	Evaluting Existing Systems	Interface Design Patterns			
	Card Sorting				
	Affinity Diagramming				
	Scenarios of Use				
	Task Analysis				
	Requirements Meeting				

Source: Usability.net website

This table is here to give an idea of the vast amount of possible methods that can be used in different phases of an information system project to make the end-result of the project more usable. Only those methods that are the most common and applicable to the case website will be presented in more detail in Chapter 3.

2.4.1 User-centred Design Principles and Activities

Meeting the technical and functional requirements in software projects is important, however, it is equally important to consider usability requirements if the usability benefits are to be realized. The following principles presented in Nectar's website explain how to incorporate the user's perspective into the software development process. The principles are in line with the ISO 13407 standard (Human-centred design processes for interactive systems). The key principles of user-centred design are:

1. Appropriate allocation of function between user and system
2. Active involvement of users
3. Iteration of design solutions
4. Multi-disciplinary design teams

A brief introduction to each principle follows:

1. Appropriate allocation of function between user and system
Determining which aspects of a job or task should be handled by people and which can be handled by software and hardware is of critical importance. This division of labour should be based on an appreciation of human capabilities, and their limitations, as well as a thorough grasp of the particular demands of the task. (Nectar website)

2. Active involvement of users
The extent of user involvement depends on the precise nature of the design activities but the general strategy is to utilise people who have real insight into the context in which an application will be used. Involving end-users can also enhance the acceptance and commitment to the new software as personnel will feel that the system is being designed in consultation with them rather than being imposed on them. (ibid.)

3. Iteration of design solutions
After end-users have used the first prototypes – in the form of paper mock-ups (low-fidelity prototype) or a working system (high-fidelity prototype) – their feedback has to be included in the further designs of the system.

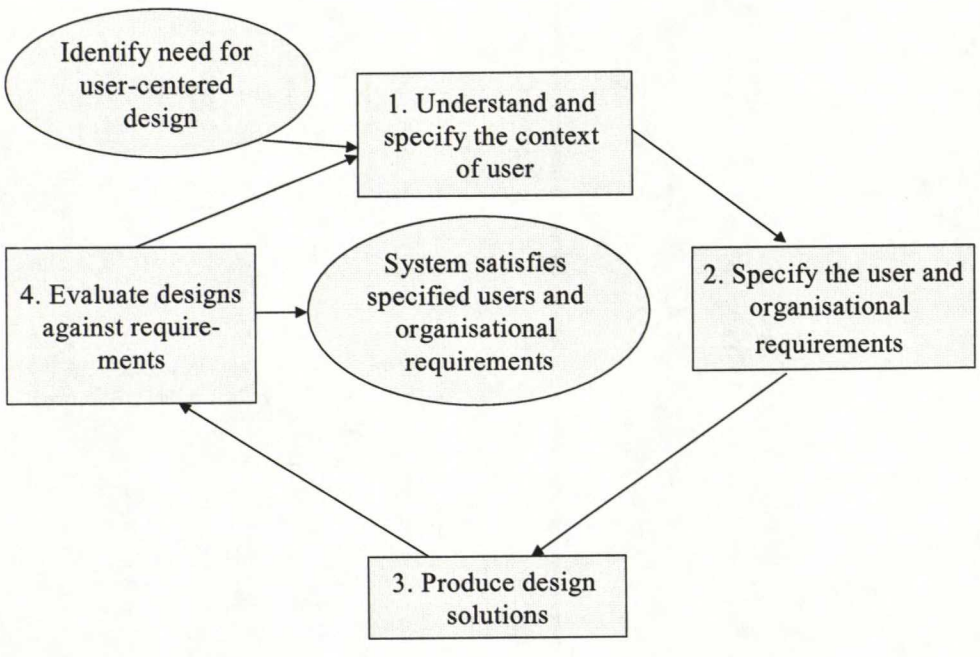
4. Multi-disciplinary design teams
It is important that the software development team is made up from representatives of all those groups who have a 'stake' in the proposed software. Depending upon the circumstances this team may include managers, usability specialists, training and support personnel, software engineers, quality assurance representatives and end users. (Nectar website)

According to the ISO 13407 standard there are four essential user-centred design activities, which should be undertaken in order to incorporate usability requirements into the software development process. The four user-centred design activities are:

1. Understand and specify the context of use
2. Specify the user and organisational requirements
3. Produce designs and prototypes
4. Carry out user-based assessment

The following figure describes the relationships between different user-centred design activities. After the figure a brief explanation of each of the activity is provided.

Figure 4: Iterative Human-Centred Design Activities



Source: Nectar website

1. Understand and specify the context of user

The quality of use of a system, including usability and user health and safety, depends on the context in which the system will be used. Capturing this information is not only important for determining the design but also to provide a sound basis for later evaluation activities. As a result of this activity the following aspects will be understood:

- The characteristics of the intended users

Software should be designed with reference to the characteristics of the intended users. Relevant factors may include the knowledge, skill, experience, education, training, physical attributes, habits and motor-sensory capabilities of the people concerned.

- The tasks the users will perform

The users use new software in order to achieve certain task goals. It is important that the nature of the tasks and the role to be played by the proposed system are understood. This information should focus on high-level characteristics such as the goals, frequency and duration of individual tasks rather than on the functional capabilities of the software.

- The environment in which the users will use the system

It is also necessary to describe the environment in which the system will be used. This relates to organisational, technical and physical factors. (Nectar website)

The results of this initial activity are embodied in a document, which describes the context of use for the proposed software.

2. Specify the user and organisational requirements

Requirements analysis is the most crucial part of software development. Alongside the technical and functional requirements for software the importance of usability requirements has to be stressed. Building on the results of the previous activity an explicit statement of the user-centred requirements for the new software should be formulated.

The following elements (as listed in ISO 13407) should be covered in the specification:

- identification of the range of relevant users and other personnel in the design
- provision of a clear statement of design goals
- an indication of appropriate priorities for the different requirements
- provision of measurable benchmarks against which the emerging design can be tested
- evidence of acceptance of the requirements by the stakeholders or their representatives
- acknowledgement of any statutory or legislative requirements, for example for health and safety. (Nectar website)

It is also important to be aware that the requirements are likely to change over time so they have to be documented well and a version control must be in order.

3. Produce design solutions

After the identification of the relevant contextual information and usability requirements it is time for preliminary designs. Previous experience, standards and style guides are the first sources of inspiration.

The idea behind prototyping is to cut down on the complexity of implementation by eliminating parts of the full system. *Horizontal prototypes* reduce the level of functionality and result in a user interface surface layer. *Vertical prototypes*, on the other hand, reduce the number of features and implement the full functionality of those chosen (Nielsen, 1994) Prototypes can thus range from extremely simple sketches (*low-fidelity prototypes*) to full systems that contain nearly all the functionality of the final system (*high-fidelity prototypes*). It is important to keep in mind that this prototype is just the first version, which will be modified.

4. User-based Assessment

Once a prototype or a working version of the software is available a user-based assessment of the product can take place. This activity confirms the extent to which user and organisational objectives have been met and provides further hints as to how to improve the design. It is advisable to carry out evaluations as early as possible before making changes becomes too expensive. (Nectar website)

User-based assessment can be conducted using different methods. I will describe some of the available methods in chapter three, but the following listing consists of the generic steps that are included in a user-based assessment.

- Evaluation plan

It is crucial that any evaluation activity is planned for in advance. The following issues have to be planned for:
i) The identification of relevant stakeholders. Their support is needed for the evaluation process.
ii) A group of representative end-users should be recruited. The actual number of people required will depend on the particular usability method to be applied, and is naturally influenced by time and resource constraints.
At a more specific level the evaluation plan should identify the roles of those people who will run the evaluation sessions, the aspects of the system to be evaluated, the test tasks to be assigned to the users, and the resources required for the evaluation. It will also be necessary to define the types of information to be gathered and how the results will be measured. (Nectar website.)

- Data collection and analysis

During the evaluation of the system or prototype, users should be encouraged to study and use the prototype and comment on any concerns that they may have.
The results of the evaluation can be used:
i) To obtain design feedback, for instance, to discover usability problems with the product and, if necessary, to prepare sample video tapes or event logs.
ii) To compare the results with set criteria to decide whether the objectives have been met. Statistical tests can also be used to find the probability that the results from the sample of users are representative of the whole population of users. (Nectar website)

- Reporting the results and recommendations for change

To demonstrate that the results of an evaluation are valid a description of the assumptions made about the context as well as details of the evaluation and analysis procedure should be available. All this information can be found in an evaluation report.

A usability report may take a number of forms. The form depends on the original purpose of the evaluation, which can be to capture design problems or to assess a software application against specific standards. All

measurements of the evaluation should be explained, as should the results of any statistical analysis. The report should clearly indicate weather the software as tested satisfies the particular requirements and objectives. (Nectar website.)

- Iterate this activity until design (and usability) objectives are met

Due to the ease and relative low cost of this activity it is possible to carry out several iterations of the process in order to achieve the particular design or usability objectives. Adequate records have to be kept to reflect changes between different versions of the design. (Nectar website)

This process and the activities presented above are generic guidelines on how to carry out user-centred design activities. When an organization starts using the guidelines, the activities will gradually evolve to suite the exact requirements of the specific organization. In my mind, user-centred design and usability go hand-in-hand. After all, all computer software products and websites face usability evaluation at some stage, at the latest in production, when making changes is at the costliest.

3 Methods of Usability Evaluation

In this chapter a variety of methods for usability evaluation are presented. There are different ways of classifying usability methods but the main division is between the objective and subjective (taking into account user's perceptions) methods. What might be different are different names for the same methods and/or different ways of grouping the same methods. One way of grouping the methods is to divide them into three broad categories: those that gather data from actual users – user testing, those that can be applied without actual users present – usability inspection, and automated methods (Riihiaho, 2000). Another way of classifying usability methods is presented by Benbunan-Fich (2001). According to her there are four broad categories of methods: i) objective performance, ii) subjective user preferences, iii) experimental evaluation and iv) direct observation methods.

- *Objective performance* measures how capable the visitors are at using the site, by measuring the amount of time or their efforts at completing specific tasks through the system.
- *Subjective user preferences* assess how much the users like the system by elicting their opinions, or by asking them to rate the site on a questionnaire.
- *Experimental evaluation* is based on controlled experiments to test hypotheses about design and their impacts on user performance and preferences.
- *Direct observation* consists of inspecting the users and monitoring their behaviour while they are interacting with the system to detect usability problems. (Benbunan-Fich, 2001)

Which usability method is chosen in a software project depends on the following issues:

- cost of evaluation,
- appropriateness of the technique to the project,
- time constraints of the project, and
- costs associated with the implementation and training of new users.

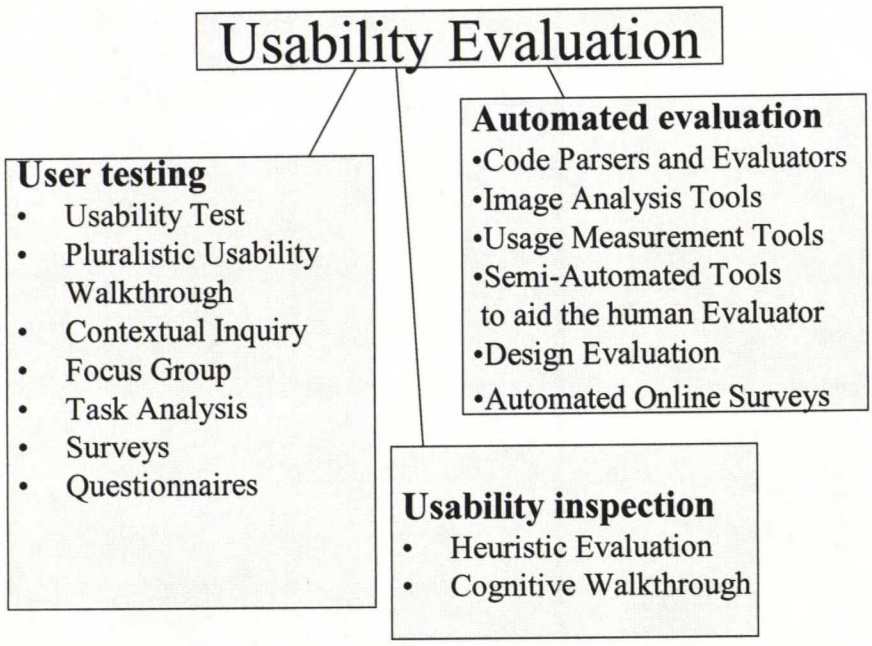
When choosing the usability method, it is important to keep in mind that the value of a usability evaluation needs to be calculated not only in time and materials involved, but also in terms of the impact on the end-users, especially considering the cost of e.g. losing return visitors to the website due to unusable design. (Usability first website)

In this paper the division of methods into user testing and usability inspections is used. Vocabulary is slightly confusing when it comes to usability testing and user testing. I chose to follow Riihiaho's definitions that she used in her licentiate's thesis. According to Riihiaho *user testing* covers a group of usability evaluation methods that involve user participation and *usability testing* is a user testing method in which one or two representative users at a time do given tasks under observation. (Riihiaho, 2000)

The following figure lists various user testing, usability inspection and automated evaluation methods of usability. The listing is not complete, I chose those user testing and usability inspection methods that are

most common to be studied in more detail later in this chapter. Automated evaluation methods are outside the scope of this paper, since I do not use them in the empirical part of the paper.

Figure 5: Usability Evaluation Methods by Type



Source: Riihiaho, 2000 (modified)

3.1 User Testing

According to Nielsen, the first rule of usability is: "Do not listen to users. Instead, watch what people actually do. Do not believe what user say they do, and definitely, do not believe what people predict they may do in the future. "(Nielsen, 2000)

User testing is the main method when it comes to finding usability problems. Nothing is more convincing than watching person after person encountering difficulties with the same part of a software or website. The difficult areas that repeat themselves between multiple test participants reveal areas that should be studied and changed. (Usability first website)

3.1.1 Usability testing

The principle of usability testing is as follows: A trained observer conducts usability testing. People who represent the target audience are asked to perform representative tasks with the software. The observer

writes a user testing report listing the problems and offering recommendations based on their findings. (Usability first website)

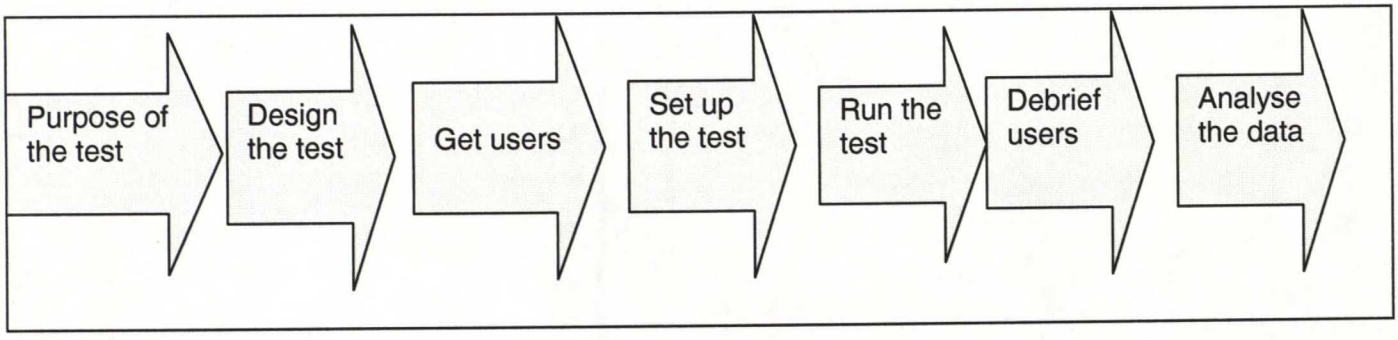
There are various attributes that affect the way usability testing is carried out and one of the attributes is what kind of usability information is searched. Usability parameters fall into two categories; objective performance measures and subjective user preference measures (Riihiaho, 2000). *Performance measures* indicate how capable the users are at using the system. *Preference measures* indicate how much the users like the system. According to Nielsen and Levy there is a positive correlation between these measures, although not straightforward (Nielsen and Levy, 1994)

A lot of usability tests that are conducted use the *thinking-aloud protocol.* During the course of a test the evaluator asks the participant to vocalize his or her thoughts, feelings, and opinions while interacting with the product. Thus, it is easier to understand how the user approaches the interface and what considerations the user keeps in mind when using the interface. Some researchers call thinking-aloud *protocol analysis.* (Benbunan-Fich, 2001)

Although the main benefit of the thinking aloud protocol is a better understanding of the user's mental model and interaction with the product, other benefits can be gained as well. For example, the terminology the user uses to express an idea or function should be incorporated into the product design or at least its documentation. Thinking aloud- technique can be used in any stage of development. Thinking aloud is a cheap way of getting a lot of good qualitative feedback during testing. (Hom website)

In the following figure the process of usability testing is depicted and later on described in detail in the text.

Figure 6: The Process of Usability Testing



1. Purpose of the test

- What are the things that the developer wants to know about your product? The starting point is the overall purpose for the test.

-The purpose has to be distilled down into a few objectives for the test. "How usable is the product?" is not a good objective. The objective has to be something you can test for, for example: "Does the delay in waiting for the Java applet to load cause users to leave the site?" (Hom website)

2. Design the usability test

- Identify the users to be tested. The user profile is important in developing the test design and choosing the sample subjects.
- Determine the experimental design. The experimental design refers to how the non-interesting variables can be eliminated from the analysis.
- Develop the tasks that the users will perform during each experiment. These tasks will be derived from tasks that the users normally perform when they are using the product.
- Specify the test apparatus. For usability testing, this is the computer and its software and video cameras to record the user's actions. A good testing can, however, be performed without additional equipment.
- Identify the required personnel. At least one experimenter is needed to run the test, to greet the test user, to explain the test sequence and to work with the test user during each task. (Hom website)

3. Get some representative users

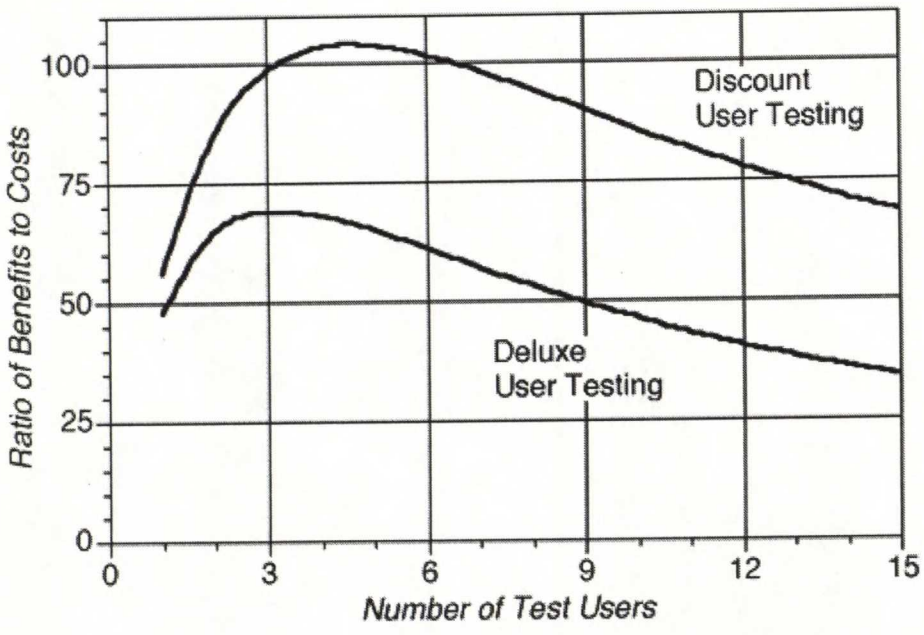
A list of users should be assembled from which test subjects can be chosen. Enough users are needed with the correct mix of experience, skills, and demographic characteristics; otherwise other factors might influence the data and ruin the test. (ibid.)

4. Setup the test

- Prepare the test apparatus. The test apparatus for a usability test includes the computer, and its software for a software test, or the machine or mock-up for a hardware test. The materials that will be provided to the subject and to the experimenter during the test will have to be included, too. The subject usually gets a list of the tasks to perform. The experimenter usually gets a basic script of how to present the tasks to the subject user, and a form to help log observations during the test.
- Prepare the test users. Most common guidelines recommend at least four to five participants to find the majority of usability problems. The sample users have to be chosen based on the objectives of the test, user profiles and their availability on the test dates. (ibid.)

A model developed by Nielsen and Landauer (1993) of the ratio between the benefits of user testing and the cost of the test for medium-sized development projects is depicted in Figure 7. The curves basically show that the benefits from user testing are much larger than the costs, no matter how many subjects are used. Discount user testing (i.e. including also other methods than usability testing) is a low-budget and speedy inspection of software usability. Deluxe testing is naturally more effective but it is also more costly and time-consuming. The maximum benefit-cost ratio is achieved when using between three and five subjects. (Nielsen, 1994)

Figure 7: The Maximum Cost-Benefit Ratio of Usability Testing



Source: Nielsen, 1994

6. Run the test

- Prepare the subject for the test. It is crucial to set the subject at ease. It must be emphasized that it is the product that being scrutinized and not the user, and that they need not feel pressured by the test. Thank the user for participating. A questionnaire gathering background information can be given to a participant to fill out before the actual test starts. (Krug, 2000)
- Run the subject through the tasks and collect data. Tests that are looking for primarily preferential or conceptual data (through thinking aloud, for example) can have a fairly large amount of interaction between the experimenter and the subject. For tests where empirical data is of interest (like error rates), it is advisable to reduce the interaction to a minimum. (Hom website)

7. Debrief the user

- Discuss the test with the user. After the tasks are completed, chat with the subject about the test. Go over events that happened during the test to gather more information about what the subject was thinking at that time. One way to review the events is to recall the event and discuss it with the subject, or to simply ask the subject which events were the most noteworthy. (ibid.)

8. Analyze the data

- Find the big problems first. Identifying the big problems is probably the easiest since they would be evident through observation notes.
- Summarize the performance data that has been collected. Performance data like error rates and task durations is evaluated by performing statistical analysis on the data set.

- Summarize the preference data that has been collected. Preference data is collected by observing the user's actions, and recording the user's opinions, either during the test using a thinking-aloud protocol and/or asking questions, or before and after the test in the questionnaires. (Hom website)

Usability testing can be used throughout the product development lifecycle. In early stages of product development, testing the previous version or competitors' products gives the design team benchmarks for the design. In middle stages of development, testing validates the design and provides feedback with which to refine the design. At the later stages, testing ensures that the product meets the design objectives. (Hom website)

3.1.2 Pluralistic Walkthroughs

Pluralistic walkthroughs are meetings where users, developers, and usability professionals go through a task scenario, discussing and evaluating each element of interaction and the usability professional acts as the session leader and facilitator. Group walkthroughs have the advantage of providing a diverse range of skills and perspectives to bear on usability problems. The probability of finding problems is greater with more people and the interaction between the team during the walkthrough helps to resolve usability issues faster. (Riihiaho, 2000)

This technique is best used in the early stages of development, as the feedback from pluralistic walkthrough sessions is often in the form of user preferences and opinions. (Hom website)

3.1.3 Contextual Inquiry

Contextual inquiry is basically a structured field interviewing method, based on a few core principles that differentiate the method from plain, journalistic interviewing. Contextual inquiry is more a discovery process than an evaluative process; more like learning than testing. (Usability.net website)

Contextual inquiry is based on three core principles:

- Understanding the context in which a product is used (the work being performed) is essential for elegant design.
- User is a partner in the design process.
- Usability design process, including assessment methods like contextual inquiry and usability testing, must have a focus. (Hom website)

Contextual inquiry is one of the best methods to use when you really need to understand the users' work context. This technique is best used in the early stages of development, since a lot of the information is

subjective - how people feel about their jobs, how work or information flows through the organization, etc. (Hom website)

3.1.4 Focus Groups

Focus groups are an informal technique that can help in assessing user needs and feelings both before interface design and long after implementation. Usually the number of participants in a focus group meeting ranges from six to nine users. The participants discuss issues and concerns about the features of a user interface. The group typically lasts about two hours and is run by a moderator. (Nielsen, 1997a)

Focus groups often bring out users' spontaneous reactions and ideas and allow the researcher to observe some group dynamics and organizational issues. The participants can also discuss how they perform activities that span many days or weeks, which is expensive to observe directly. However, only what users say they do can be assessed and not the way they actually operate the product. Since there are often major differences between what people say and what they do, direct observation of one user at a time always needs to be done to supplement focus groups. (Nielsen, 1997a)

Using focus groups to evaluate a system is an efficient way to get user feedback and gauge initial reactions to a design. Focus groups are also good at discovering how the system being tested differs from the user's current expectations. Focus groups provide two major benefits. i) They are less expensive than conducting interviews with the same number of people and ii) they rely on group interaction to trigger memories that may not come up during interviews. (Usability first website)

Where task analysis often discovers the standard way people interact with information systems, focus groups can bring out exceptions to the rules. These exceptions are often very important interactions that users simply do not think of in one-on-one sessions. Conducting only a single focus group can be misleading, however, as some groups are affected by "group-think" or may simply have irregular views. For this reason, at least two groups should be evaluated for any one project. The focus group leader writes up the impressions and comments of the groups and recommends areas for improvement. (Usability first website)

Focus groups can be used at any stage of development, depending on the questions that are asked. Often, interviews or focus groups are used after products are shipped to assess customer satisfaction with the product. More likely, though, focus groups are held at very early stages of development, when the product requirements are still not firm. Focus groups are then held to extract user requirements prior to initial design. (Hom website)

3.1.5 Task Analysis

Task analysis is a method that evaluates how people actually accomplish things with software. Through observation and interviews with users, an analyst determines a set of goals belonging to the target user. Then, a set of tasks that support these goals is determined. These are prioritized based on criteria such as the importance of the goal to the organization and the frequency of task performance. (Usability first website)

The highest priority tasks are decomposed into their individual steps. The level of decomposition varies with the budget and type of system evaluated. The analyst then suggests ways to make the task more efficient or suggests new tasks, which more effectively support the goals. It is important to recognize that the analysis is done from the perspective of the end-user. (Usability first website)

3.1.6 Surveys

Surveys are ad hoc interviews with users, where a set list of questions is asked and the users' responses recorded. Surveys differ from questionnaires in that they are interactive interviews, although not structured like contextual inquiries, nor formally scheduled and organized like focus groups. (Hom website)

Surveys can be used at any stage of development, depending on the questions that are asked in the survey. Often, surveys are used after products are shipped to assess customer satisfaction with the product. Such surveys often identify usability issues that should have been caught in-house before the product was released to the market. (Hom website)

3.1.7 Questionnaires

Questionnaires are written lists of questions that are distributed to the users of the product under scrutiny. Questionnaires differ from surveys in that they are written lists, not ad hoc interviews, and as such require more effort on the part of users to fill out the questionnaire and return it. (Hom website) However, in the Internet era, a lot of questionnaires are posted in the Internet. In this case, a special attention has to paid in designing the questionnaire form so that it is not too long or too difficult to fill. Like surveys, questionnaires can also be used at any stage of development, depending on the questions that are asked in the questionnaire. (Hom website)

3.2 Usability Inspection

A usability inspection is a review of a system based on a set of guidelines. The review is conducted by a group of experts who are familiar with the concepts of usability in design. The experts focus on a list of areas in design that have been shown to be troublesome for users.

Usability guidelines are usually derived from studies in human-computer interaction, ergonomics, graphic design, information design, and cognitive psychology. Some areas that get evaluated are the language used in the system, the amount of recall required of the user at each step in a process, and how the system provides feedback to the user. In particular, issues such as clarity, consistency, navigation, and error minimization are analyzed. Once the problems are discovered, the experts make recommendations for resolving these issues. (Usability first website)

3.2.1 Heuristic Evaluation (Expert Evaluation)

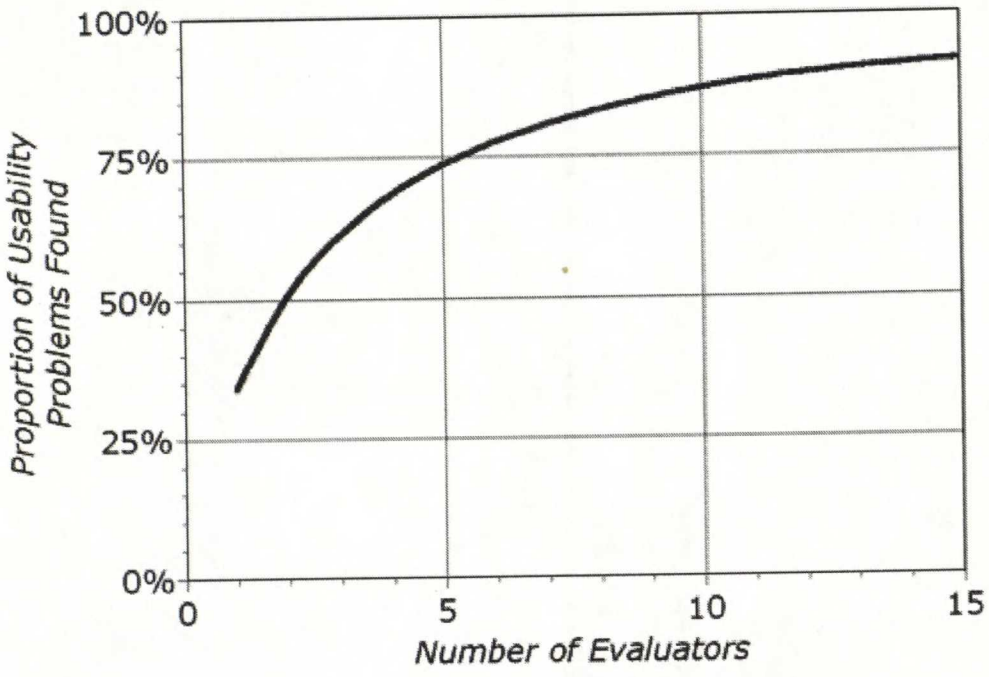
Heuristic evaluation method is a part of the so-called "discount usability engineering" method. Heuristic evaluation is a technique used to identify potential problems that users can be expected to meet when using a computer. Analysts evaluate the system with reference to established guidelines or principles, noting down their observations and often ranking them in order of severity. The analysts are usually experts in human factors or HCI, but others, less experienced have also been shown to report valid problems. (Nectar website)

The most common list of heuristics, Nielsen's ten usability heuristics, is presented in this chapter: Nielsen's heuristics were used in the evaluation of the HSE website. Another set of rules that was also used in the empirical part of the study is developed by an Australian usability expert Gerry Gaffney and his company Information & Design (Information & Design website) and is presented in Chapter 5 of this paper.

The process of administrating the heuristic evaluation is as follows:

1. Gather a group of experts to perform the evaluation
The more experts look at the interface, the more problems can be found. According to Nielsen, however, already three to five evaluators detected most of the usability problems. (Nielsen & Laudauer, 1993) The following figure shows how the experience of the evaluator correlates with the number of usability problems found during the evaluation. As much as 75 % of usability problems are found if five usability experts evaluate the site.

Figure 8: The Correlation of the Number of Evaluators and Found Problems

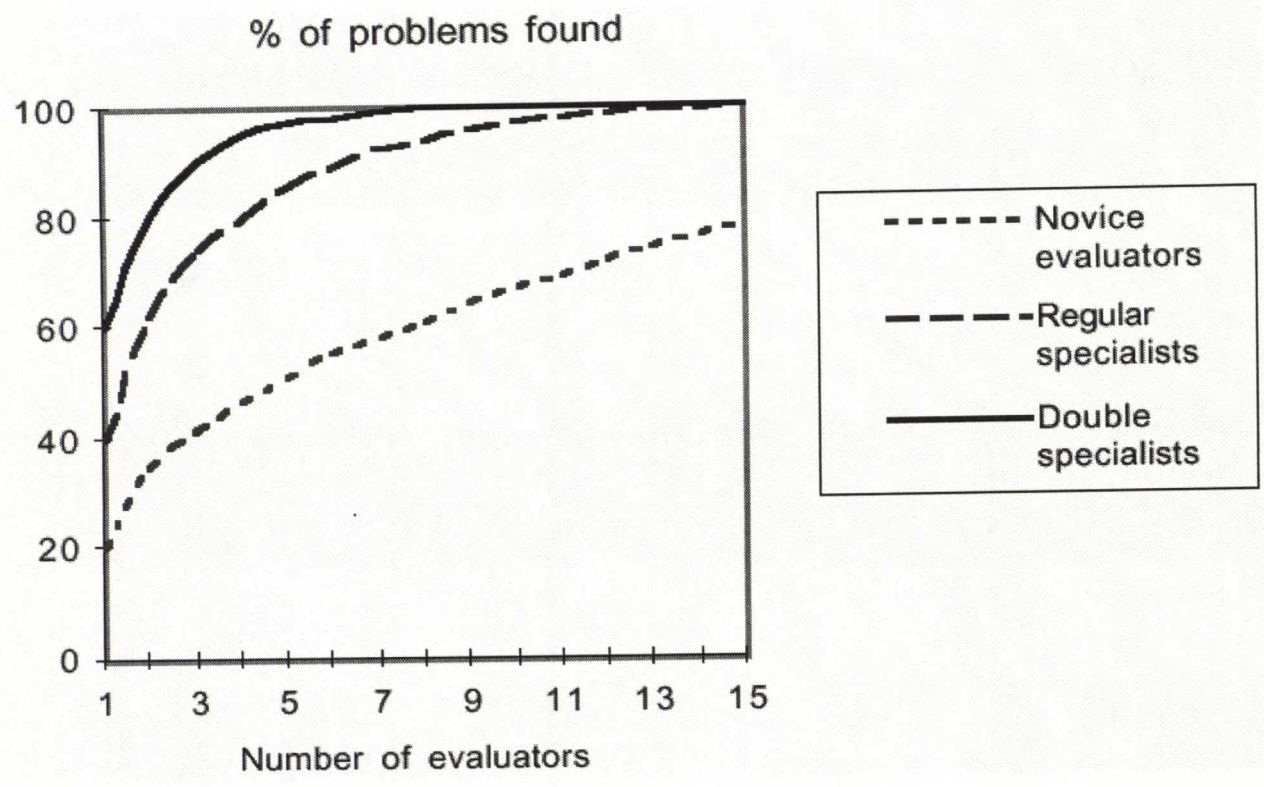


Source: Nielsen & Landauer (1993)

According to Nielsen, a good usability professional has knowledge of interaction theory and user-research methodologies, high brainpower and ten year's of experience in running user test and other usability activities. I doubt that there are not too many people with these qualities around since user-centred design and usability has became a hot topic in the software development and design only with the increasing use of computers and Internet which has occurred during the last ten years.

Luckily even novice evaluators are able to conduct usability inspections even though the amount of usability violations they find is smaller than in the case of an expert evaluation. Figure 9 shows the proportion of problems found in relation to the number of evaluators and the expertise of the evaluators. Usually the first five evaluators find many new problems. However, two to three evaluators are enough if double specialists (expertise in usability and in the system domain) do the work. For regular usability specialists, three to five evaluators are needed. For novice evaluators, a group of 14 evaluators is needed to find more than 75% of the problems.

Figure 9: The Proportion of Usability Problems Found as a Function of the Number of Evaluators and the Evaluators' Expertise



Source: Nielsen, 1992

2. Experts evaluate first individually and compare their findings afterwards

The evaluators need to look at the interface on their own so that their fellow evaluators do not bias them. The evaluators have to be provided with the proper roles and scenarios to use so they will have the right perspective when interacting with the product. The expert will go through the interface at least twice, looking at each element of the interface (for example, each menu item, button, control, affordance) and evaluating its design, location, implementation, etc. in regards to the list of heuristics. (Nielsen, 1994)

3. Experts provide feedback

When each expert performs an evaluation, he or she can provide feedback as a structured report or verbalized findings. Evaluators usually write a summary report of all the usability problems found. Most reports provide the heuristic(s) that were violated by the problem and give an idea of how to correct it.

Heuristic evaluation can be used at almost any time during the development cycle, although it's probably best suited to earlier stages, when there is not enough time for testing. Heuristic evaluations can be done with the help of low-fidelity prototypes such as paper mockups, and still get a good amount of usability problems discovered before actual production work begins. (Hom website)

Guidelines and checklists help ensure that usability principles will be considered in a design. Nielsen's list of usability guidelines is as follows:

Ten Usability Heuristics by Jacob Nielsen (Nielsen, 1994)

1. Visibility of system status
   The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.
2. Match between system and the real world
   The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.
3. User control and freedom
   Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.
4. Consistency and standards
   Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.
5. Error prevention
   Even better than good error messages is a careful design, which prevents a problem from occurring in the first place.
6. Recognition rather than recall
   Make objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.
7. Flexibility and efficiency of use
   Accelerators - unseen by the novice user - may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.
8. Aesthetic and minimalist design
   Dialogues should not contain information, which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.
9. Help users recognize, diagnose, and recover from errors
   Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.
10. Help and documentation
    Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

A longer list of Nielsen's heuristics that was used in the HSE website evaluation case is provided in the Appendix 1.

3.2.2 Cognitive Walkthrough

Based on a user's goals, a group of evaluators goes through tasks, evaluating at each step how difficult it is for the user to identify and operate the interface element most relevant to their current sub goal and how clearly the system provides feedback to that action. Cognitive walkthroughs take into consideration the user's thought processes that contribute to decision making, such as memory load and ability to reason. This approach is intended especially to help understand the usability of a system for first-time or infrequent users, that is, for users in an exploratory learning mode. (Usability first website)

Cognitive walkthroughs are performed at any stage of design using a prototype, a conceptual design document, or the final product. Most often this method is used at early stages of development when an expert plays the part of a user and the interface is a prototype. Compared to pluralistic walkthrough method the main difference is that users are not present in cognitive walkthroughs.

For example, finding the HSE website can be broken down to several levels of tasks. At a general level, it requires opening up a browser, remembering the URL and typing it in the text box at the top of the browser. Or, if the user does not remember the URL, he/she must choose a search engine, think of a search term, view the results, scroll through the results, and then click on the link. Each of these actions can be further decomposed.

3.3 Comparison and Criticisms of Usability Evaluation Methods

Many researchers have compared various usability evaluation methods by different attributes. A common attribute for comparison is the problem detection rate, i.e., the number of problems that the methods help to reveal. Other attributes have also been used, such as Karat lists below (Karat 1994):

- types of usability problems revealed
- ability to address usability evaluation goals
- reliability of the usability findings
- involvement of usability experts
- ability to support the launching of usability goals and activities into an organization
- applicability at different points in the development cycle
- effectiveness in generating usability recommendations for change
- cost-effectiveness.

Usually, usability testing is the method against which the other methods are compared. In the following some tables are presented in which the features of some of the usability evaluation methods are compared.

Jeffries, Miller, Wharton and Uyeda (1991) compared four usability evaluation methods: expert evaluation, software guidelines review, first version of cognitive walkthrough, and usability testing. The evaluated interface was a visual interface of the UNIX operating system.

The expert evaluation involved four usability experts walking through the interface. The guidelines group consisted of software engineers who had prior experience with the system. This group used a set of 62 guidelines based on established human factors principles and sources. The cognitive walkthrough was also done by a group of software engineers. Although both the guidelines review and the cognitive walkthrough are originally intended for the actual designers and implementers, other groups were used, because the researchers had no access to the real designers. The usability tests involved six participants as representative users. Usability experts conducted the tests. (Jeffries et al., 1991)

As a summary, in the study of Jeffries et al. (1991), usability expert evaluation was the most effective method: it identified the greatest number of problems, was successful in identifying serious usability problems and was lowest in cost. The cost-effectiveness of expert review was reduced because of the many low-priority problems that the method also revealed. Usability testing, on the other hand, was an effective means of identifying serious and recurring problems, and avoided identifying low-priority problems, but it was the most expensive testing method. Table 4 presents a summary of the findings of this study.

Table 4: Comparisons between some Usability Methods

	Advantages	**Disadvantages**
Expert Evaluation	Identifies many problems Identifies many serious problems Low cost	Requires usability expertise Requires several evaluators
Usability testing	Identifies serious and recurring problems Avoids low-priority problems	Requires usability expertise High cost Misses consistency problems
Guidelines review	Identifies recurring and general problems Can be used by software developers	Misses some severe problems
Cognitive walkthrough	Helps define users' goals and assumptions Can be used by software developers	Needs task definition methodology Tedious Misses general and recurring problems

Source: Jeffries et al. (1991)

Karat (1994) studied the strengths and weaknesses of user testing and inspection methods. She states that usability testing seems to be able to address a wider range of evaluation issues than inspection methods, e.g., in predicting user performance (see Table 5). Testing also reveals more usability problems than

inspection methods, especially the severe ones. Still, inspections find different problems than testing, so they should be used as a combination: inspections are good at making several small evaluations and usability testing is good at giving guidance for high-level design.

Table 5: Strengths and Weaknesses of Usability Testing and Inspection Methods

Issue		Usability Testing	Inspection Method
Ability to address usability evaluation objectives.		+	-
Number and type of usability problems identified.		+	-
Usability personnel involvement in applying the method.		-	+
Ability of a method to facilitate organizational acceptance of usability goals and activities.		+	+
Appropriateness of the use of the method at different points in the development cycle.	For numerous lower-level design trade- offs	-	+
	For high level design guidance: full coverage of interface	+	-
Effectiveness of a method in generating usability recommendations for change.		+	-

Source: Karat (1994)

It has been argued that the result of Nielsen and Landauer's experiment whereby they state that five users would uncover 70% of major usability problems is not necessary valid for websites. Nielsen and Landauer's result was achieved when small software applications were tested. However, according to Schroeder writing in the User Interface Engineering website, extending the "five user theory" to larger software applications and to the www environment turned a useful rule into a myth with no scientific basis (Schroeder, 2002). In addition, he criticizes the statements: "Users give up because pages take too long to download" and "User will leave a site if they do not find what they want after three clicks" and claimed that there was no scientific basis for these statements. (ibid.)

Another author on the same website, User Interface Engineering, felt that common guidelines can point the designers into a totally wrong direction. Instead, website developers should not trust the generic guidelines but they should produce their own guidelines by e.g. examining existing competitors' websites and how the actual website target users function in these sites. From the collection of data, designers could compile their own best practice guidelines to be used in the website that is under construction. (Spool, 2002)

4 Website Design and Creation

In this chapter issues that are particular to website development projects – technical implementation, content design, information architecture, visual design and quality assurance - are briefly studied. But first a couple of remarks on web projects and different types of websites are listed.

There are differences and similarities in graphical user interface projects for "normal" computer systems and for systems aimed at Internet. The main difference is that designing for Web means giving up full control and instead, sharing responsibility for the user interface with users and their hardware/software. According to Nielsen the user is in control because of these factors:

- Devices are diverse – Internet can be accessed through different devices (traditional computers, palm, mobile phone etc.). Thus any given web-design will look different on different devices. In addition, browser types and setting influence the "look and feel experience" of an individual user.
- The user is in control of navigation - Users can take paths that were never intended by the designer.
- Part of a whole - Users feel that the site he/she is using is a part of a whole web. Users frequently "surf Internet" rarely staying a longer period of time in any specific site and definitely not bothering to learn it if it seems difficult. (Nielsen, 1997c)

Mielonen adds to this list other web specific features:

- Response times vary a lot depending on the traffic in the Internet.
- There are still only few commonly accepted standards and designers attack even the few ones in their attempt to design something new and thrilling.
- The audience is very heterogeneous, hence the services should be simple and easy to use.
- The barrier for setting up a service site in the Internet is low. Thus, the quality of services varies a lot. (Mielonen, 1999)

The raison d'être of a website is where the design starts. There are several reasons for setting up a website, the three main site types are informative, commercial and entertainment site. In practice, sites are usually combinations of these pure types. The design process for each of these site types emphasises different aspects of the design. (Laine, summer 2002). According to Laine the following questions should be asked when planning a website.

General navigation questions that apply for all types of sites:

- Where am I?
- Where can I go?
- How will I get there?
- Where I have been before?
- How can I get back to where I once was?

In the following table the design issues that should be taken into account in different site types are divided into purpose-oriented and topic-oriented questions. In general, in information sites the accuracy of information is of importance and in e-commerce sites the user wants to makes sure that his/her financial information is safe. In entertainment sites users want to know the rules of the game. (Leino, summer 2002)

Table 6: Relevant Questions in Designing Different Types of Sites

	Purpose-oriented questions	Topic or audience oriented questions
Information sites	How do I know the exact information I am looking for? How will I know if the site has what I am looking for? What if I am not sure exactly what I am looking for? Will the information be right for me? Can I trust the information? Can I store what I find for later use?	Is this information up-to-date and accurate? Does it reflect any particular stance or bias? To whom is it for? Can I search something specific? Can I limit my search for certain topics (I am interested in)? Is there a glossary available? Can I talk to an expert who can help me make sense of this information?
E-commerce sites	How do I know my financial information is secure? How can I protect my privacy? How can I find the item I want? What if I am not sure exactly what I am looking for? How can I preview products to see if they are right to me? What if I have problems or returns?	How can I find books by a particular author? How can I find books that are similar to books I like? How do I know what the reading level the book is? Where can I get reviews or recommendations? How do I find out about new releases and awards?
Entertainment sites	How do I begin? What is going to happen? Will I get hints and tips as I go alone? Am I going to have to work at it? How will I know I am finished?	What are the rules? What do I need in order to play? What if I made a mistake or change my mind? What if I need to leave in the middle? Can I store results and continue later? Can I play against someone? How do I win (or lose)?

Source: Laine, summer 2002

4.1 Technical Aspects of Website Creation

In this chapter the main characteristics of technologies that Internet works by are briefly listed. Most of the definitions have been collected from an Internet site Whatis.teachtarge/definitions (www.whatis.techtarget.com).

The *Internet*, sometimes called simply "the Net," is a worldwide system of computer networks - a network of networks in which users at any one computer can get information from any other computer. Internet is a public, cooperative, and self-sustaining facility accessible to hundreds of millions of people worldwide. Physically, the Internet uses a portion of the total resources of the currently existing public telecommunication networks. Technically, what distinguishes the Internet is its use of a set of protocols

called *TCP/IP* (for Transmission Control Protocol/Internet Protocol). One factor that differentiates the various networks is their *speed of bandwidth* that is rated in bits per second (bps) Users can connect to the Internet over the telephone through digital modems (speed ranges from 28.8 kbps to 56 kbps), digital subscriber line connections (speed from1 to 1,5 mbps) or cable connections (speed up to 10 mbps). Dedicated digital circuits or optical fibre carriers can obtain even greater speeds. (Tech Target website/definitions)

The most widely used part of the Internet is the *World Wide Web*. Its outstanding feature is *hypertex*t, a method of instant cross-referencing. In most Websites, certain words or phrases appear in text of a different color than the rest; often this text is also underlined. When a user selects one of these words or phrases, he/she will be transferred to the site or page that is relevant to this word or phrase. Sometimes there are buttons, images, or portions of images that are "clickable." If the pointer is moved over a spot on a Website and the pointer changes into a hand, this indicates that you can click and be transferred to another site. (Tech Target website/definitions)

The user of WWW has access to millions of pages of information. Web browsing is done with a *Web browser.* Technically, a Web browser is a client program that uses the Hypertext Transfer Protocol (HTTP) to make requests to Web servers throughout the Internet on behalf of the browser user. The most popular browsers are Microsoft Internet Explorer and Netscape Navigator. Other browsers are e.g. Mosaic, Lynx and Opera. The appearance of a particular Website may vary slightly depending on the browser that is being used. Also, later versions of a particular browser are able to render more "bells and whistles" such as animation, virtual reality, sound, and music files, than earlier versions. In general a *server* is a computer program that provides services to other computer programs in the same or other computers. In Web a *web server* is the computer program that serves requested HTML pages or files. (Tech Target website/definitions)

HTML (Hypertext Markup Language) is the set of markup symbols or codes inserted in a file intended for display on a World Wide Web browser page. The markup tells the Web browser how to display a Web page's words and images for the user. Each individual markup code is referred to as an element or tag. Some elements come in pairs that indicate when some display effect is to begin and when it is to end.

HTML is a formal recommendation by the World Wide Web Consortium (W3C) and is generally adhered to by the major browsers, Microsoft's Internet Explorer and Netscape's Navigator, which also provide some additional non-standard codes. The current version of HTML is HTML 4.0. However, both Internet Explorer and Netscape implement some features differently and provide non-standard extensions. Web developers using the more advanced features of HTML 4 may have to design pages for both browsers and send out the appropriate version to a user. Significant features in HTML 4 are sometimes described in general as dynamic HTML. What is sometimes referred to as HTML 5 is an extensible form of HTML called Extensible Hypertext Markup Language XHTML. (Tech Target website/definitions)

Cascading style sheet (CSS) is a Web page derived from multiple sources with a defined order of precedence where the definitions of any style element conflict. The Cascading Style Sheet, level 1

recommendation from the W3C, which is implemented in the latest versions of the Netscape and Microsoft Web browsers, specifies the possible style sheets or statements that may determine how a given element is presented in a Web page. Style sheets simplify the task of creating and maintaining a consistent look and feel across a website. However, this still leaves the issue of managing the content. In an HTML document there is virtually no structure to the content, the content is simply interspersed among the tags in the page. CSS gives more control over the appearance of a Web page to the page creator than to the browser designer or the viewer. (Tech Target website/definitions)

XML (Extensible Markup Language) is a formal recommendation from the W3C and similar to the language of today's Web pages, HTML. Both XML and HTML contain markup symbols to describe the contents of a page or file a flexible way. However, in an HTML document there is virtually no structure to the content, which makes creating and maintaining the content difficult. It also makes it difficult for other applications, like software agents, to use the content. Like HTML, an XML document is a text file consisting of a set of tags along with content, however, there are no fixed tags. XML describes the content in terms of what data is being described. This means that an XML file can be processed purely as data by a program or it can be stored with similar data on another computer. XML is "extensible" because, unlike HTML, the markup symbols are unlimited and self-defining. XML is actually a simpler and easier-to-use subset of the Standard Generalized Markup Language, SGML, the standard for how to create a document structure. It is expected that HTML and XML will be used together in many Web applications. XML markup, for example, may appear within an HTML page. (Tech Target website/definitions)

An *Active Server Page (ASP)* is an HTML page that includes one or more scripts (small embedded programs) that are processed on a Microsoft Web server before the page is sent to the user. An ASP is somewhat similar to a server side include or a common gateway interface (CGI) application in that all involve programs that run on the server, usually tailoring a page for the user. Typically, the script in the Web page at the server uses input received as the result of the user's request for the page to access data from a database and then builds or customizes the page on the fly before sending it to the requestor. ASP is a feature of the Microsoft Internet Information Server (IIS), but, since the server-side script is just building a regular HTML page, it can be delivered to almost any browser. (Tech Target website/definitions)

4.2 Content Design

"When spectators leave the theatre you want them to talk about how good the *play* was, not about how *beautiful* costumes were." The same principle applies to the content design in the Internet. Content is the king! (Leino, summer 2002)

Information in a website needs to support the user's tasks. The audience and goals should be determined by a requirement analysis conducted prior to building the site as the user-centred design principles recommend. It is also important to help users navigate the website. One way of doing this is to organize information in the

order that the user is likely to need it. It is a demanding task to organise the content of several hundred or even thousand pages. Thus, information architecture and information design are closely linked with the setting up of the contents.

Journalists have long written in a style that tells the reader the most important kernel of information followed by supporting information, and concluding with more general background. In the Web, this style is even more important since users do not always scroll to the bottom of the page. It is possible that they will only read what appears in the beginning of the page. It is important, therefore, that text be kept to short, scannable segments. According to a study conducted by Nielsen and Morkes 79 % of their test users always scanned text at Web, only 16 % of test users read word-by-word. (Morkes & Nielsen, 1997). This study prompted Nielsen and Morkes to study further what effect the writing style has on usability.

In their empirical study, Nielsen and Morkes developed five different versions of the same website (same basic information, same site navigation, different wording). The control version was written in a promotional style (i.e. "marketese"); one version was written to encourage scanning; one was concise; one had an "objective," or non-promotional, writing style; and one combined concise, scannable, and objective language into a single site. The results showed that the measured usability was 124% better when the text was concise, scannable and objective. (Morkes & Nielsen, 1997)

The measures of usability in this empirical test were:
- Task time was the number of seconds it took users to find answers for specific questions about the content.
- Error measure was a percentage score based on the number of incorrect answers users gave for questions that had a known answer.
- Memorability comprised two measures from an exam given to the users after they had finished using the site. *Recognition memory* was a percentage score based on the number of correct answers minus the number of incorrect answers to 5 multiple-choice questions. *Recall memory* was a percentage score based on the number of items correctly recalled after the test minus the number incorrectly recalled.
- Time to recall site structure was the number of seconds it took users to draw a sitemap. This is a measure of how well the users had understood the information architecture: if they understood it well, they would draw it quickly; if they understood it poorly, they had to think longer.
- Subjective satisfaction was determined from participants' answers to a questionnaire. Each question used a 10-point rating scale. Four satisfaction criteria were averaged to derive the subjective satisfaction score: perceived *quality,* perceived *ease of use*, *likeability* and *user affect.*
The overall measure was calculated as the geometric average of these five measures. (ibid.)

According to Nielsen the three main guidelines for writing for the Web are: (Nielsen, 2000)
1. Be succinct: write no more than 50% of the text you would have used in a hardcopy publication
2. Write for scannability: don't require users to read long continuous blocks of text
3. Use hypertext to split up long information into multiple pages

In the following these rules are explained in more detail:

1. Because reading from computer screens is about 25% slower than reading from paper, Web-authors should write 50% less text and not just 25% less since it is not only a matter of reading speed but also a matter of feeling good. Studies have also shown that users do not like to scroll, this is one more reason for keeping pages short. (Nielsen, 1997b)

2. Users scan text and pick out keywords, sentences, and paragraphs of interest while skipping over those parts of the text they care less about. Thus articles should be structured with two or even three levels of headlines (a general page heading plus subheadings). In addition, a heading should tell the user what the page or section is about. Highlighting and emphasis make important words catch the user's eye, so they are recommended on websites. (Nielsen, 1997b)

3. Text should be short, but without sacrificing depth of content. Very often hypertext is used to segment a long linear story into multiple pages even though hypertext possibilities should be used to split the information into coherent chunks that each focus on a certain topic. The guiding principle should be to allow readers to select those topics they care about and only download those pages. In other words, the hypertext structure should be based on an audience analysis. In addition, each hypertext page should be written according to the "inverse pyramid" principle and start with a short conclusion so that users can get the idea of the page even if they do not read all of it. (Nielsen, 1997b)

Consistency

Most website projects will include content from multiple writers. However, it is important that the writing on a website appears uniform and consistent in order to achieve clarity and establish a brand identity. The only way to ensure that writing does not appear idiosyncratic is to use an agreed upon style guide that establishes the writing standards for the project. The style guide should include issues such as: Tone, voice, corporate slogans and terminology, spelling self-consistency (e.g. web site/website), structure, layout and file formats (Usability first website).

4.3 Visual Design

Designers and simplicity gurus don't often see eye-to-eye when it comes to website design. When people were more committed to learning software due to software expense and limited choices, users had to adapt to poorly designed user-interfaces. But on the Internet users can be choosy and only use sites that are easy and quickly. While beautiful, impressive, and compelling design is important for a variety of reasons i.e. creating brand identity, entertaining and drawing people in and establishing credibility, design choices need to be weighed against meeting the user's needs in order for a site to achieve its goal. (Usability first website)

There are several lists aiding designers to plan usable websites. Even though some designers feel that these kinds of recommendations chain their innovative spirit, listings are useful especially for novice designers. The Usability first website has prepared the following checklist by combining many of Nielsen's checklists.

1. Simplicity rules

Nielsen suggests going through all the design elements on a website and removing them one at a time. If a design works without a certain design element, kill it (Nielsen, 2000). While not everyone may want to follow such a drastic rule in all their designs, it is useful to remember that graphics can often be only supplementary to a website and should never get in the way of users.

2. Follow established web conventions

The web is becoming a genre with its own established conventions. From a usability standpoint, it can be helpful to follow some of the design conventions that are being established by dominant websites as users are accustomed to seeing certain layouts and features on commerce sites, marketing sites, or informational sites. (E.g. studies have shown that blue-underlined text is the most reliable indicator of links and provide the most click-throughs. Another advantage to text links is that browsers support differentiating visited and unvisited links, which cannot be supported with graphics.)

3. Don't disable user preferences

In website design, there is a constant tension between wanting to control the way a page looks like and allowing users to set their own preferences. However, users should not be prevented from customizing certain elements for themselves. Users can set their own preferences for:
- text link colors (visited and unvisited)
- background color
- displaying graphics or not
With this in mind, background and text link colors should be chosen with user preferences and browser defaults in mind and make sure that there is enough contrast between background and text.

4. Use semantic tags whenever possible

Another practice that can increase usability is the use of semantic tags rather than format tags. Although format tags offer designers more control over the appearance of text, semantic tags can be more usable across platforms. People with different browsers will more likely get the proper interpretation of text regardless of how it is displayed. (Usability first website)

According to usability specialist Steve Krug the most important thing in designing websites is to keep the rule: "Do not make me think!" in mind. Websites should so be self-evident or at the least, so self-explanatory

that users realize instinctively what they are supposed to do in a website, which buttons to press, how to navigate etc. His rule is based on examining user behaviour when interacting with a website. Krug's "facts of life" include the following observations:

- Users do not read pages, they scan them.
- Users do not make optimal choice, they satisfice.
- Users do not figure out how things work, they muddle through. (Krug, 2000, pp. 22 – 26)

In addition, there are several rules on colors, fonts, pictures, icons, forms, layouts, alignments etc. that designers either follow or break deliberately in order to create something new. These aspects of website design are taken into account when studying whether the HSE website is usable in the empirical part of this study.

4.4 Information Architecture

In everyday language *information architecture* can be said to be a set of ideas about how all information in a given context should be organized.

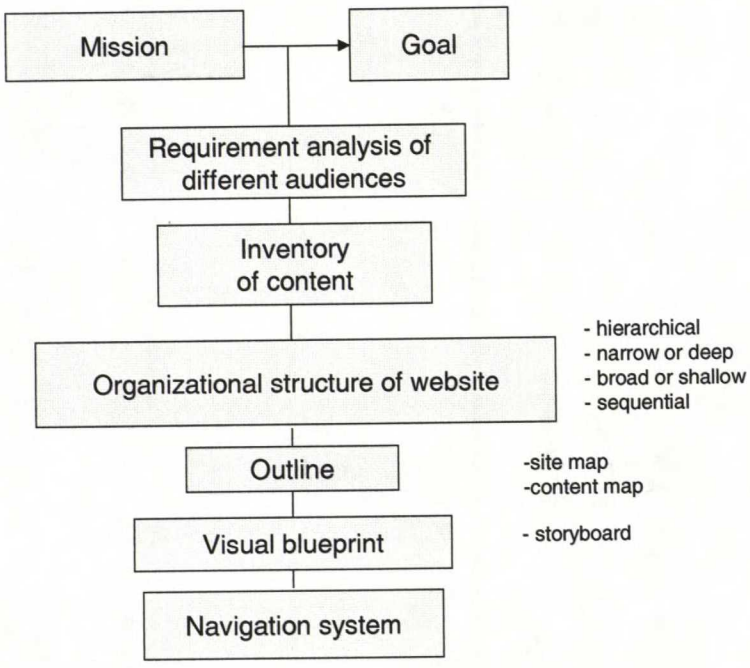
A more detailed definition states that information architecture focuses on designing effective navigation, organization, labelling, and search systems. It is an interdisciplinary field that draws upon the research and practices of information and library science, computer science, graphic design, and psychology. The role of the information architect is crucial to the planning and conceptual design/redesign stages of web development, as good information architecture lays the foundation upon which a website is built. (Usability first website)

Information design, on the other hand, focuses more narrowly on the information itself and may compass e.g. information content design, page design, Website design, illustration design, typography decision and so forth.

Users can feel lost even in a relatively small information space that is not well organized. The problem becomes even greater in the Internet when you consider the possibility that people can arrive at any given web page from any other page on the web.

The process of planning information architecture of a website is much more than just deciding on where to have the main navigation bar and other navigation menus. The complexity of information architecture planning is depicted in the following figure.

Figure 10: The Process of Planning the Information Architecture



Source: Usability First website

First, the mission or purpose of the website has to be defined, and the reasons for people coming to the site have to be figured out. Then the immediate and long-range goals of the site have to be determined. Next, the intended audiences have to be recognized and requirements analysis has to be carried out for each user group. Then, the content has to be collected and altered to suit the web.

When all this preparatory work has been done, the organizational structure of the website can be determined. The structure can be hierarchical, narrow or deep, broad or shallow or sequential. The outline of the site should be created next. This can be done with the help of site maps that are maps that reflect navigation and main content areas. They are usually constructed to look like flowcharts and show how users will navigate from one section to another. Another option is to use content maps that are detailed maps that show the contents of each page and how the content in the pages is related to other pages. (Usability First website)

The following step is to crate a visual blueprint of the site, which can include designing the page schematics (they can also be called storyboards) that are black and white line drawings or block diagrams to hand off to a visual designer. These may or may not reflect layout and are used mostly to inform the designer and the client exactly what information, links, content, promotional space, and navigation will be on every page of the site. Schematics help illustrate priority. Last but not least, the navigation systems have to be defined. Navigation should be easy to learn and consistent throughout the website. (ibid.)

Navigation

Basically, Internet is a navigational system: the most common user interaction is to click on hypertext links in order to move around in a huge information space with hundreds of millions of pages. Since the space is so vast, navigation is difficult, and it has become necessary to provide users with navigational support beyond the simple "go-to" hyperlinks. (Nielsen, 2000) The purpose of navigation interface is to help user answer three fundamental questions of navigation:

- Where am I?
- Where have I been?
- Where can I go?

No matter what navigation design is chosen for a site, there is one common theme to all navigation: It just visualizes the user's current location and alternative movements relative to the structure of the underlying information space. If the structure is a mess, then no navigation design can rescue it. Thus, poor information architecture will always lead to poor usability. (Nielsen, 2000)

4.5 Quality Assurance

Quality Assurance is an important step in the website development process. A broken link or a misspelled word may seem like trivial mistakes, but they can greatly undermine the credibility of a website. It is a good idea to come up with company's own set of guidelines to follow. The guidelines should address editorial, graphics, and coding conventions. After the site has been built, it should be put through a rigorous post-production process. Finally, there should be a provision for user feedback, the results of which can influence the ongoing maintenance of the site. (Usability First website)

Some areas that should be covered in own quality assurance checklist are included in the following table:

Table 7: Quality Assurance Checklist

Content	Documentation	Graphics and layout	Browser compatibility	User preference compatibility
Spelling, grammar, mechanics	Sufficient documentation	Image quality	Check on different platforms	Font size
All critical information is present		Download time	Check on different browsers	Link colours and underlining
Titles, headers, and navigation labelled correctly		Text layout		Plug-ins
		Alignment of elements		Window size
		Colour accuracy		

Source: Usability First website (modified)

5 Usability Evaluation of the HSE website

This chapter presents all the usability methods employed in the usability evaluation of the HSE website and the results achieved when applying different methods.

The project for redesigning a new website for the Helsinki School of Economics started in 2000 and the new website was introduced in autumn 2001. The objectives of the new HSE website design project were:

- To make research projects and knowledge accessible to different interest groups of the HSE.
- To serve as an advanced electronic service portal.
- To build and enhance the HSE community.
- To offer means and tools for communication to research community, students and potential students, corporations, alumni, social interest groups and own personnel. (ICL Invia, 2000)

The ISS faculty, a professor of which chairs the IT advisory board of the HSE, commissioned my thesis. The IT advisory board wanted to find out how usable the HSE website is and what could be done to improve the usability of the website. In order to find out the more detailed objectives of the study and suitable methods to be used in the research, two meetings were arranged with Professor M. Rossi, Assistant Professor J. Bragge and web coordinator J. Ahvenainen in March and April 2003.

In addition to the main research interest, whether the HSE website followed the usability guidelines, a couple of other research questions were identified:

- Do different usability research methods provide different results?
- Was there a difference of opinion regarding the usability among the main interest groups, students and personnel?

The empirical part of the thesis describes how each usability method was used in this research and what kinds of results were achieved when applying different methods. Since one of the objectives of the study was to compare what kind of information is achievable with various methods, the results of different methods: web-questionnaire, focus group meeting, heuristic evaluation and usability tests, are explained in detail. In addition, different suggestions of solving the usability problems found are attached to the results of heuristic evaluation and usability testing. This kind of reporting might be tedious for the reader. Hence, the reporting of the results is done as clearly as possible by using a lot of tables and lists even though the kind of reporting does not represent a scientific way of reporting.

The following table gives an overview of the methods that were applied in the research. Even though usability research is usually started with heuristic evaluation, in this case the methods that needed user participation were conducted first.

Table 8: Usability Methods Used in the HSE website Evaluation

Method	Date	Target group and number of participants	To note
Focus group meeting	24 April 2003	Personnel members, 9	GSS was used.
Web-questionnaire	From 24 April to 13 May 2003	Students, 67	
Heuristic evaluation	Started in May, final meeting 26 June 2003	Two evaluators	The other evaluator was a professional in the usability field.
Usability tests	From 15 May to 17 June 2003	Students, 6 Personnel, 4	Tests were videotaped.

5.1 Focus Group Meeting

The first method that was used for collecting data on user opinions of the HSE website was a focus group meeting. It was organized with the help of GroupSystems software and all the participants belonged to the personnel. Ten representatives of personnel – five from the administrative side and five from faculty were invited to take part in the focus group meeting. Nine representatives were able to take part in the session. The session took place on April 24, 2003.

The objective of the focus group meeting was to find out personnel's opinions, preferences and wishes regarding the HSE web page. The data was used to plan tasks for the upcoming usability tests.

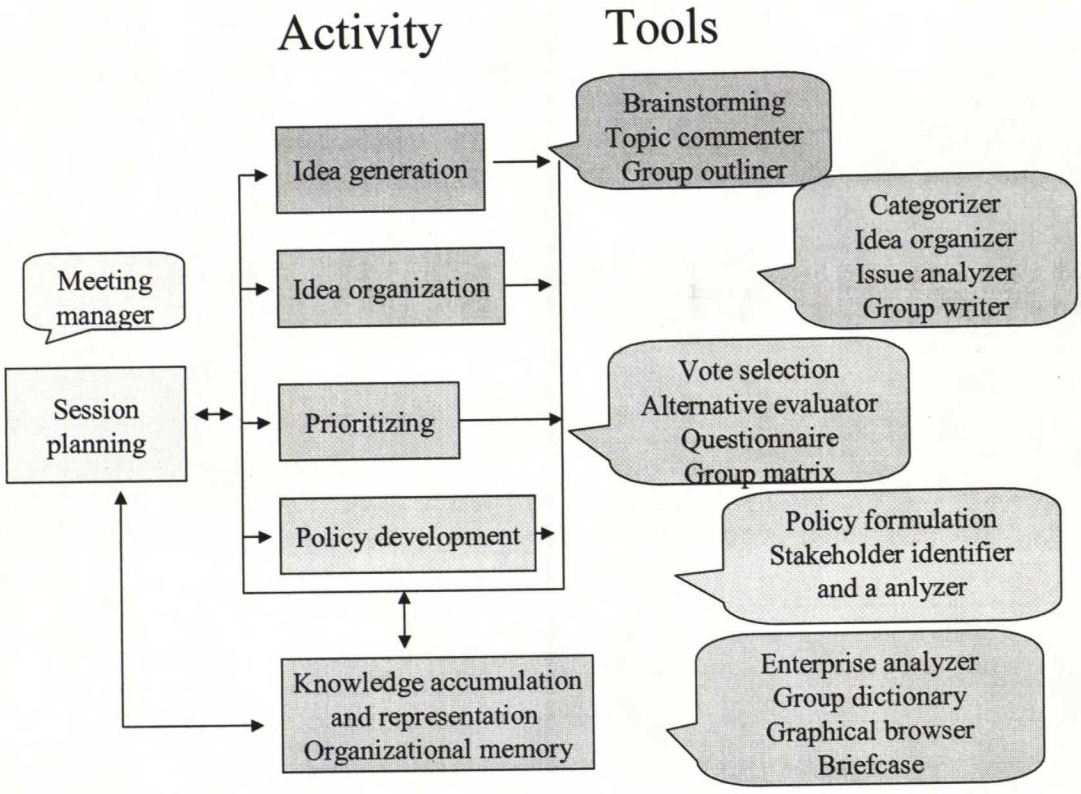
5.1.1 Group Support Systems

The goal of Group Support Systems (GSS) is to assist groups in communicating, collaborating and coordinating their decision-making activities. *GSS can be defined as software systems that support a group of decision makers engaged in a common decision making task by providing access to the same shared environment and information.* (Bidgoli, 1996)

Even though GSS were primarily designed to improve productivity in face-to-face meetings, GSS enable also more rational and even-handed decisions by stripping away egos and overly assertive behaviour, encouraging equal participation by providing anonymity or enforcing turn-taking. Traditional face-to-face meetings are time-consuming, they get easily sidetracked, a lot of people do not participate and a couple of participants can dominate. In GSS environment the familiar 80/20 rule can be interpreted that instead of spending 80 per cent of the time finding out what people are thinking, the GSS software gives you 80 per cent of the time to focus on why they think this way and what to do about it. (Chapman, 2003)

In order to a GSS meeting to be successful special attention has to be paid to facilitation and to careful preparation of sessions. An example structure that represents an earlier version of GroupSystems is depicted in the following figure.

Figure 11: Activities and Tools in a GSS



Source: Bidgoli, 1996

Regarding GroupSystems software there are three main features that apply to it:

- Simultaneous contribution – everyone is "speaking" at once, which saves time and increases productivity.
- Anonymity – the identity of each contributor is unknown, so participants tend to feel freer to express their opinions, and ideas are evaluated more objectively.
- Complete Records – at the end of a meeting, it is easy to produce a complete and accurate report of all ideas, comments, and vote results (GroupSystems website).

GroupSystems has seven tools, each of which focuses on a specific aspect of group collaboration, such as idea generation, evaluation, organization, and exploration. Below is an overview of each of these seven major tools (ibid.).

Categorizer

Used to collect a list of ideas, then categorize those ideas into logical groupings. The group can brainstorm on one single list, or enter ideas directly into the categories.

Common uses include cause and effect analysis; organizing lists of tasks; and simple brainstorming.

Vote

Eight voting methods, including a customizable point scale, make the voting process flexible and powerful. Used to evaluate, make decisions, and build consensus.

Group Outliner

Used to generate and/or organize ideas into a familiar hierarchical structure. Outlines can be displayed in bulleted or numbered format. The leader can distribute the whole outline to participants, or allow them to work in subgroups.

Common uses include action planning; group writing; and process design

Topic Commenter

The leader enters a list of topics and asks participants to comment on those topics.

Common uses include discussing strengths and weaknesses (SWOT analysis) and focus group research

Alternative Analysis

Used to evaluate a list of alternatives based on multiple criteria. Sophisticated charting allows for in-depth analysis.

Common uses include evaluating job candidates; assessing risks; rating vendor proposals; and evaluating options.

Electronic Brainstorming

Used for simultaneous and anonymous idea sharing on a specific question or issue.

Common uses include team building; broad or focused brainstorming; and visioning or strategic planning sessions

Survey

Used to build, distribute, and collect survey forms.

Common uses include employee feedback surveys; 360 performance reviews; and customer surveys.

5.1.2 Results of the Focus Group Meeting

Dr. Bragge acted as a facilitator of the focus group meeting and I summarized some of the answers to the questions presented.

The agenda of the session was as follows:

1. I welcomed the participants and described the study and the aim of the focus group meeting.
2. Dr. Bragge introduced GroupSystems software.
3. Questions were presented with the help of the GSS.

The following questions were asked during the meeting (questions are grouped into A: warm-up questions, B. focus group questions and C: feedback questions)

A. Warm-up statement questions

The scale of the warm-up statement questions ranged from 1 to 5, 1 indicates total disagreement and 5 total agreement with the statement. The survey results are summarized in Table 9 below.

Table 9: Survey Results of the Warm-up Questions

Question	Mean	Standard Deviation	N
I know usability as a concept.	3,89	1,05	9
I am interested in technique and computers.	3,67	1,00	9
I use Internet daily at work.	5,00	0,00	9
I use Internet also a lot at home.	2,67	1,58	9
HSE website helps me at work.	3,89	1,27	9
I find all the information that I need from HSE from the website.	2,89	0,93	9
I have a high bandwidth Internet connection at home.	2,33	2,00	9

B. Focus group questions

Focus group questions were divided into subgroups: *background, technical, graphical design, contents, structure, navigation and preference questions.* I have shortened and summarized the answers from the original focus group report. A more comprehensive account of the focus group results is given in Sunikka (2003a). The numbers in parentheses tell how many similar answers were given.

Background questions

a. Which adjectives would you use to describe your employer? (list three adjectives)
Most common adjectives were traditional, appreciated and aiming at change.

b. What is the most important goal of the HSE?
All the participants agreed with slight variations that the main goals are business education and research.

c. To whom do you think the HSE website is aimed?
All three major user groups; faculty and personnel, students and partner companies were mentioned.
Somebody commented: "At the moment the site is suitable for nobody."

d. To which group/groups the HSE site is the prime source of information on the HSE?
Students and potential students were mentioned.

e. How and in which situations do you user the HSE website?

Person search was by far the most common function that was used (7 mentions), then searching for current information (3) and library services (2)

f. Which pages do you follow the most actively?
Current Affairs on the main page (8), *Events*-calendar (2), dissertation list

g. If you are a content provider, which pages do you update?
Own subject, own department and own course pages

Technical questions

a. If you connect to the HSE site from somewhere else than HSE, from where is it?
Home got most of the mentions (6) or from somewhere else (e.g. library).

b. Have you had any problems with downloading pages?
There has been no special problems, but *Person Search* is especially slow (2)

Graphical design

a. What do you think of the graphical design of the HSE site? (colors, fonts, pictures, graphics)
Graphical design is business like and clear and colours are good. However, navigation is perceived to be unclear, as links do not look like links. There is too much information on some pages, on other pages there is no information at all but the user is forced to click very deep into the navigation hierarchy to get to the source of the information.

b. Does the graphical design reflect the adjectives describing the HSE?
Business like design builds trust, but the design could be more personal. The content is unclear.

c. Are links easy to distinguish from other text?
Generally links are easy to distinguish but the logic of linking varies according to departments and subjects. Top navigation links do not reveal what information is stored under them. To an inexperienced user the HSE site is not an easy site to use.

Contents

a. Does the heading indicate what the text is all about?
Link names do not give enough hints of what kind of information is hidden under that link and the practice of naming headings changes from subject to subject.

b. Are there enough subheadings for improving the readability of the text?

This is no problem (5). Three participants commented that maybe there are not enough subheadings used. However, this does not seem to be a major problem.

c. Have you noticed any clear mistakes in the HSE website?
Course links do not always work and there are some dead-ends. But this is not a major problem.

Structure and navigation

a. What do you think of the site structure and the ease of navigation? (All answers are included)
- It requires a lot of clicking to find certain issues. The site structure cannot be determined based on headings and navigation bars. Site structure is problematic and it reflects the organizational chart.
- It is difficult to navigate since it is impossible to bookmark URL's. (2)
- The structure of the site should be rethought once again, this time from the point of view of person looking for information.
- On one hand it is good to have a common structure, on the other hand it is good to leave some liberty to departments and subjects. For an outsider it is complicated if the structure is different in different pages.
- The structure is not directed to anybody. There should be a separate intranet sites for personnel, students etc.

b. Do you easily find what you are looking for in the HSE site?
Usually no (2), but with the help of search – yes (2)

c. Would you like to have a sitemap?
Sitemap would be a good idea (3), but it is not a solution to the problem. However, it would support the use of the site (2)

d. What do you think of the search functionality in the HSE site? (*Search* and *Person Search*)
Person Search functions well if you know the name of the person you are looking for (4). Sometimes slow. *Search* does not usually give the results that the user expects.

Preference questions, ideas for further development?

a. The participants were asked to list which are the best features of the HSE website. After listing these they voted on the issues generated. The top five positive features are listed below. The scale ranged from 1 to 5 where 5 was the highest grade. The total number of voters was 9.

Table 10: Positive Features of the HSE Website

Positive features	Mean	Standard deviation
A lot of information	4,44	0,53
Course homepages	4,22	0,83
Events-section	3,89	0,93

Current Affairs-section on the first page	3,78	0,83
Electronic person search	3,44	1,12

b. The participants were asked to list which are the worst features of the HSE website. After listing these they voted on the issues. The top five negative features are listed below.

Table 11: Negative Features of the HSE Website

Negative features	Mean	Standard deviation
No logic	4,78	0,44
Structure	4,67	0,71
Course pages are not updated – no clear division of responsibility	4,33	0,71
Navigation solutions (three bars at same site)	4,33	1,12
Problems with URL	4,22	0,83

c. Which advise would you give to the Chief Information Officer of the HSE in order to improve the usability of the HSE website?

Two issues received more comments than others:

1. Attention should be paid to the structure of the site in order to make it easier to find information.
2. Better discipline in updating the site.

C. Feedback questions on the GSS software

Participants found that the use of the software was beneficial in a study like this. They did, however, feel that because there was not much verbal discussion, the study could have been conducted as an online meeting just as well.

5.2 Web-questionnaire

The first aim of the web questionnaire was to find out background information on demographics and what kind of equipment students have at their disposal. Another aim was to collect student opinions and perceptions of the HSE website. The gathered information was used for planning student tasks for the upcoming usability tests. The web-questionnaire was posted on the HSE website for a couple of weeks, from 24 April to 13 May, 2003. The questionnaire was placed in the log-on page of the students and 67 students filled the questionnaire. The Finnish language web-questionnaire can be found in Appendix 2.

The descriptive statistics of the background questions are presented in graphical format in Appendix 3. Below is a brief description of the results of the web questionnaire.

A. Background questions

Age of Respondents: Almost half of the respondents were between the ages of 21 and 25 which is expected since most of the HSE students are aiming at B.Sc (Econ,) and M.Sc (Econ.) degrees and are thus fairly young.

Type of Respondents: First year and 3 rd year students participated most actively in the survey. Besides "normal" students there were also participants from the ISS upgrading program and Ph.D. students.

Division of Respondents by Major : The biggest group of respondents was those who had not yet chosen they major subject. Students of Information Systems Sciences (both "normal" and those who take part in the upgrading program) formed the second biggest group or respondents.

Place of connecting to the HSE website: Students were most often at home (67%) when they connected to the HSE website. Around 15 % of the students used the HSE website at the HSE. According to these results most of the HSE students have a computer of their own at home.

Type of connection to Internet: Students usually had quick connections to the Internet, over 80 % of the respondents had either local area network or broadband connections.

Browser Type: Over 85% of the respondents had the newest or the second newest Internet Explorer browser at their disposal.

The main reason for visiting the HSE website: Over 50 % of the students stated that the most common reason for visiting the HSE website was to retrieve course material. Other reasons were getting information on exams, searching for recruitment information, departmental information or information on current affairs.

B. Statement questions

There were eight statement questions with the scale ranging from 1 to 5 in the questionnaire. Total disagreement with the statement was indicated with 1 and 5 indicated total agreement with the statement. The results for the statement questions were as follows:

Table 12: Statement Questions in the Web-questionnaire

Statement	Average	Standard deviation
Downloading of HSE pages is quick enough.	3,69	1,11
The visual image of the website reflects the image of the HSE.	2,97	1,22
The contents of pages reflect well the heading of the text.	2,69	0,97
There are too few pictures and graphics at the HSE website.	2,51	0,96
The content in the HSE site is clear and useful.	2,38	1,16
It is easy to use the HSE website.	2,25	1,01
I always know where I am when I surf at the HSE site.	1,97	0,92

I easily find the information I need at the HSE site.	1,84	0,95

The most liked aspects of the HSE website were quick downloads and visual image. The feeling of getting lost in the HSE website and not being able to find the needed information quickly and easily were the most criticized aspects of the site.

C. Open-ended questions
There were three open-ended questions in the web-form.

Which aspects are good and should definitely be left at the HSE website?
There were 49 students who answered this question. The most positive comments were given to the quality and quantity of information and amount of links (especially quick links to Weboodi, Careerweb, student union's own website KY, and to the homepages of major subjects). *Current Affairs*–section at the first page and the visual image, especially lightness and colours, also received a lot of positive remarks.

If you could change three things at HSE website, what would those things be?
There were 58 students who listed their opinions on negative features of the HSE website. Students felt that the technical support should function even during the weekend, nowadays the HSE website is down too often during the weekends. The structure and navigation of the website received lots of negative comments; the HSE website is perceived as too complicated and there are too many menu areas. According to the responses the finding of the right information from the HSE website is very difficult.

If you want to you can comment on the research or this web-questionnaire.
There were 24 students who commented this question. In general students appreciated the fact that this study is being done. At the same time they were sceptical about the method and doubted that the questionnaire would not result in reliable information on usability.

Finally, I wanted to get an overview of the perception the students had on the HSE website and asked them to grade the website and their own major 's website using the normal Finnish school grades from 4 to 10.

Table 13: Student Grades for the HSE Website

	Average	**Standard deviation**
HSE website	6,12	1,34
Home site of own major	6,2	1,5

Both the HSE general website and the home pages of own major subjects got relatively low grades from the students.

5.3 Heuristic Evaluation

The area of heuristic evaluation was restricted to the three main sections of the HSE website since it would have been too time-consuming to go through all the website.

Heuristic evaluation and usability tests were chronologically the last methods that were used in studying the usability of the HSE website. Heuristic evaluation is typically the first method and the results of the evaluation are usually used in order to plan the usability test tasks. In our case, however, time was the constraining factor and methods that involved users, i.e. questionnaire, focus group meeting and partly usability tests had to be conducted when students were still at school i.e. before the end of the spring term.

Ideally, three to five experts should study the website on their own and then meet to bring their findings together in a form of an evaluation report. There were, however, only two evaluators in the case of the HSE website. Ms. Tarja Toikka, a graphical designer at Mosaic Productions and I studied the HSE website for nearly a month, from the end of May to the end of June. The fact that a person unfamiliar to the HSE conducted the evaluation contributed a lot to the study. She paid attention to things that I as a student of HSE was already used to, e.g. naming conventions and abbreviations. For a new user these terms are confusing but if you are a student at the HSE you will learn them gradually.

Two sets of heuristics were used in evaluating the site. The most common set of heuristics is Nielsen's list of ten heuristics. This list was presented in Chapter 4 and a long list of Nielsen's heuristics is attached in the Appendix 1. The preliminary findings based on Nielsen heuristics were delivered to the ISS faculty as well as to the marketing and communication department in July and a revised version of the report was delivered in August (Sunikka2003c). I do not go through that evaluation in this paper. Instead, I will present a slightly different report based on another set of heuristics. An Australian usability expert Gerry Gaffney and his company Information & Design compiled this list of heuristics. In this chapter I present the summary and the most important findings of the heuristic evaluation.

Below is the listing of Gaffney's heuristics, i.e. questions to be asked when evaluating a website.

1. Navigation

   Is there a clear indication of the current location, and are there clear navigational elements providing the ability to go to other parts of the application?

2. Functionality

   Is the required functionality available?

3. Control

   Is the user given control of the application?

4. Language

   Does the application use appropriate language for the audience?

5. Consistency

   Is the application internally consistent, and is it consistent with common practice and standards?

6. Visual clarity

Is the application visually appealing and uncluttered? Is the purpose of the various visual elements clear?

7. Help and support

Are clear instructions provided when needed?

8. Workflow support

Does the application support users in completing their tasks?

9. Error handling

Are errors avoided as much as possible? Where errors occur, are there clear explanations and useful instructions?

5.3.1 Results of Heuristic Evaluation

The results of the heuristic evaluation are presented following the web-writing conventions i.e. starting with a summary, followed by general recommendations and the detailed findings of the evaluation.

Summary

- The HSE website has a professional appearance and a pleasant visual image.
- There were only few links that ended up in a phrase "No articles are attached to this level".
- There is a lot of useful information to be found at the HSE website. There are, however several usability issues that have to addressed:

    1. Navigation is difficult. Users are not presented with a clear indication of their current location and it is easy to get lost in the HSE website.
    2. The *Search*-function is inadequate. Even typical search words do not return right results. *Person search* functions, but it is extremely slow. Because there is so much information on the site and the organization of the information is unclear, it would be crucial to have a well functioning search in the site.
    3. Information architecture follows the organizational chart and is not planned with user task flows in mind.
    4. A lot of important information is situated at the bottom of the site, e.g. *quick links*. Thus, the HSE website does not follow the web-convention "Place the most important items at the top of the site and indicate their importance with size and color".

Recommendations

I would recommend a major re-design of the information architecture in the HSE website, beginning from the first level navigation. It would be advisable to include promotional material and general information of the HSE in one place, maybe under *Corporate Co-operation*-section. At the moment promotional material and

general information are included in *Studying at HSE* and *Research and Teaching* -sections adding an "unnecessary" layer of information and making it more slowly to find the actual information students or personnel are looking for.

If the HSE is not willing to start a major restructuring of the site, smaller changes in the site could help the user to find information better. These recommendations are not in order of importance.

- Remove all unnecessary photos, think about the message that photos want to deliver and concentrate on using high-quality photos in right places.
- Explanations behind the link name (i.e. where the link is leading to) should be added.
- Quick set of instructions for new users should be added to the site. The instructions should emphasise the importance of *Quick links* and especially *Units* and *Subjects*-sections.
- *Search* should work better. If adding necessary keywords is enough I strongly suggest that all content providers are trained to add metadata including keywords to the material they want to post to the site.
- I recommend that usability testing will be carried out in the English language section, in library site and in different department and subject sites. Regular usability tests should be a part of the HSE website development project.

Detailed Findings

The following part contains detailed findings based on the heuristic evaluation checklist. A severity rating has been assigned to each issue.

The severity of a usability problem is a combination of three factors:

- The frequency with which the problem occurs: Is it common or rare?
- The impact of the problem if it occurs: Will it be easy or difficult for the users to overcome?
- The persistence of the problem: Is it a one-time problem that users can overcome once they know about it or will users repeatedly be bothered by the problem? (Nielsen, 1993)

Even though severity has several components, it is common to combine all aspects of severity in a single severity rating as an overall assessment of each usability problem in order to facilitate prioritizing and decision-making. According to Nielsen (1993) the following 0 to 4 rating scale can be used to rate the severity of usability problems (ibid.)

0 = I don't agree that this is a usability problem at all
1 = Cosmetic problem only: need not be fixed unless extra time is available on project
2 = Minor usability problem: fixing this should be given low priority
3 = Major usability problem: important to fix, so it should be given high priority
4 = Usability catastrophe: imperative to fix this before the product can be released

The heuristic list by Information & Design is divided into nine major issues. I only include the six first issues (navigation, functionality, control, language, consistency and visual clarity) in this paper. Help and support and error handling are handled quite well in the HSE website. Workflow support was difficult to evaluate since the user groups of the HSE are so diverse. I left this aspect of the HSE website usability to be studied in usability tests. In the following I go through the six usability heuristics stating the issue, a set of recommendations and severity of the issues. I present the results of the heuristic evaluation in table-format since I believe that presented this way the results are more understandable.

Navigation refers to the ability to find one's way with the web site. Navigation is particularly important on the Internet, since people easily get lost. It is also crucial to support navigation, especially in the commercial sites because of the ease with which customers can switch to a competitor site. This is, however, not the case with the HSE site and users tend to try longer to find a needed page since there is no direct substitute for the HSE website.

Table 14: Results of the Heuristic Evaluation – Navigation

Issue	Recommendation	Severity
Navigation		
The current location is not always clear.	The visual appearance of a chosen link should change when user is in that location (this already happens in some elements). Especially link bar in the left is not prominent enough.	3
When user clicks a link, it is unclear if the content opens up in the same or another window.	Consistency throughout the site is required.	2
Site map is hidden under quick link *Departments* that is situated at the bottom of the site.	Site map should be located at the top of the site and should be accessible from every page.	3
Site structure is very complicated. Division to three main parts of the site (*Studying at HSE, Research and Teaching, Corporate Co-operation*) is not enough to organize the information of the site properly. In addition, there are several other home pages in the HSE site but the user only sees the division into three parts. There are two sets of link lists at the top, two at the bottom, occasionally appearing link listing on the left and link lists under *Current Affairs* in every home page.	Attention should be paid into organizing information in such a way that it would support the user's task flows and would not lean too heavily on the organizational chart.	3 (4)
Search function is situated at the bottom of the site and it does not work properly.	*Search* should be situated at the top of the page. Special care should be attached to defining the key words and other meta data.	3 (4)

Functionality refers to the support of all the activities, which may be carried out on the site.

Table 15: Results of the Heuristic Evaluation - Functionality

Issue	Recommendation	Severity
Functionality		
Such functions as *search, person search* and *feedback* are clearly labelled. They are, however, situated at the bottom of the page. Especially with smaller screens the user will have to scroll in order to access the bottom link lists.	Users are probably used so far in finding all the functions at the bottom of the page. In order to make it easier for new users to find these services, colour, size or different fonts should be used to increase their prominence.	2

Users should feel that they are always in **control** of the interaction.

Table 16: Results of the Heuristic Evaluation - Control

Issue	Recommendation	Severity
Control		
Site is often down during the weekend.	Attention should be paid to technical functioning of the site during weekends.	3
The site does not support the user's workflow. The site has been planned with the organizational chart in mind. E.g. if a student wants to find out the e-mail address and reception hour of a lecturer, he/she does not find that information from the electronic personnel card of the lecturer. In addition, information on courses appears in several places.	Organizing the information in one place would make finding information easier.	3
Person search and *site map* are very slow pages to download.		3

It is important to speak the **language** of the user in order to prevent confusion and frustration.

Table 17: Results of the Heuristic Evaluation - Language

Issue	Recommendation	Severity
Language		
The language is not simple enough. Naming of the navigation links is not always clear neither in the three major parts of the site nor in the home pages of different subjects. In addition, there is too much noise that distracts the user from finding the important information. Furthermore, text is not short enough to allow easy browsing.	Clear naming conventions, information under proper headings, shorter texts and more subheadings and lists. No "marketing texts" under *Studying at HSE*- section. Clear rules from where to find course information. Preferably all the information should be located at the same place or at least links to vital information should be provided.	3
Jargon is not avoided. Used language is OK for HSE students and personnel since they know what e.g. Weboodi or career web mean. In order to find information, the knowledge of HSE division of departments and subjects is a must (e.g. in order to find experts, the user has	It is OK to use HSE specific jargon since the site is aimed at HSE students and personnel. There should, however, be clear instructions as to what the jargon means in plain Finnish. More attention should be paid on how to	3

to know the structure of the school, under which department and under which subjects the expert works). The site has been planned with the organizational chart in mind and it is noticeable in the naming conventions.	organize the information in the site.	

Both language and visual cues have to be **internally consistent** and consistent with general practice, so that customers do not have to learn any new techniques in order to use the site successfully.

Table 18: Results of the Heuristic Evaluation – Consistency

Issue	Recommendation	Severity
Consistency		
More that one term is used to describe some item. E.g. M.Sc. diploma (link on the HSE front page), How to become a M.Sc. student and M.Sc. (links under student venue) all end up in the same page. Under *Studying at HSE* and *Research and Teaching* there is so much information that the naming of the second level navigation is obscure.	Simpler structure and naming. Now the visual design controls the information architecture and it is difficult to add new issues into the site.	3
Links does not always match title of the pages to which they refer.	More attention should be paid into naming conventions.	2
Standard colours and location are only partly used for links. Under main venues links in the text are usually blue. Links in navigation bars are of normal font and thus difficult to identify as links. Especially sometimes appearing left side link bar is difficult to recognize as link bar since the links are of normal font	Important information should have more prominent status.	3

Visual clarity makes it easy for the user to read from the page since the layout is simple and clear and it is immediately obvious what the purpose of the different interface elements is-.

Table 19: Results of the Heuristic Evaluation – Visual Clarity

Issue	Recommendation	Severity
Visual clarity		
The layout is clear, calm and stylish.	All the possibilities of using colour to guide navigation have not been used.	0
Uninformative and low quality pictures in the website.	The usage of photos should be considered again because photos can distract the user from the information they are seeking. Big pictures should be resized to fit the half window size of the *Current Affairs*- section	2
Occasionally there is too much white space. Especially pages with only one sentence e.g. "Click hear to go to the...." are annoying	These pages should be removed so that the information seeker would reach the information without unnecessary side-steps	2

5.4 Usability Testing

In this section the process of conducting usability tests is described and the results presented. Usability tests were conducted between 15 May and 17 June, 2003 in the media laboratory of the HSE. Test users were recruited in two ways:

- Personnel: Dr. Bragge sent invitations to ten selected members of personnel inviting them to take part in the tests at the times convenient for them. Five of those who were invited contacted me. I succeeded in arranging the usability test with four of them. There were three lecturers and an assistant among the test users but there were no representation from the administrative personnel.
- Students: Most of the students contacted me on the basis of a report describing the results of the web-questionnaire that was posted in the HSE website in April, 2003. Six students attended the usability tests.

The usability tests followed the below-listed agenda:

1. A brief introduction to the usability study of the HSE website
2. Background questions and beginning interview
3. Test tasks
4. Finishing interview

1. Introduction to the usability study of the HSE website

I described the HSE website usability evaluation in general and explained different methods that had been used in the study. I asked test users to sign the consent of videotaping the test. I emphasised the fact that it is the site that is being tested and not the user.

2. Background questions and interview

In order to compare the test users to those students who filled the web-questionnaire and those personnel members that took part in the focus group meeting, I asked the test users similar background questions that were used in the previous methods.

Table 20: Usability Test - Background Questions

Question	Answer
How many years have you studied? (Students only)	Answers ranged from1 to 6 years.
What is your main subject? (Students only)	ISS (three), logistics, international operations, not chosen yet.
In which department do you work? (Personnel only)	Economics, accounting, languages and communication, Centre for Innovative Education
How old are you?	Ages ranged from 24 to 51
How often do you use Internet?	Daily
What is the Internet connection type of your computer and where do you access the HSE site most often?	Fixed line or broadband, half used the site from home, half from the HSE. One test user commented that he does not use the HSE site at all.

What is your browser like?	Latest versions of the Internet Explore (8), Netscape Navigator (4) Two students only used the Netscape browser.
For which purpose do you typically access the HSE site?	Students: course pages, library, Web Oodi, opening hours, Personnel: person search, contact information, updating own site

Compared to the students who filled the web-questionnaire the test users were older and there were more Netscape-users. In addition, the students participating in the usability test were knowledgeable about usability. When the focus group participants and the personnel test users were compared, the two groups did not differ from each other considerably. The main difference was that there was no representation form the administrative personnel in the usability test.

3. Test tasks

It was necessary to restrict the scope of the usability test tasks somehow and I used the same restriction criteria as in the heuristic evaluation: I concentrated on the main sections of the HSE website: *Studying at HSE, Research and Teaching* and *Corporate Co-operation*.

When configuring the tasks I had several sources of information: the feedback from the time when the site was introduced (in 2001), discussions with Dr. Rossi, Dr. Bragge and Ms. Ahvenainen, results of focus group meeting and the web-questionnaire.

I invented two user scenarios to bring realism to the tasks. In the first scenario the user was a marketing student who carried out typical information search tasks for students. In the other scenario the user was a lecturer from the ISS faculty and wanted to plan his/her lectures for the following autumn. I wanted both students and personnel to solve the same tasks. In that way I would gain an experienced and inexperienced view to the task in hand.

I carried out a pilot study where I had 16 tasks and thanks to the comments of the test user I reduced the number of tasks to twelve. Almost all of the students carried out the twelve tasks but the members of the personnel only solved 10 tasks. I tried to plan the test tasks as versatile as possible, including both difficult and easy tasks since I wanted the test users to succeed in tasks every now and then. I explained the task to the user and handed out the written question one by one so that the user would not forget the task. The shortest user test only took 35 minutes, the longest lasted over two hours.

In the following tasks, problems that were encountered when test users were solving the tasks and possible solutions to the problems are listed. Problems, possible solutions and ideal route to the source of information are presented in table-format to increase the readability of the results. The student scenario consists of test tasks one to seven and the test tasks from eight to twelve are included in the lecturer scenario.

<u>Student scenario</u>

Task 1: You are still trying to find a job for the summer. Search for a suitable job for a marketing student.

- Three students wrote career web after the HSE's main address. They succeeded in accomplishing the task in a couple of minutes. Those who had the most difficulties spent eight minutes solving this task.
- I had to hint to a couple of test users how to continue after they were stuck in the career website.

Issue: Navigation path and prominence of links	
Problem	Possible solution
Users had difficulties deciding whether to start in *Studying at HSE* or *Corporate Co-operation.*	
Users had difficulties deciding whether to click on *Career Services Centre* or *careerweb* links.	Add explanations on the contents of these sites.
Users got confused because they had to choose *Student Services* under *careerweb*-site, since they had already made that choice in *Career Services Centre*-site.	Users should only choose *Student Services* one time.
After users chose *Jobs,* link *Get a Job!* was not prominent enough. Many users spent quite a long time trying to figure out how to continue.	Link *Get a Job!* should be more noticeable (more colour, different font or different location).
The quick link bar is not noticeable enough. Only one user used *Units*-link to navigate to *careerweb*-site.	Use colour, different font etc to have the quick link bar to jump at users' eyes.
Search-function was not useful since Recruiting search word only returned links to other pages than Career Services Centre or careerweb.	Recruiting is a common search word and it should be possible to find the right page using this word.
Ideal route: >Units > Careerweb > Student Services > Get a Job! > Get a Job!	

Task 2: Despite your efforts you have not been successful in finding a summer job. You want, however, to spend the summer productively and plan to improve your accounting skills. Look for information on accounting courses in the open summer university program. Are there some places left for you to attend? How much do the courses cost?

- About half of the users either wrote open after the HSE's address or used search function successfully with search word open or used quick link *Units.*
- No major problems since the search functioned well.

Issue: Navigation outside of HSE main pages, use of search	
Problem	Possible solution
One user used Google-search engine since she did not trust the HSE search function.	Improve the search function.
One user used a long path to the open university site (> *Studying at HSE* > *Teaching* > *Teaching at the HSE* > *Summer studies* > *Open University*) She wondered link name Teaching at the HSE. Is not the whole site about studies in the HSE? She also wondered about the link called *Summer studies*, is the link name going to change in the autumn, and	The naming convention of links is rather confusing, the user gets no clear picture what to expect under e.g. *Degrees and Programs* . The first layer is pretty clear but after that things get really confusing. Some of the items seem to be in wrong places. Information architecture should be redesigned.

again in the fall since Open university provides teaching during the whole year?	
None of the test users used the path *(> Studying at HSE > Degrees and Programs > Open university)* because Open university was not perceived as a degree or a program	The link naming conventions and information grouping should be thought again.
Open university site worked well. The only complaint was that the information on 50% reduction on course prices should appear on the course page as well.	Include the discount information on every course page even though it is in the first page.
Ideal route: >Units > Open University	

Task 3. You did not get to the accounting course either. You do not get depressed but decide to start studying accounting in the fall term. Look for information on the obligatory intermediate accounting courses.

- Only students were given this task. Most of the students turned to pdf-format Study Guide to find information on obligatory courses.
- No major problems since the students knew that the information could be found in the Study Guide.

Issue: Use of Study Guide (pdf) or department site	
Problem	Possible solution
Test users had to make the first choice by deciding whether to choose *Studying at HSE* or *Research and Teaching*. Most of the users chose *Studying at HSE* and Study Guide. It is time consuming trying to find information in a pdf-format.	Ideal solution would be to have all course information gathered in one place. If pdf-format is used, finding information should be made easier (hyperlinks inside pdf-file).
Only one user used the long but logical path to find the information in the department site (> *Studying at HSE > Teaching > Deparments and Subjects > Department of Accounting > Accounting > Teaching > Courses*).	The quick link bar should be made more prominent. If users choose *Subjects quick link*, the navigation path is halved.
Users said that since all subjects have their own ways of arranging information in their home page, it is difficult to find the required information from there.	At least the top navigation should be similar in all subjects and the naming convention should be common throughout the school.
Ideal route: > Departments > Accounting > Teaching > Courses	

Task 4. Your foreign friend wants to know what subjects one can study at the HSE. Your task is to find information on all the departments and subjects that can be studied in the HSE

- Finding subjects was not difficult *(Departments* quick link) but finding departments was trickier since there were more paths than one to choose from.
- No major problems because the information was organized under right headings.

Issue: Navigation to the basic information about the HSE	
Problem	Possible solution
The students normally do not realize the difference between subjects and departments and do not	Information architecture redesign.

necessary know which subjects belong under which department. The site has been built according to the organizational structure and if the user does not understand it, quick information retrieval is difficult.	
Test users had to make the first choice by deciding whether to choose *Studying at HSE* or *Researach and Teaching*. Those who chose the route > *Studying at HSE > Teaching > Departments and Subjects* wondered about the appearance of the site.	The left link list and the content page both consist of the names of departments. User has to click on every link in order to find out the subjects that can be studied under different departments. The information on departments and subjects should be visible at a glance.
Those users who chose route > *Research and Teaching > Departments* got the information on departments and subjects at a glance.	The picture was unnecessary in this page, it only made the already long page even longer. The picture should be removed.
Ideal route: > Research and Teaching > Departments	

Task 5. A friend of yours has a B.Sc. (Econ.) from Mikkeli and he would like to continue his studies to a M.Sc.(Econ.) in HSE. He has heard that there is an English language Master's Program in Information and Service Management (ISM) in HSE. Your friend is at his summer cottage without Internet connection and would like to learn immediately how and when to apply to the ISM-program. From where would you start to search information on the ISM-program?

- Most of the users used the search function.
- No major problems since the search functioned well.

Issue: Navigation to subject's site, use of search	
Problem	Possible solution
Search functioned well with the abbreviation (ISM) but returned no results with the whole name of the program.	Search should function better.
Some of the users do not understand what Show in the site (*Näytä sivustolla)* means.	Label should be clearer.
In the ISS site there is only a text "Englanninkielisen tieto- ja palvelutalouden maisteriohjelman kotisivut ovat täällä".	There could be a short introduction to the ISM program in Finnish.
This same page can be reached by clicking at M.Sc. Programs (*Maisteriohjelma)* link. The "normal" ISS-program is also a master's program, confusion about terms.	Instead of *Maisteriohjelma* there should be either the English or Finnish name of ISM-program as a link.
The information on applying is easy to find. The visual image of the site is different.	Font should be the same as in the other pages.
Ideal route: > Departments > ISS > Teaching > M.Sc. Program	

Task 6. You have studied management as your minor subject. For some reason, you have not done the first obligatory course Business and Strategy. You would like to compensate this course with your other studies and would like to talk to the lecturer personally. Look for the contact information and reception hours of Dr. Päivi Eriksson who works as a professor at the Department of Management

- Most of the users started to look for information from the *person search*. Only a couple of experienced users knew that the information on reception hours can be found under the main

sections of the HSE website. Test users tended to start searching the information under the subject site.

- Two users did not find the reception hour information at all. For some users it took over 10 minutes to find the information. Many users commented that in reality they would have sent e-mail and asked for the information.

Issue: Navigation to the basic information, use of person search	
Problem	Possible solution
Only one user did not recognize the name as a link to the electronic personnel card.	
Reception hour information could not be found in personnel card.	Information should be there or at least a link to the place where this information can be found.
It was difficult to find reception hour information in the department of management website since it was not there where it should logically be, under Personnel (*Henkilöstö)*	This kind of information should be found under same logical headings in every subject and department.
Only experienced users knew that reception hour information can be found under *Studying at HSE* and *Research and Teaching* main sections.	Vital information to students should be collected in one place.
Ideal route: >Studying at HSE > Teaching > Reception hours > Organization and Management	

Task 7: Look for tomorrow's menu in Rafla (only students were given this task)

- All the students knew that this information can be found in the student union's website (KY) and in weekly student magazine (Punakulma). Most of the students used search to reach the information.
- This was a relatively easy task.

Issue: Navigation to support information	
Problem	Possible solution
Search word menu/s (ruokalista/t) returned no results.	The search should function better.
Ideal route: >Studying at HSE > Studying at HSE services> Other services> Menus	

Lecturer scenario

Task 8: You want to know which research issues the Centre for Knowledge and Innovation Research Institute (CKIR) studies. Where do you find the information in HSE website?

- Half of the test users used search engine to find CKIR, others used quick link *Units.*
- This was an easy task since the search functioned well.

Issue: Navigation outside of HSE main pages, use of search	
Problem	Possible solution
Search with the official name of the institute, Centre	The search should function better.

for Knowledge and Innovation Research Institute returned no results.	
Ideal route: > Units > CKIR	

Task 9: You want to plan for Fall 2003 lectures. You remember that a seminar series called *Liiketoimintaosaamisen tulevaisuus FOORUMI 2002* aimed at corporate management and researchers was organized in fall 2002. You do not quite remember what the issues of the seminars were. Where do you find information on events, especially past events?

- Most of the users started searching under *Events* since I used word Event in my question. The next logical places to search for information were *Corporate Co-operation* and *Communications* quick link.
- I helped four test users by hinting that search could be useful. I offered no help to one test user and he did not find the information. This was one of the most difficult tasks.

Issue: Navigation to past events arranged by the HSE, use of search	
Problem	Possible solution
Search with the official name of the event *Liiketoimintaosaamisen tulevaisuus FOORUMI 2002* returned no results. Foorumi and liiketoimintaosaamisen were the search words that took users to the right place.	The search should function better.
There was no indication of past events under *Events* quick link	An archive of past events should be found somewhere (maybe a link from *Events).*
In *Current Affairs*-section under Marketing and Communications there were all the past news stored.	A date in the link name would help the user in searching for the right news. Large sized photos should be removed from the HSE stories since they force users to scroll horizontally and quick browsing of the news does not succeed.
Clicking on *Units (Yksiköt)* quick link was the fastest way to the information, however FOORUMI 2002 is not a unit.	Naming and information architecture should be more self-evident.
Ideal route: > *Units* > *Liiketoimintaosaamisen tulevaisuus FOORUMI 2002* (at some time in June this link was removed and the only way to find information on 2002 foorumi was to use the search)	

Task 10: You would like to have a lecturer from the faculty of finance who has specialized in investor psychology to lecture in your lecture series. Where would you look for HSE researchers?

- Many users commented that they remember seeing the information somewhere. Five users navigated to the finance faculty site but to get the information would have meant clicking on all the names of the faculty members. Search gave no results.
- I helped three test users by showing where to find information on researchers. This was one of the most difficult tasks and it is incredible since researchers and research areas are the first things outsiders are interested in when they enter the HSE site.

Issue: Navigation to critical information of the HSE, use of search	
Problem	Possible solution

Search with the word investor psychology (sijoittajapsykologia) returned no results.	The search should function better.
The information was in two places, under *Corporate Co-operation* and *Research and Teaching*	The link Experts by Research and teaching fields *(Asiantuntijat opetus- ja tutkimusaloittain)* is not prominent enough. This link is situated under the second navigation level or in the quick link bar. The second level navigation does not change its appearance when chosen, the link name is too long, the location of links is arbitrary in the menu bar etc. All these attributes should be changed for the user to realize where he/she is situated. The information hierarchy of the HSE website is so deep that second level navigation is often used, hence users face this problem often.
The link *Experts by Departments (Asiantuntijat opetus- ja tutkimusaloittain)* is not prominent enough.	The big and colourful picture draw user's attention away from the second level navigation. This picture should be removed!
Ideal route: > Research and Teaching > Tutkimus ja opetuslaitokset > Experts by Research and teaching fields (Asiantuntijat opetus- ja tutkimusaloittain) > Department of Accounting > Faculty of Finance	

Task 11: You would like to cooperate more closely with the Technology Management and Policy lecturer who lecturers the course Topics in Technology Management II: Finance of Innovation. Who is the lecturer of the course and where can you find information on the content of the course?

- Two users used quick link *Departments,* others navigated to from main section *Studying at HSE.*
- I helped four test users by telling them under which department the subject Technology Management and Policy is situated.

Issue: Navigation to a subject site	
Problem	Possible solution
The visual layout of the site is different than in the rest of the HSE site (fonts, logo, colours).	The site should follow the HSE image.
The information on the lecturer and practical information on the course were easy to find, but the content of the course was only available in the Study Guide (pdf)	There should be a centralized database where all the information on the courses would be stored. A pdf-file is not an easy way to find information, instead, hypertext should be used.
The content of the course is not available where the rest of the information is and there was no short way to the course home page.	Standardization of course names should take place so that when a student knows the code of the course he/she can type it behind the HSE web address and gain immediate access to the course home site.
Ideal route: > Departments > Technology Management and Policy > Studies	

Task 12: You would like to co-operate with some companies as part of your lectures. Which companies are the partner companies of the HSE?

- Almost all test users used the logical and short path > *Corporate Co-operation* > *Partnership* > *Partners*. I deliberately had this task at the end since I wanted to end the test with a feeling of success.
- This task was by far the easiest task.

Issue: Navigation to company co-operation site	
Problem	Possible solution
There was no usability problem. Comment: "This is how easy it should be"	
Ideal route: > Corporate Co-operation > Partnership > Partners	

4. Finishing Interview

The test situation had been stressful for both the test user and the evaluator. Even though I told at the beginning of the test that I am testing the site and not the person, some test users took failures in test tasks personally. I asked the following questions in the finishing interview:

How do you feel? Were test tasks too difficult or too easy? Were there some other pages you feel strongly about and would have liked to tell your comments about?
Most of the test users said that the test had been after all an interesting experience. A couple of test users were very frustrated because they thought that the site functioned really poorly.

What is good in the site and should be preserved?
Visual image is calm and elegant, font size should, however, be resizable. Personnel representatives liked the *Current Affairs* in the front page, dissertation list and *person search* (even though it is slow). All test users agreed that there is a lot of useful information in the HSE website "You just have to know the constraining factors of how to use the site in order to be able to find your way to the information".

What would you like to change in the site?
It is too difficult to find information and the route to course home pages requires too many clicks. There are too many navigation bars in various locations in the site. In an information abundant site the search should function well but it does not do that in the HSE website. Researchers and research areas should be easier to find.

Personnel and students felt differently about the standardization of the site, students wanted all the subjects and departments to have similar information architecture and structure, personnel preferred to have autonomy when deciding on where to locate information and under which heading.

After usability tests I asked six test users (out of ten) to comment the same statement questions that were used in the web-questionnaire. Below are the results of both web-questionnaire and test users. Number 1 indicates total disagreement and 5 total agreement with the statement. Based on the feedback gained from the web-questionnaire I divided the question about the content of the HSE website into two questions: "The content of the HSE site is clear" and "The content of the HSE site is useful" .The students who filled the web-questionnaire felt that the question asked opinions on two separate issues, clarity of the contents and usefulness of the contents.

Table 21: Results of the statement questions

Statement	Web questionnaire (67 respondents)	Test users (6 respondents)
Downloading of HSE pages is quick enough.	3,69	4
The content of the HSE site is useful.	2,38	4
The visual image reflects the image of the HSE.	2,97	3,83
I easily find the information I need at the HSE site.	1,84	3
It is easy to use the HSE website.	2,25	2,83
There are too few pictures and graphics at the HSE website.	2,51	2,67
I always know where I am when I surf at the HSE site.	1,97	2,5
The content of the HSE site is clear.	2,38	2,5
The contents of pages reflect well the heading of the story.	2,69	2

In general the test users reacted more positively to the statements that the students who filled the web-questionnaire. The personnel representatives were less critical than students in grading the statements. The biggest difference in opinions is in the statement "I easily find the information I need at the HSE site". The results of the questions about content cannot be compared since I divided the web-questionnaire question into two questions for the test users.

In addition, I asked the test users to grade the HSE website and the site of their own major subject. Test users gave considerably better grades for both HSE site and own subject's site than the students who filled the web-questionnaire.

Table 22: Usability test participant's grades to the HSE website

	Web questionnaire (67 respondents)	Test users
HSE web site	6,12	7 (8 respondents)
Home site of own major	6,2	7,5 (7 respondents)

At the end of the interview I thanked the test users and gave them a coupon for getting a new HSE t-shirt form the Marketing and Communication department.

5.4.1 Analysis of the Data

Usability test data could be analyzed quantitatively. In that case the measures are (Karat, 1994):

- time to accomplish the task
- time to accomplish the task at first attempt
- % of objectives reached
- % of tasks accomplished correctly
- % of tasks accomplished correctly at first attempt
- finished tasks/time

- time to correct the mistakes
- amount of mistakes that the system corrected
- average accuracy
- use of manuals, reference guides etc.
- number of complaints
- number of satisfied users

In deciding how to analyze the data from the HSE usability tests, I used the example of the MIT Library that has been studying usability of their web-services since 1999. The first MIT usability tests were analysed quantitatively, but soon the usability team realized that the emphasis should be on more frequent, less formal tests that would focus on finding and fixing specific usability problems. It is stated in the MIT Library usability test site: "The qualitative information is much more valuable than the quantitative information when studying usability issues". (MIT Library usability test site)

Hence, I concentrated on the behaviour of test users, since behaviour reflects the mental models of users. Since I asked the test users to vocalize their opinions, a talkative person might have used 6 minutes in a task, since he/she commented on fonts, pictures, colours, contents, naming of links etc. Another person might have used the same 6 minutes just to finish the task. That is why the time to accomplish a task is not necessarily a good measure. I have, however, commented if a task took an unexceptionally long time and it was clearly frustrating to the test user.

I also analysed the data gathered with respect to the five usability components of Nielsen: memorability, learnability, effective use, error prevention and subjective satisfaction. It was hard to plan questions that would measure these attributes directly so I decided to analyze how the HSE website reaches these attributes based on the results of all the usability methods used in the study. I then drew my subjective conclusions about how the HSE websites reaches these usability attributes. I briefly comment on attributes next:

- *Memorability* – The site is not designed so that it would be easy to remember where a certain piece of information is located. Comments like "I know that I have seen it somewhere here in the website but I just cannot remember where" indicate poor memorability in the HSE website.
- *Learnability* – Since users who had used the site for over two years had not been aware of e.g. quick links, it is reasonable to say that the HSE website is not an easy site to learn.
- *Effective use* – There are some aids to help an experienced user to accomplish tasks more quickly, e.g. quick links and writing the name of e.g. unit or course after the HSE website URL address.
- *Error prevention* – There are not many places that cause error text to appear (mainly services that require registration). Since clicking on a wrong link and ending up in a different page that the user meant is perceived as an error by the user, there are abundant amount of these errors in the HSE website.
- *Subjective satisfaction* – Grades that both students who filled the web questionnaire and test users gave, were fairly low. Apparently these stakeholders are not very satisfied with the HSE site.

5.5 Comparing the Usability Methods

When comparing what kind of information was collected by different methods, it can be said that the web questionnaire is not the best method. However, it is a great method of collecting background information (especially technical information on equipment that students have at their disposal). Students who enjoyed the anonymity were very frank with their opinions. A lot of feedback was given to the fact that the HSE website does not function well, especially on weekends. None of the personnel commented on this issue either in the focus group meeting or in the usability test. Open comments concentrated on the same issues as the results of the other usability methods in the study: unclear structure and navigation made finding information unnecessarily difficult in the HSE website.

The web-questionnaire was planned deliberately to be so easy and short that it would only take a maximum of ten minutes to fill. Some of the questions in the web-questionnaire should have been reformulated since they were not clear enough. That just proves how important it would be to have many people test-read the questionnaire. I had four people proof-reading my version of the web-questionnaire and I did a lot of corrections to the form. Still, there were some unclear statement questions left.

The focus group meeting supported by a GroupSystems provided personnel with anonymity and the comments were much more frank than the comments from their colleagues who attended the usability tests. Participants of the focus group emphasised the fact that the website was designed with the organizational chart in mind. Another question that they drew attention to was the lack of discipline in updating the site. As Susanna Suckensdorff from PHS Interactive commented in an interview: "When a lot of people share the responsibility of providing content to the website, it has to be absolutely clear what the rules of the game are; who is allowed to update the site, what the structure of the site is, when and how often updating will occur etc., otherwise the site is a mess only a couple of months after the launch of the website." (Suckensdorff, 2003)

It seems that the lack of discipline in updating the site has lead to sections of the HSE website that differ vastly from each other making it extremely difficult for users to understand the logic and structure of the site. The focus group provided information on more detailed issues than web-questionnaire since there was time to ask more questions. The meeting could have taken place online as well, since there was not much discussion in the meeting. I found it hard to conduct discussion and respect the anonymity of the respondents at the same time. The focus group meeting should have been planned more carefully as well. But all in all, using a computer supported group system was an interesting experience.

Many inconsistencies were found when the HSE website was gone through systematically by evaluators with the help of a heuristics list. An outsider to the HSE website conducted the heuristic evaluation, which was extremely good. An outsider paid attention to e.g. the ambiguous naming conventions in the menu bars.

Another major discovery was that even though the HSE website seemed to follow web-conventions, the implementation differed from the "normal" way of doing things in the Internet.

Results of usability tests did not differ a lot on the basis of the respondent (whether the user was a student or represented personnel). Even though the users did as well or as badly in the test tasks, the personnel members still had more positive reactions towards the HSE website and they gave better grades to the HSE website and to their department website. Since there were no major differences between the two groups, the same results could have been reached with less test users. Hence, the last usability tests resembled more discussions than usability tests since I tried to find out the reasons why the user did not search the information the way the designer of the HSE website had thought.

5.5.1 Validity of Usability Testing

Dr. Deborah J. Mayhew (Mayhew, 2003) emphasised the following issues when figuring out whether the usability test can be said to be valid:

1. Sampling
2. Test task design
3. Conducting the test
4. Capturing the data
5. Interpreting the data

I will go through the conduct of the usability test with the abovementioned issues in mind.

1. Sampling of test users

The group that participated in the study consisted of two subgroups, students and personnel. Since statistical significance is required to establish scientific truths and usability tests are not scientific truths, the sample of ten people seemed adequate. There could have been more members of personnel but they were not interested in or did not have the time to participate in tests.

There is some doubt whether the sample group was truly representative of the student user population. There were four Information systems science majors who had a fairly extensive knowledge of usability. It might be that they were more experienced users than an average user of HSE website is.

2. Test task design

Background information was gathered from both students and personnel in order to find out how users used the HSE website and what they hoped from the website. The results from the web-questionnaire and the focus group meeting provided material for test scenarios and tasks.

With hindsight some of the test task wording referred too directly to the user interface elements or the terminology either guided the user into the right direction or gave wrong hints of the direction to move to. More attention should have paid to the phrasing of the test tasks.

3. Conducting the test

During the first couple of tests I did not help the test users at all and the result was that around 20% of the test tasks could not be solved successfully. I later started to hint to the test users to what direction they should continue in order to find the solution because I wanted to talk with test users why they were not able to solve the task right away. I might have been too interactive for an ideal usability test situation. On the other hand, since I aimed at gathering preference data rather than performance data, the interactive mode might have been appropriate.

4. Capturing the data

The tests were videotaped and I had the set of questions in front of me when the test user was solving the tasks. I noticed, however, that a more detailed data collection sheet would have been useful since watching the tasks from the videotapes was very time-consuming. It would have been helpful to have some of the information already noted down while watching the videotapes.

5. Interpreting the data

According to Dr. Mayhew (Mayhew, 2003) interpreting test data correctly and effectively requires an understanding of human perception and cognition and a lot of design and testing experience. I have studied education sciences but I cannot brag with vast design and testing experience. It might be that a more experienced evaluator had interpreted the data somewhat differently.

6 Summary and Conclusions

The use of Internet is nowadays a part of everyday life for a large group of people in the developed countries. Internet can be used e.g. for searching for information on diverse subjects and for entertainment purposes. Since "everybody" is in the Internet nowadays more attention has to be paid to how usable the websites or web services are. It is not enough to design for "propeller heads" that have interest in learning new systems because they are interested in technique and computers. The users are becoming more demanding and they know that there is a substitute not too far away.

User-centred design increases usability of systems since users, users' tasks, task flows etc. are taken into account from the start of the information system development projects. Iterative design is build into the user-centred design "forcing" the project team to test system's usability regularly. The methods for usability evaluation can either involve users (user testing), or can be done with the help of usability experts (usability inspection). There are automated methods of evaluating usability but they were outside the scope of this study. Since different usability methods reveal different usability problems, the best result is achieved if both user testing and usability inspection are employed.

Usability evaluation is accused of being expensive and time-consuming and still not ending up with systems that would satisfy everybody. Some information system designers are confident that they know the system's users and that is why no formal usability methods are needed. There are also some usability experts that doubt if the "rules" on which the usability methods are built on are really valid. As was discussed in chapter three, some experts are doubtful if usability testing conducted with as few users as five to eight can reach valid results. In addition, general usability heuristics are held for too generic and according to some experts heuristic list should always be modified to suit the case in question. However, even though only some, and not all, of usability problems were found by using five test users the software is still considerably better compared to the situation that no usability evaluation had been carried out. After all, every product, software and website undergoes usability testing. Unfortunately in many cases this happens when the system is in production and then the failure is at costliest.

The main emphasis of this study was not on the user-centred design but on definitions of usability, usability methods and the issues that have to be taken into account when designing for the Web. The case example for the usability evaluation was the Helsinki School of Economics website. The redesigned HSE website was launched in autumn 2001. User-centred design principles were practised, at least to some extent, since a large number of HSE personnel was asked e.g. their opinions on the purpose of the HSE website and what information the HSE website should include. However, the end-result of the design process, the HSE website, is not optimal.

The main research question was to find out if the HSE website users – personnel and students – find the website usable. The short answer to the questions is no. We only have to look at the measure of the subjective satisfaction, the grades that the students and the members of personnel gave to the HSE website

either in the web-questionnaire or during the usability testing. The average grade for the HSE website was 6,2 and to the website of the own major 6,15 in the web-questionnaire. The test users liked the HSE website better than those students who filled the web-questionnaire, and especially the personnel members gave higher grades to the HSE website. The average grade for the HSE website was 7 and to the website of the own major 7,5. These are not grades for a usable website.

Another research question was to find out if the two main user groups of the HSE website felt the same way about the website. Student opinions were gathered by web-questionnaire and usability tests. There were 67 students who filled the web-questionnaire. One of the main causes for criticism in the web-questionnaire was actually not a usability problem at all but a functionality problem: the HSE website does not work during many weekends. Other reasons for annoyance were: complex structure, difficult and time-consuming information retrieval from the site, incoherent navigation, and lack of a proper search function. Most of the students felt that the visual image was pleasing and there was a lot of useful information in the website. The student test users commented the site even more critically during the usability testing. Most of the six student test users already had some or even comprehensive knowledge on usability and they commented many things about information architecture, navigation and visual elements.

The personnel members' opinions were gathered in the focus group meeting and during the usability testing. In the focus group meeting the nine personnel representatives appreciated the quality and quantity of information in the HSE website and found that course home pages were useful. The aspects that were criticized the most were the structure, navigation and the lack of discipline in updating the pages. The four personnel members that took part in the usability testing were not as critical as the focus group participants. They also emphasised the need for academic freedom when designing the homepages of different subjects and departments.

In summary, there were no major differences in the students' or personnel members' perceptions on the HSE website. However, personnel members did not complain about the non-functioning HSE website during the weekends whereas that was an issue that was mentioned many times by students, especially in the web-questionnaire. Should we draw the conclusion that students search for information from the HSE website also during the weekends whereas personnel members either do not work during the weekends or their work does not include searching for or updating information in the website?

The third research question looked for an answer to the question whether different usability methods end up with different results. The purpose of using different methods varied, so naturally, the data gathered varied as well. Web-questionnaire provided useful background information on students as well as some very frank comments about the HSE website. Apparently the possibility to answer anonymously prompted frank comments about "the rotten state of the HSE website". In the focus group meeting the biggest usability problems were found but there was no detailed analysis of the usability of the HSE website. Another objective of focus group was to collect similar background information on the members of personnel that was

gathered from students through the web-questionnaire. Compared to representatives of personnel that took part in the usability tests, focus group participants gave more frank comments about the HSE website.

The heuristic or expert evaluation was not a typical evaluation since I am not an expert evaluator. However, I believe that length of time during which I and the other evaluator studied the HSE website compensates for the lack of expertise in the usability issues. I believe that most of the serious usability problems were found along with a lot of minor usability problems.

The usability test resulted in the richest information on the user-experience. During the course of a test, many pages were visited, a lot of big and small usability issues were recognized and, what is most important, the reasons for users' behaviour were gathered. Nothing is more convincing than to observe a user after a user the same problems repeating. After having followed users stumble at same places the observer can be sure that he/she has just identified a usability problem.

There is a lot of useful information for students, would-be students, corporate representatives, the HSE personnel and the academic community at large in the HSE website. However, in order to serve all it's user groups better, the HSE website should face several corrections. There are some things that can be corrected quickly and some of the corrections have already taken place (e.g. including an icon that takes to the venue home page from the various sites). Then there are issues that take more time and planning to improve, but they can be done at HSE and the cost accrued will not be large (e.g. checking the necessity and appearance of all photos). The third group of improvements requires a lot of time and effort since it includes the major restructuring of the HSE website. If the present platform, with all its rigidity, is the platform that the HSE has to deal with, the HSE can improve the website experience mainly by rethinking the second level navigation again and removing unnecessary text from the website so that users would have shorter navigation path to the information. In addition, stricter discipline should be exercised in the updating of the site. I would also recommend continuing usability tests maybe as a part of some ISS course or as a project work during the Information Technology Program that takes place during summers. In my mind, usability should also be taught as a separate course at the HSE since usability is nowadays such an important factor in the software development projects.

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8 Appendices

Appendix 1: Ten Usability Heuristics

This list is modified from Jacob Nielsen's and Keith Instone's lists of heuristics. Example questions are added to the list. Even though heuristic evaluations are meant to be conducted by experts in usability, I nominated myself a novice usability expert and used this list when conducting the heuristic inspection of HSE website.

1. Visibility of system status
The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

Questions:
Is the service still working?
Has the service received my input?
What is going to happen next?
Where in the service am I right now?
Where can I go next?
Am I going to the direction I want to go to?

3. Match between system and the real world
The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.

Questions:
Are words and sentences easy to understand?
Are the concepts used in the same meaning as in the real life?
Do metaphors work logically?

3, User control and freedom
Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo-functions.

Questions:
Is it necessary to follow a mandatory and difficult navigation path in order to reach a certain page?
Is it easy to return to the homepage and other important pages?
Is it possible to change a faulty input (e.g. in a form) after sending the form?
Does the service open futile windows, prevent resizing the browser window or force the user to see videos or hear audio-files?

4. Consistency and standards
Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

Questions:
Are names, colors, icons, links etc. consistent throughout the site?
Are navigation bars and buttons in familiar places?
Do links, buttons and input fields look familiar (e.g. color and shape)?
Is the navigation style consistent throughout the service?
Are de jure standards of websites followed?

5. Error prevention

Even better than good error messages is a careful design, which prevents a problem from occurring in the first place.

Questions:
Do forms use form validation methods?
Can clear and helpful instructions be found In the case of problematic inputs?
Is there any guidance when a user has to input something or when he/she performs a function?

6. Recognition rather than recall
Make objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

Questions:
Are the most important functions visible so that their location does not have to be remembered on another page?
Are all user interface elements (e.g. text fields, interactive buttons) easily recognizable?
Are all user interface elements situated so that their independence and relationship to the other elements in the screen is clear?
Can the user move forward from page to page without having to remember by heart information he/she saw in previous pages?
Is the URL (Uniform Resource Locator) of the service and site easy to determine based on the content and provider of the service?

7. Flexibility and efficiency of use
Accelerators -- unseen by the novice user -- may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

Questions:
Are the most common functions always usable and visible?
Is it possible to change a complex site into a simpler mode?
Is it possible to scale the service for different screens, browsers, fonts, colors, computers, systems and connection speeds (bandwidths)?
Do frames interfere with linking, browsing and printing?
Is it easy to link to pages that are used the most often?
Is it easy to load dynamic pages (e.g. questionnaires)?
Are meta words used in the main page in order to improve hits from search engines?
Is there a simpler version from a complex user interface to a novice user?

8. Aesthetic and minimalist design
Dialogues should not contain information, which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

Questions:
Is there only a limited number of color hues, values or codes used in the site (approximately from 1 to 3)?
Is there only a limited number of font styles and sizes used (from 1 to 3)?
Is white space used to emphasise important elements?
Is the attention drawn to most important elements first?
Does an (or more) element dominate the whole page and its navigation too much?
Are texts short enough, of proper style and size to be read from the screen?

9. Help users recognize, diagnose, and recover from errors

Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.

Questions:
Are error messages understandable?
Is it clear from the error message what happened, why and how the situation can either be mended or avoided?
Are error messages polite and not blaming the user?
Is it easy to follow the help instructions?

10. Help and documentation
Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

Questions:
Is help provided automatically in difficult phases?
Are help instructions always available?
Are instructions and help based on a situation or a page?
Are instructions easy to understand and is it possible to follow the phases?
Are instructions short but divided into sensible parts?

Appendix 2: HKKK:n sivuston käytettävyystutkimus opiskelijoille

Tämä kyselylomake on osa HKKK:n sivuston käytettävyystutkimusta. Kyselylomakkeen tarkoituksena on kerätä taustatietoja HKKK:n sivuston käyttäjäkunnasta (kysymykset 1 - 9). Kysymykset 10 - 22 kokoavat opiskelijoiden mielipiteitä HKKK:n sivuista. Vastanneiden kesken arvotaan elokuvalippuja.
Voit vastata kysymyksiin nimettömänä. Jos haluat kuitenkin osallistua elokuvalippujen arvontaan, kirjoita sähköpostiosoitteesi kyselylomakkeen loppuun. Sähköpostisoitteesi erotetaan välittömästi vastauksistasi, eikä sitä voida käyttää vastaustietojen tunnistamiseen. Lopullisista tutkimustuloksista ei voida johtaa yksittäisen vastaajan tietoja. Lomakkeen täyttämisessä menee aikaa n. 5 - 10 min.
Kiitoksia tutkimukseen osallistumisesta!

1. Valitse, mihin ryhmään kuulut — 1. vuosikurssin opiskelija

2. Valitse pääaineesi valikosta. — ASP/Talousmaantiede

4. Kuinka usein käytät Internetiä? — Päivittäin

5. Mihin ikäryhmään kuulut? — 20 tai alle

6. Missä olet useimmiten, kun otat yhteyttä HKKK:n sivuille? — Kotona

7. Millainen on sen koneen Internet-yhteys, josta olet useimmiten yhteydessä HKKK:n sivuille? — Modeemiyhteys HKKK:n soittosarjaan

8. Mikä on sen koneen selaintyyppi, josta olet useimmiten yhteydessä HKKK:n sivuille? — Internet Explorer 3 tai 4

9. Minkä vuoksi tulet useimmiten HKKK:n sivuille? Jos et löydä vierailusi syytä valikosta, kirjoita se oheiseen kenttään. — Hakemaan kurssimateriaalia.

Valitse, oletko samaa vai eri mieltä kuin seuraavissa väittämissä.	täysin eri mieltä	eri mieltä	neutraali	samaa mieltä	täysin samaa mieltä
10. HKKK:n sivuja on helppo käyttää.	☐	☐	☐	☐	☐
11. Tiedän aina, missä olen, kun selailen HKKK:n sivuja.	☐	☐	☐	☐	☐
12. HKKK:n sivustolla on liian vähän kuvia ja grafiikkaa.	☐	☐	☐	☐	☐
13. HKKK:n sivujen sisältö vastaa hyvin otsikkoa.	☐	☐	☐	☐	☐
14. HKKK:n sivut latautuvat käyttämälleni koneelle riittävän nopeasti.	☐	☐	☐	☐	☐
15. HKKK:n sivuston sisältö on selkeä ja hyödyllinen.	☐	☐	☐	☐	☐
16. Löydän tarvitsemani tiedot helposti HKKK:n sivuilta.	☐	☐	☐	☐	☐
17. HKKK:n sivuston graafinen ilme	☐	☐	☐	☐	☐

vastaa koulun imagoa.

18. Mikä HKKK:n sivustolla on hyvää ja ehdottomasti säilytettävän arvoista?

19.Jos voisit muuttaa kolmea asiaa HKKK:n sivustolla, mitkä nämä asiat olisivat?

20. Voit antaa halutessasi palautetta tästä lomakkeesta tai käytettävyystutkimuksesta.

21. Minkä kouluarvosanan annat HKKK:n sivustolle?

4

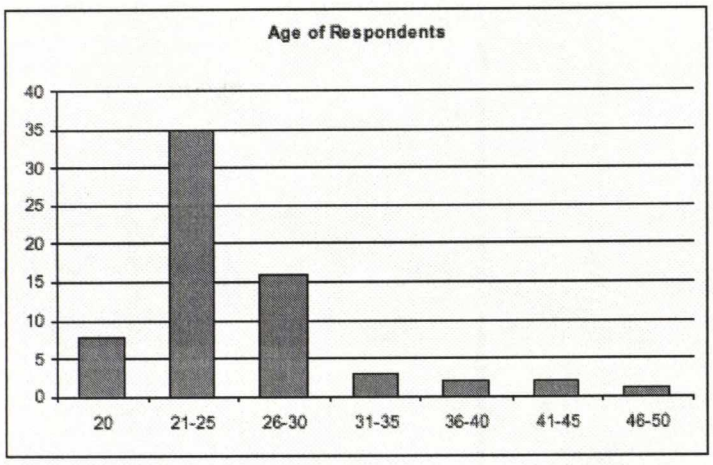
22. Minkä kouluarvosanan annat oman pääaineesi sivuille?

4

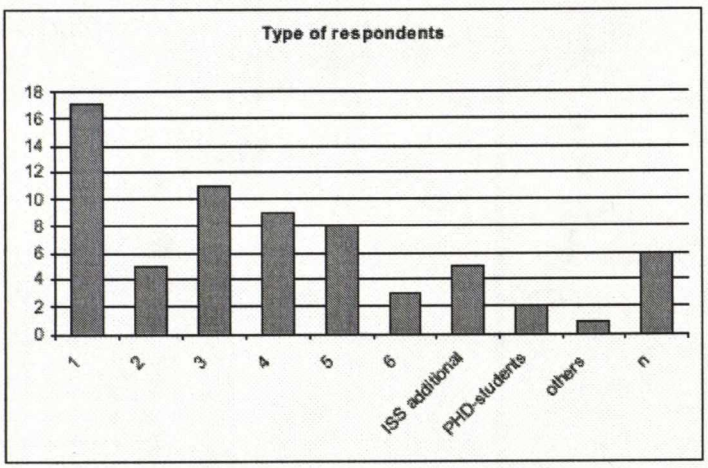
Jos haluat osallistua elokuvalippujen arvontaan, kirjoita sähköpostiosoitteesi tekstikenttään.

Appendix 3: Results of the background questions of the web-questionnaire

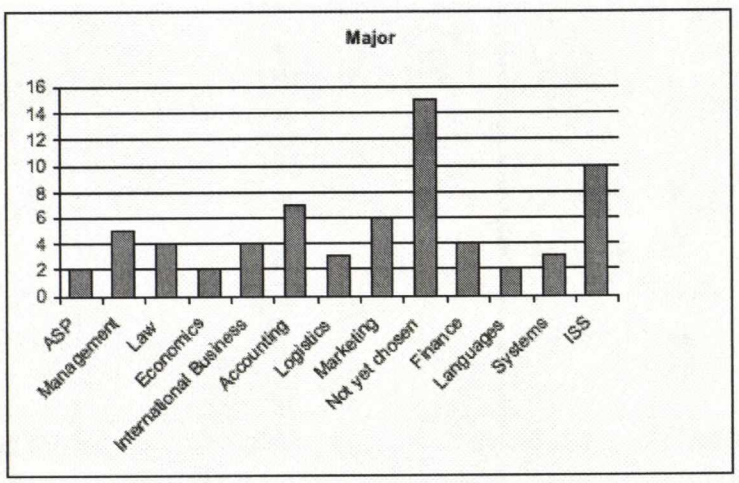
Age of Respondents



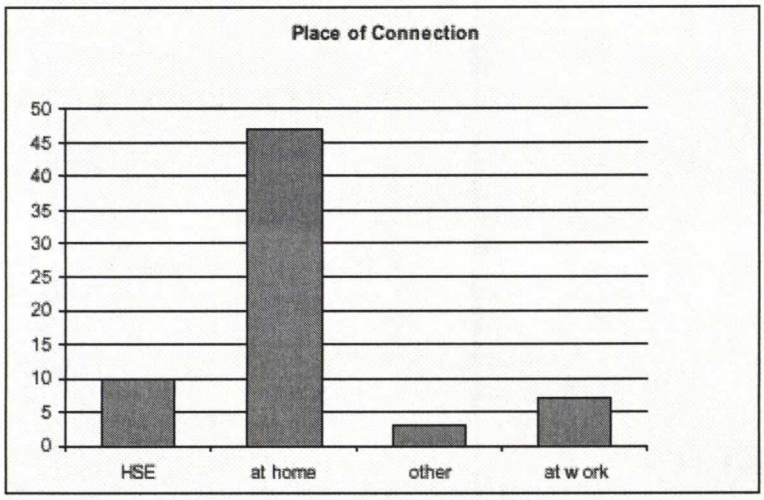
Type of Respondents



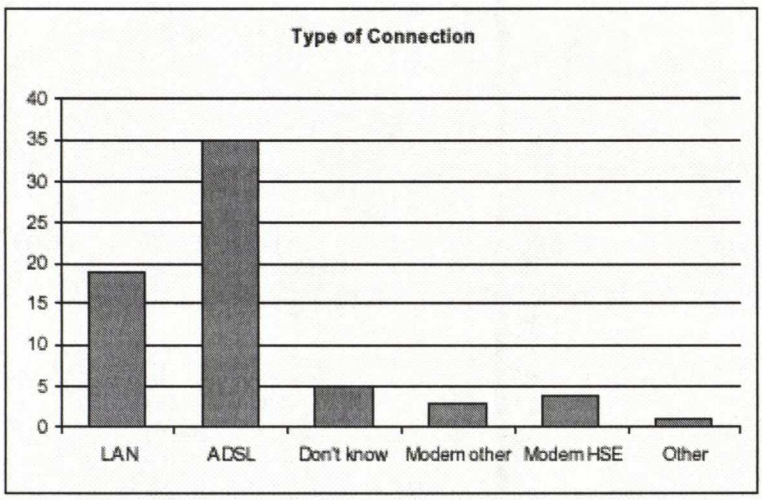
Division of Respondents by the Major Subject



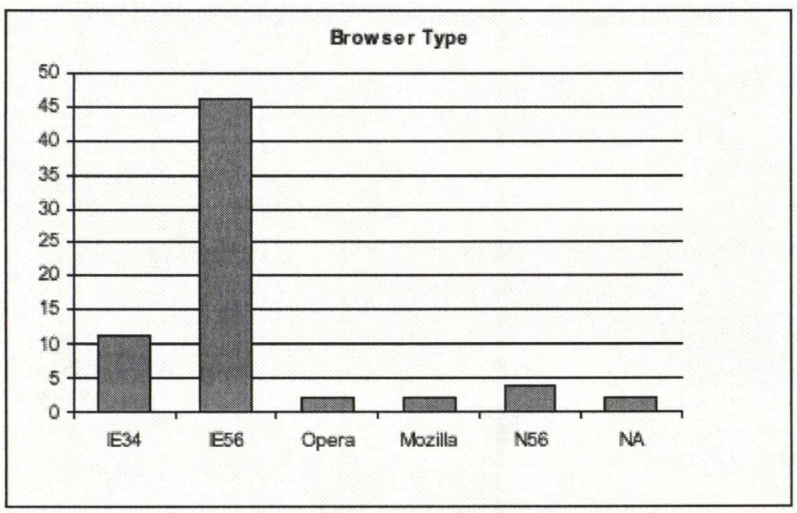
Place of taking Internet connection to the HSE web site



Type of connection to the Internet



Browser Type



The main reason for visiting the HSE website