UNIVERSITI TEKNOLOGI PETRONAS

ELEMENTS OF WEB APPLICATIONS FOR DISABLED USERS

By

Najua Mohd Nasir

A project dissertation submitted to the

Information Technology Programme

Universiti Teknologi PETRONAS

In partial fulfillment of the requirement for the

BACHELOR OF TECHNOLOGY (Hons)

(INFORMATION TECHNOLOGY)

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CERTIFICATION OF APPROVAL

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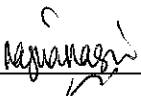(INFORMATION TECHNOLOGY)

Approved by,

_____

(Pn. Hasiah Mohamed @ Omar)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
MAY 2004

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or person.

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(NAJUA MOHD. NASIR)

ABSTRACT

This document provides an introduction to use of the Web by people with disabilities. It illustrates some of their requirements when using Web sites and Web-based applications, and provides supporting information on how do they go about using this particular area of studies or technology. It will be divided into two main disabilities, which are visually impaired and cognitive and neurological disabilities which acts as an addition to the first topic which is visually impaired. There will be an introduction on the topic covered, as well as the objectives. The scope and objectives will be discussed here. The problem statement will be identified here as well. Literature review will then be enclosed together and subsequently, the methodology used will be rationalized. There are many methods used and it is divided into two major parts which is the research part and the second part is the prototype or the development part. The next part will be results and discussion, where future enhancement will be talked about, followed by the conclusion and recommendation. Lastly, references are noted.

ACKNOWLEDGEMENTS

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CHAPTER 1

INTRODUCTION

1. INTRODUCTION

1.1 Background of study

Normal people can use the computer with ease and with normality. As for the disabled users, it is difficult for them to navigate the web unless there are aids that can help them to find the way. At all times, browsing a website can be very frustrating and undesirable for disabled users, especially for blind people. Despite that fact, people with disabilities can use assistive technology such as screen readers, programs that convert text displayed on the screen to voice.

Although there are aids that can be very helpful, there is still a long way to go before we can provide equal access to the entire audience. As there are many categories of disabilities, I have focused to accomplish my research and findings on visually impaired users and cognitive and neurological disabilities. Visual disabilities include blindness, low vision and color-blindness. Cognitive and neurological disabilities include dyslexia, attention deficit disorder, impairments of intelligence, memory impairments, mental health disabilities and seizure disorders.

There are many problems faced by the disabled users. Here the two main types of disabilities are divided into two. They are visually impaired users as well as neurological and cognitive disability. First of all there are not many website or software that can cater for these types of people.

For example, although there are many screen readers that can read out loud the information or text on the web, it is insufficient as there are a lot of navigation links and webs that can be fully utilized. Even so, it is a gratification and enjoyment that at the very least, nowadays, the blind users can use the computer despite the small shortcoming and inconvenience.

Although there are a few websites that give the access to color-blind users, there are still less webs that can be fully operated by blind users. In order to view the web, speech recognition or screen reader has to be installed. To develop a web for Color-blind users, Cascading Style Sheets (CSS) is used but as for the blind users, sound plays an important role in achieving the real objective, so that the blinds can fully utilize the web.

Focusing towards the Malaysian communities, an observation has been done and there are still lacking in terms of the usability elements as the webs that have been developed do not incorporate important elements that can be applied by these disabled or unfortunate people. This in return will benefit the society itself as it will create a community which is computer literate.

1.2 Problem Statement

It is crucial to take note that there are not many available softwares that are developed to help the disabled users to use the computer especially the internet. However, there are some softwares that can be useful for example, JAWS application. Recently, Java applications and applets could not be accessed by Windows screen readers. Three things were required to make them accessible. First, the Java platform itself had to be modified so that it could be accessed.

Second, Sun Microsystems had to create the Access Bridge which allows screen readers to access and understand applications written with the SWING Classes or other accessible libraries. The Access Bridge exposes the accessible information to Windows-based programs such as JAWS. Third, the screen reader had to be modified to allow it to communicate and understand the data provided by the SWING Classes (or other accessible libraries) and the Access Bridge. This last requirement was met starting with JAWS for Windows version 3.5. Thus, any user who is running JAWS 3.5 or later can access Java applications and applets after obtaining and installing the required software packages.

Although creating a website for normal users as well as disabled users are more or less the same, there is still circumstances that needs to be abided. The websites created are beneficial and helpful, but they are not usable enough to be fully utilized by the blind users. Thus, websites usability needs to be improved so that the blind community can benefit from this technology.

As to accentuate further, when focusing on Malaysian community, many organizations do not support the blinds by giving them access to the computer or the Internet, thus making them computer illiterate when the technologies are actually emerging. This creates distress and anguish among the community.

1.2.1 Significance of a Project

This project can be relevant when it is used by the intended users. There are many organizations or society that will require this technology and it will surely be in demand as time passes by.

The places that are appropriate to be visited are:

1) Persatuan Pemulihan Orang-orang Cacat Selangor Darul Ehsan.
2) Persatuan Pemulihan Orang-orang Cacat Wilayah Persekutuan.
3) World Blind Union (WBU) Organization.
4) Malaysian Association for the Blind (MAB).
5) Sekolah Menengah Khas Setapak., Kuala Lumpur
6) St. John's Institution., Kuala Lumpur

1.3 Aim

The aim or the main purpose of this project is to develop a website and to prove the usability of the website for the disabled users.

1.4 Objectives and Scope of Study

1) To ensure that people who are visually impaired or with other disabilities can utilize web application.
2) To provide support to these disabled people.
3) To satisfy all user groups so that it can be easily adapted in the different needs of disabled end-users.

4

4) To design a more usable web interface that can be informative and educational for the disabled people.

5) To increase awareness about the usability issues.

1.5 Target Users

The target audience for this project and research is basically to the computer literate users who are blind or visually impaired. Somehow or rather, human computer interaction element such as sound is very important for any application or purposes that has the relevancy due to this area.

CHAPTER 2
LITERATURE REVIEW

2. LITERATURE REVIEW AND THEORY

2.1 Overview

The author plans to conduct a research regarding the website usage or application by the disabled users using the navigation of sounds. This paper introduces the method of delivering information via the web for disabled users whereas in this case, there are two major parts: (i) visually impaired users and cognitive and (ii) neurological disabilities. Visual disabilities include blindness, low vision and color-blindness. Cognitive and neurological disabilities include dyslexia, attention deficit disorder, impairments of intelligence, memory impairments, mental health disabilities and seizure disorders. This topic of interest is derived whereby it is known that many websites virtually exclude efficiency and usability elements especially for the disabled users. Thus, this will create uneasiness and unattractiveness in terms of users' attention towards the representation.

2.1 Cognitive Aspects

In general, cognition refers to a process by which we became familiar with things or in other words, how we gain or acquire knowledge. This includes understanding, remembering, reasoning, acquiring skills and creating ideas. The main objective in Human-Computer Interaction is to understand how humans interact with computers in terms of how knowledge is transmitted between the two. Understanding is the most crucial element that needs to be emphasized. Then only comes the process of acquiring the knowledge by intuition or by senses.

How can human perceive information? In psychology, a general term covering the functions are involved in producing information, for example perception (seeing, hearing and so on), attention, memory and reasoning. [Hutchinson Multimedia Encyclopedia 1996]. Cognition is the act of knowing and cognitive psychology is the study of all human activities related to knowledge [Grolier Electronic Publishing, Inc, 1999].

A highly successful approach to web interface design is to enhance on users' existing knowledge, capabilities and also the use of metaphors. The main concern here is to develop suitable metaphors. As Donald Norman put it, "The problem is to design the system so that, first, it follows a consistent, coherent conceptualization-- a design model-- and, second, so that the user can develop a mental model of that system-- a user model-- consistent with the design model".

Basically, there are relations between the users' model, design models and the system image. The diagram is shown below:
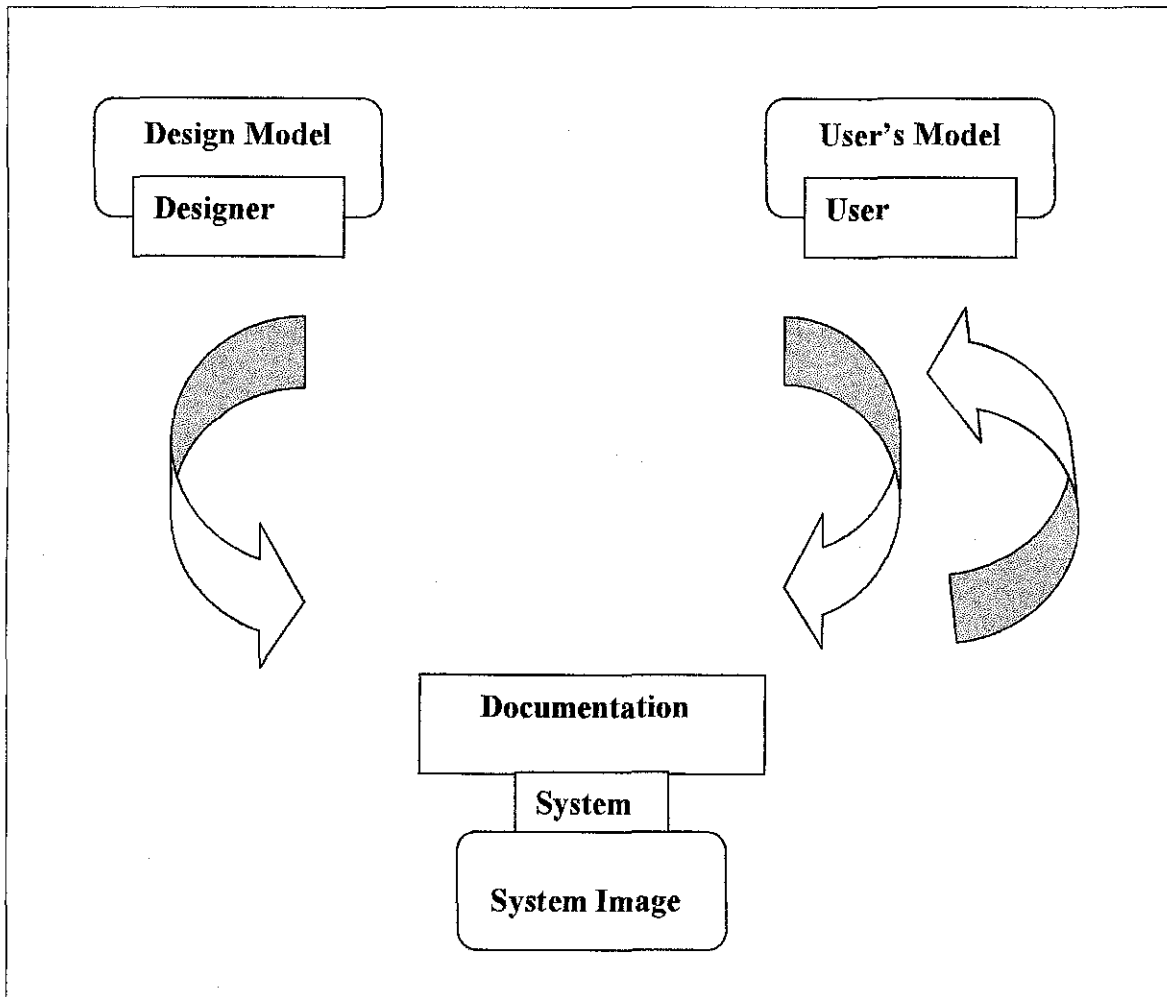
Figure 2.1 The Design Model, The User's Model and The System's Image [Norman and Draper]

Generally, to recapitulate on what has been clarified, this research focuses on two main broad areas, which are visually impaired and also cognitive and neurological disabilities. But before it is being detailed out, there are a few important elements that must be taken into considerations. For visually impaired, the most important issue will be on the navigation of sound whereas for cognitive and neurological disabilities, the main issue here will be on metaphors and also the appropriate Graphical User Interface (GUI) such as large/ideal font size, the correct font type and the correct background color.

2.1.1 Type of Disability: Visual Impairments

Web now gives access to any materials around the world, foreign newspapers are posted online as well as foreign radio and television broadcasts. All of them are available at anytime to anyone with an Internet connection. Contrary to Tim Berners-Lee, the inventor of the World Wide Web wishes that the web had grown to be a place not entirely accessible to people with disabilities.

Originally, when the Web was created, online content was entirely text-based and was quite easy for assistive technologies such as screen readers or Braille interpreters to convert to a usable format for people with vision problems. There was no audio being used online as the bandwidth at that time did not support it. So, people with auditory disabilities were not being left out. There were no Flash animations or complex interfaces for users to navigate. Thus users with mental or physical disabilities were not put in adverse and unfriendly positions.

As the Web has become a richer, more multimedia-centered place, the inherent accessibility has dropped dramatically. According to Schmetzke (2002):

"The very technology that has opened the door to unprecedented access also harbors the possibility for the very opposite. Just as there are enabling and disabling conditions in the physical environment, there are conditions associated with digital technology that result in the inclusion or exclusion of certain people. Technology that is not universally designed, without consideration for the full spectrum of human (dis) abilities is likely to contain access barriers for people with disabilities".

Another literature review indicates on the progress of two research teams in France, INSERM (Institute National de la Santé et de la Recherché Medicale) and compared this to research conducted at the University of York.

All three groups were found to be addressing the problems created by the introduction of Graphical User Interfaces (GUIs) in the early 1980s. Whilst GUIs have made it easier for sighted people to access information on computers they have created problems for blind users. The reason for this is that the screen contents are stored as bit-maps (rather than ASCII characters) which cannot be read by screen-readers. All three groups have used a combination of sound (speech and non-speech) and Braille to develop a multimodal interfaces which aim to give blind people access to the same information and in a similar way to their sighted colleagues.

To describe further, multimodal interfaces is an interface deemed to be multimodal if there are a number of ways of doing the same thing. For example, music, text synthesis and digital synthesis are all examples of auditory modalities or several senses are used to communicate information. For example, sight, hearing and touch.

2.1.2 Type of Disability: Cognitive and Neurological disabilities

For this particular type of disability, metaphors will be discussed thoroughly. It is easier for this type of users to use metaphors rather than seeing a group of texts with small fonts and complicated organization of wordings. According to Johnson-Laird and Byrne (physchologists), mental models are representations in the mind of real or imaginary situations and can be constructed from perception, imagination or from comprehension of the discourse. Mental models underlie visual images but they also can be abstract, representing situations that cannot be visualized.

It explains how knowledge can be represented and how mental models develop and are used in Human Computer Interaction (HCI). This also refers on how people construct in their mind of themselves, others, object and the environment to help them know what to do in current and future situations. Donald Norman, A professor from Departments of Cognitive Science and Psychology, UCSD explains that the deal is the model people have of themselves, others, the environment and the things with which they interact. People form mental model through experience, training and instruction.

The most important characteristic of these representations is that they are "small-scale models" of the situation and the possible actions. With this representation in mind, we are able to try out various alternatives, conclude which is the best, react to future situations before they arise, utilize the knowledge of past events in dealing with the present and the future and in every way to react in a much fuller, safer and more competent manner to emergencies which face it. [Craik, 1943]

<u>Types of mental models:</u>

1) **Right brain** mental models provide for theory in use and intuition. They are usually tacit, which is like "what you don't know you know". They are generally more accurate than left brain mental models but appear less useful in that we don't necessarily understand how we actually use them.

2) **Left brain** mental models are the theory we support and are generally considered being rational. They are explicit in that they describe "what you know you know". They are inaccurate but useful to understand our problem solving method.

3) **Metaphors,** whilst not strictly mental models, bridge the gap between right and left brain mental models. They are tolerant of ambiguity and allow you to articulate something which you cannot formally define.

"..... a more or less definite representation or metaphor that a user adopts to guide his actions and help him interpret the device's behavior." [Young, 1983]

"The essence of metaphor is understanding and experiencing one kind of thing in terms of another." [Lakoff and Johnson, 1980 in Zalman and Coulter, 1995:38]
Based on this statement, metaphor do assist in understanding and exoeriencing.

Metaphors. It can be classified as terms, images and concepts that are easily recognized, understood and remembered. As referred to the meaning of mental model, metaphors help to assist the mental model function. Both left brain and right brain has their own function. Metaphors provide a bridge between left brain and right brain. Hill and Levenhagen suggest that metaphors may provide a bridge between "intuitive models" (right brain) and "formal models" (left brain). In addition to imaginal representations, human naturally tend to relate new systems to existing knowledge, often by associating them with other physical objects. While most metaphors are not as distinctive, they are very important means for understanding people's mental models.

The motivations for using metaphor in the design of user interfaces are similar to the reasons metaphors that have long been popular in education, especially for the neurological disability children. Many educators have observed that giving students comparisons can help them learn. For example, an analogy commonly used in teaching about electricity is "Electricity is like water". Imagine electricity flows as water does. Another example is the usage of typical 'nouns' of the user interface, for example Desk for drawers, files and folders, papers and note cards. Metaphors help users understand and remember things.

"The way we think, what we experience and what we do everyday is very much a matter of metaphor." [Lakoff and Johnson]

Examples of application and associated metaphors are listed as below:

Application Area	Metaphor	Familiar Knowledge
Operating Environment	The desktop	Office tasks, file management.
Spreadsheets	Ledger	Columnar tables.
Object-oriented Environments	Physical World	Real-world behavior.
Hypertext	Notecards	Flexible organization of structured text.
Learning Environments	Travel	Tour, guides and navigation.
File Storage	Piles	Categorizing objects in terms of urgency, projects and etc.
Multimedia Environments	Rooms	Spatial structure of buildings.
Computer Supported Cooperative Work (CSCW)	Multi-agents	Travel agents, butlers and other serving roles.

Table 2.1 Application and associated metaphors

"The construct, mental models, emerged from the human computer interaction field as a mental metaphor for describing the conceptions that human develop for internally describing the location, function and structure of objects and phenomena in computer systems. The facility with which users apply and exploit the functionality of computer systems depends, mental model theorists argue on their conceptual models for describing the components and interactions of those systems. Are mental models merely conceptual? Mental models have been distinguished from other types of models that are also used to aid the development of user interfaces." [Farooq & Dominick, 1998]

The research summarized here is an initial attempt to understand how metaphors can facilitate users' performance and to identify the characteristics of metaphors that make them enhance performance. It is also to know the advantages provided by User Interface metaphors compared to non-metaphoric interfaces. Whether interacting with devices, machines, computers, people or the physical world, people use their prior knowledge to develop mental model to enable them to understand and predict their behavior.

The desktop metaphor and its composites have been the most successful and pervasive of all interfaces metaphors. More consideration needs to be taken on the selection of appropriate effect of the interface metaphors.

Generally, the way users get to find out about the design model is through the interface, its behavior and the documentation. These are called system image comprising the physical interface. Again, the role of metaphors is very important. The users learn not by just looking at the system but also from their experience of using it. If the system image is not able to convey to the users the design model in a clear and obvious way, then it is likely that the users will develop incorrect mental models.

In order to support more on the roles of metaphors, experiments are done to demonstrate a performance advantage provided by User Interface compared to non-metaphoric interfaces. The findings also identify some of the characteristics that contribute to the effectiveness of metaphor. Below is the experiment done by some of the researchers. This is to support the importance of metaphors as to assist the human information processing.

CHAPTER 3

METHODOLOGY

3. METHODOLOGY

3.1 Procedure Identification

The procedure chosen in order to complete this research is Hypothetico-Deductive Method. This method consists of 7 steps of development and concentrates more on the research part. The processes involved are observation, problem definition and preliminary data gathering for the earlier phase. After the earlier phase has been completed, all the data gathered during the earlier phase will be clearly defined to move to the design phase. The research design will be analyzed and interpreted to show the result of the findings.

Research and preliminary experiments will be done in completion of this project. This research still needs several techniques more to support the data gathering and the analysis phase. The techniques that can be used for instance are, questionnaires, observation, interviewing, evaluation testing. Evaluations will be done by Information Technology experts involving end-users with different disabilities into experimental research environments, where it can be divided into two: (i) lab experiments and (ii) field experiments.

The concentration on prototyping development phases has to be emphasized because developing prototype is a part of this project. In this case, prototyping method is adopted to assist this small-scale study in order to ensure it runs smoothly. Therefore, Prototyping Development Phases will concentrate on the prototyping part while Hypothetico-Deductive Method is incorporated to concentrate and intensify more on the research aspect of the project.

As for the continuance of this project, the methodology used in this particular project, apart from Hypothetico-Deductive method is the Spiral Model. It is a development model combining elements of both design and prototyping-in-stages, so it is a healthy mix of top-down and bottom-up approaches. Early phases focus on the construction of prototypes because prototypes model is only a part of a system and it can be implemented quickly. Lessons learned from the development of one prototype can be applied to the next iteration of the spiral. As for now, project development is abided by going phases by phases. They include planning, analyzing, design, construction and evaluation.

The advantages of adopting spiral model are:

1) Estimates on budget and schedule get more realistic as work progresses because questions have been raised.
2) More able to cope with inevitable changes that development generally entails.
3) Focuses on early design flaws.
4) Uses identical approach for development and maintenance.
5) Can be used for hardware and software development.

3.2 Methodology Framework

Design & Development Process Phase	PROTOTYPE Prototype Development Phases	RESEARCH Hypothetico-Deductive Method Phase
Planing Phase	Prototype Planning	Observation Preliminary Data Gathering Problem Definition
Analysis Phase	Prototype Analyzing	Theoretical Framework Generation of Hypothesis Scientific Data Collection Data Analysis
Design Phase	Prototype Designing	-
Construction Phase	Prototype Construction	-
Evaluation Phase	Prototype Evaluation	Deduction Report Writing Report Presentation Decision Making

Table 3.1 The detailed procedure used for this project

3.2.1 Analysis Phase

As for the analysis in the Research Methodology Framework, shown in Table 3.1, the important and crucial data are all gathered in order to collect all the information supporting the research topic. Since this project basically focuses more on the research part, it is important to collect and assemble data and also other supported documentation materials, which are based on the previous researchers, documentation, journals and others.

Due to this research analysis, two main issues are put into consideration. The first issue is on the navigation by sound. It is because different sounds can be adopted by systems to display meaning in terms of distance and direction. The second issue is the cognitive aspect of human brain that mainly focuses on the cognitive and neurological disabilities. A web interface will be produced to show the cohesiveness of these two main issues.

Most of the crucial time of the project development is being concentrated on the analysis phase as it acts as a backbone to the entire finding in order to produce a proper and meaningful project. Only then will it be successful and favorable. For instance, the method or styles of the disabled people see or perceive things have to be studied first before a web application can be produced.

Below are the various techniques applied to undergo the research:

1) Collecting facts, data or information from existing documents.

Data are gathered through books, journals as well as Internet articles. Some of these secondary sources of data are gathered based on statistical bulletins, previous experiments, case studies and on-line data. The advantage of secondary data id in terms of economical cost and time saving when acquiring information. All data that are collected is very valuable as to support the research issues. This process will be continuously throughout the development phase.

2) Observation / Self Experience.

Besides data collection technique, observation and self-experience also contribute towards the analysis phase. From the observation and self-experience which is based on two types of human disabilities medium. Both mediums are analyzed in terms of the purpose as to serve as a usable and friendly web application to help and ease people with disabilities.

3) Prepearing Questionairre 1 as Pretest.

This questionnaire is predetermined to gather user's perception on the existing web applications. This questionnaire is prepared to the users who at least have had experience or familiar with the web applications, either browsing the internet at home or at workplace.

As for Prototype Planning and Analysis Methodology Framework, the main areas or issues highlighted here will be supported with the prototype development. For example, the sounds, metaphors, icons and information provided as well as the cognitive aspects of human information processing that needs to be taken into consideration. After analyzing what are the drawbacks and witnesses occur due to the research issues above, problem statement is then generated.

3.2.2   Design Phase

For research Design Methodology as explained in the Methodology Framework, a theoretical framework was illustrated after defining the problem above. The theoretical framework is illustrated based on the data gathered during the analysis phase. As mentioned above, data gathering or data collection is a continuous process. Therefore, throughout the theoretical framework, it will show a clearer illustration or representation on the issue arises.

As for the prototype design, it is done to support the research issues that arise. What is to be emphasized here are the elements of both navigation of sound as well as the cognitive aspects of web application for the disabled. The prototype being developed is not a real product, since it only shows what are the areas that developers need to take into consideration in order to give valuable information to the web users. Furthermore, both two mediums which are based on two types of human disabilities are the highlighted elements that will be emphasized in order to develop the prototype.

3.2.3   Construction Phase

This is the phase for Evaluation Method Construction. The evaluation methods are applied to evaluate the users perception together with the users acceptance of the importance of the cognitive aspects of human beings. Basically, the task is to construct the test plan which includes pretest, actual test or evaluation and finally posttest.

During the pretest phase, the questionnaire is constructed to express what are the users' opinions and perceptions on the web applications for the disabled. After getting all the information needed, it will bring into actual test, where cognitive walkthrough technique will be applied and the last part is the posttest, where there will be interviews withs the users due to the prototype constructed.

To strengthen the data in construction phase, these activities will take place. They are:
1) Questionnaire.
2) Interview.

1) Questionnaires

In order to get what is essential from users' perception due to the web application, questionnaires are constructed. Basically, the intended users of this questionnaire focus more to the users especially local users, who are Malaysians. This is because, the information provided by the existing websites cannot be used by the disabled users.

For instance, blind users cannot see what is composed or designed on the interface as they are visually impaired, thus they cannot appreciate how worthy and advantageous the computer and the internet to the normal society. Therefore, the research issues stated at the beginning part of the report will be able to help the disabled users to easily and effectively retrieve the information from the internet.

2) Interview

After undergoing the pretest and the actual test, the audiences will be interviewed during the posttest phase. The interview is prepared to collect users' opinions and perception during the actual test, which is basically after the users have experienced the prototype that has been developed.

In order to show certain elements that need to be emphasized, a prototype of interfaces will be developed to support this small-scale study. They are created using Macromedia Flash as well as Hypertext Markup Language (HTML). Prototyping helps to deal with the problem of understanding requirements and it can provide information that enables designers to provide more appropriate operation sequences.

Information on the representation reveals those symbols and displays which users can readily understand and recognize without any confusion or regular lapses of memory and those which they find difficult.

3.2.4 Evaluation Phase

In the evaluation phase, the prototype will be evaluated and the interface will be compared. The prototype developed is to support the research issues instead of producing a full product to replace the existing web applications. Therefore, the prototype is not tested in terms of its full usage or usability. The prototype is prepared to view some of the important aspects that are already highlighted based on the research findings.

Rossi and Freeman (1993) define evaluation as the "the systematic application of social research procedures for assessing the conceptualization, design, implementation and utility of the programs". There are many other similar definitions and explanations of what evaluation is in literature terms. An overview of the steps of a typical evaluation as shown in Figure 3.2:
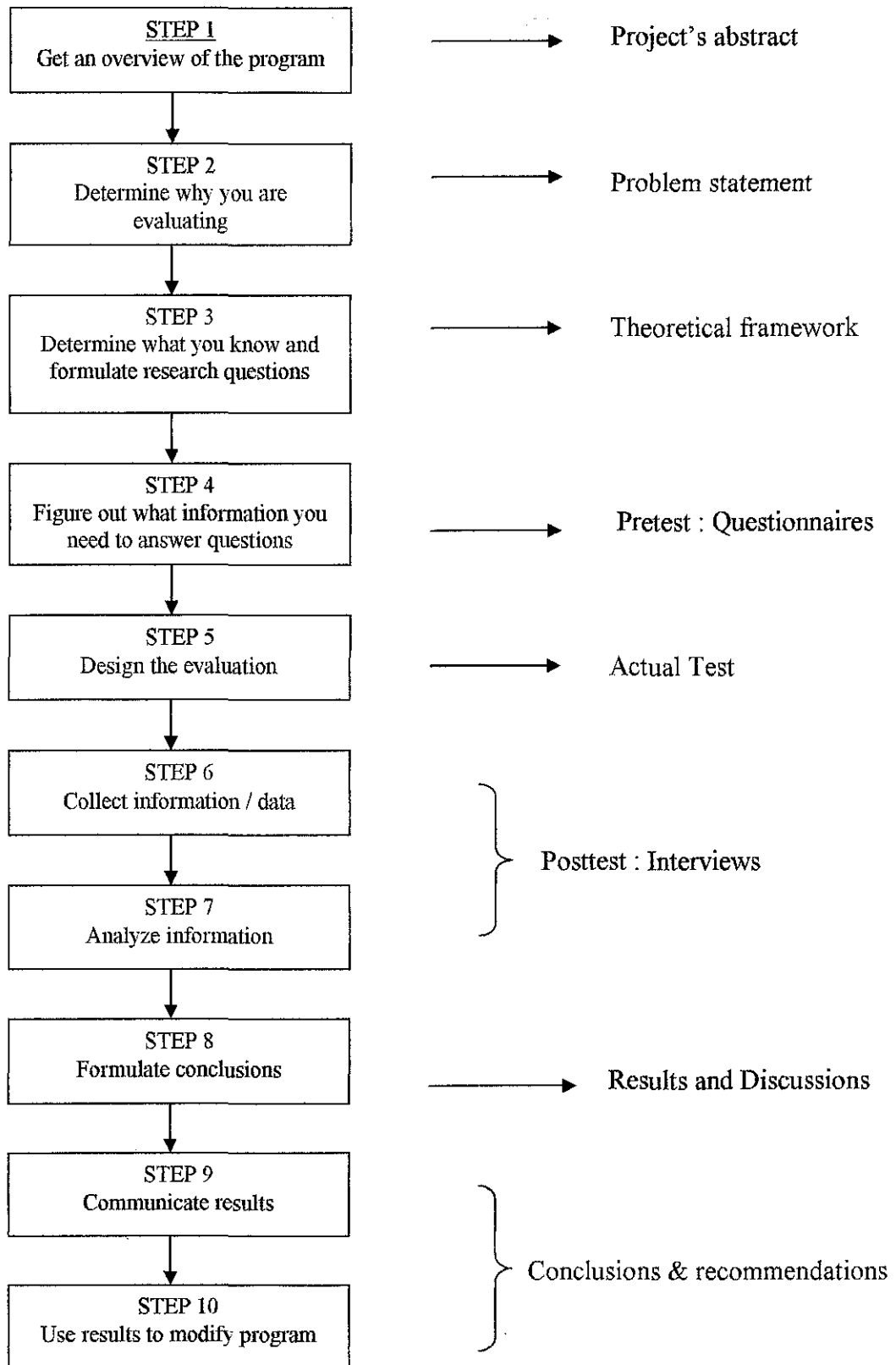
STEP 1 Get an overview of the program	→	Project's abstract
STEP 2 Determine why you are evaluating	→	Problem statement
STEP 3 Determine what you know and formulate research questions	→	Theoretical framework
STEP 4 Figure out what information you need to answer questions	→	Pretest : Questionnaires
STEP 5 Design the evaluation	→	Actual Test
STEP 6 Collect information / data		
STEP 7 Analyze information	}	Posttest : Interviews
STEP 8 Formulate conclusions	→	Results and Discussions
STEP 9 Communicate results		
STEP 10 Use results to modify program	}	Conclusions & recommendations

Figure 3.2 Evaluation Overview

3.3   Interface Design

The web application is created for the acceptance of both normal and disabled users. The only difference is that visually impaired users need additional software to disburden them. For example, screen reader is very important as it provides a very important multimedia element which is sound. Sound is the only medium for them to navigate the web successfully.

First, there will be an index page where it acts as a welcoming page. It will prompt a message box or a pop up to be clicked upon entering the page. Next, the homepage will appear and this is where the information of the page is predetermined. There will be several links where it will lead the users by producing sound so that they know where they actually positioned. The links will lead the users to several more pages. Refer to the Appendices for details.

3.3 Tools

The tools used in completion of this project are HTML, SPSS Editor, Adobe Acrobat Access Plug-in for Windows and JAWS which acts as a speech and recognition software. Examples of speech recognition or screen reader sofwares are JAWS, Hal, Window Eyes and etc. but for the time being, JAWS is popularly accepted in Malaysia.

CHAPTER 4

RESULTS AND DISCUSSIONS

4. RESULTS AND DISCUSSIONS

4.1 Analysis Phase Results

In this section, results will be discussed based on the tasks that are accomplished during the Analysis Phase. If referred to the methodology framework in the methodology section, it shows that the first part of gathering data is completed during this phase. For instance, the tasks are observation, preliminary data gathering and problem definition. Since this project is more towards research, therefore collecting facts from existing document is very valuable. This is basically based on the previous researchers' journals or documentations.

In order to complete this research, all the data needs to be gathered to assist in terms of the content of the issues arises. The issues raised here is web application for the disabled users using mainly navigation by sound. Initially, the research title needs to be defined before proceeding to further explanation. This is to support understanding on the scope of research and to give a brief idea on what the topic is all about. All the terms are defined in the Literature Review Section in chapter 2.

Human information processing, which is known as brain, has its capabilities as well as limitations. Since this part of psychology issue seems to be sophisticated and needs more emphasis, the web developers might be neglecting this issue as the usability is not guaranteed 100%. This applies especially to the disabled users, more specifically, the visually impaired users or the blinds. Human ability to perceive information depends on the capability of the user's brain. Besides, the sound elements as a means of navigation also assist human brain to gain knowledge.

To accomplish this research on small-scale study, these interrelated issues are revised based on the existing data and facts from books, journals as well as articles. From the data gathered, it is known that human memory or brain has its own limitations. Human memory tends to decay in certain period of time where it leads to forgetting the information. Unless if an element such as sound is incorporated, then it can lessen the memory loss or forgetting the information. This is where human is tested to recognize things and recall information with as addition element mentioned earlier, which is the sound.

On the other hand, metaphors are also part of the mental model as what has been said by John McLehhand, a psychologist, in his journal. Briefly, a metaphor is a bridge between right brain and left brain. This shows the significance of metaphor (other than sound) to assist human information processing in performing its tasks. Other finding also shoes that *icon (metaphors) maniac* also needs to be avoided.

All the data collected are important to provide a good design of the web application for the usage of the disabled users. Various types of guidelines of user interface guidelines as well as the human information processing principles were looked through. This research will refer to the guidelines or principles required to support the findings.

Through observation and self-experience, there are not many applications that incorporate sound as a means of navigation to be used especially by these disabled users. After some observation from the web sites, there was only one particular website that allows color-blind users to access that particular site as it uses Cascading Style Sheets so that the colors used suit the color-blind people's needs and requirements in order for them to view that web application or website.

The issues arise here are the cognitive aspects of mental model and the factor that assist the cognitive aspects, which in this case, the sound element (visually impaired users) as well as the interface metaphor (cognitive and neurological disability users).

Based on the data gathering technique mentioned above, for web based medium or web based application, there are a few results that can be discussed here. First, web based medium or web based application which is to be used by visually impaired users is discussed. Then, web based medium or web application where the target users are for those with cognitive and neurological disabilities will be pointed out.

For visually impaired users, the results are as follows:

1) In most cases, the information provided by the web is sufficient but the blinds or visually impaired users cannot access as the web developers do not incorporate important elements such as the sound.

2) Prioritization in selective information is neglected. As it is, the sound is not incorporated. Moreover, all the information given are put on the screen simultaneously where there will be too much of information displayed on the respective screen.

3) The data provided is not what as expected by the audiences / users. It means that the information is either reliable, not up-to-date or do not conform to their requirements.

For cognitive and neurological disabilities, the results are as follows:

1) In most cases the information provided by the developers are not sufficient and unorganized. The information is scattered around and they are not organized in chunks. As for the usage of cognitive and neurological disabilities, the information given has to be precise, simple and if possible, pictures are incorporated. That gives them easier access to information provided.

2) Prioritization in selective information is neglected. As for these type of disability, information must be out in an orderly manner or in sequence, according to its priority and precedence.

3) The data provided in the websites or any web applications are not as expected by the audiences / users. It means that the information is either reliable, not up-to-date or do not conform to their requirements.

In addition to the cognitive and neurological disabilities, the responses gained from the users are also based on the human information processing capabilities and its limitations. Human do have limitations on memorizing, recalling and forgetting the information retrieved. It is even more difficult for a person who has this particular type of disability. This come the role of the interface metaphors to assist the capabilities of human information processing in understanding the information.

Based on the result above, it is known that the main factor that leading to the drawbacks of the usability effects of the web application is the unawareness of the web developers that their webs will be used or viewed by not only normal users, but also by the disabled users as well. The drawbacks will occur and produce imperceptible information for this type of disability.

4.2 Construction and Design Phase Results

After all the existing data from journal, previous researchers, books as well as the articles have been analyzed, the prototype was designed and the prototype construction is designed by applying the ergonomics user u\interface guidelines as well as the human information processing capabilities and limitations guidelines. The information or facts gathered during the analysis phase on the human information processing and the interface metaphors are used to produce the prototype .

The results based on the prototype development will be discussed in the later part which is due to the emphasis of the issues of the research. The issues are on the cognitive aspects and interface guidelines. It is important to incorporate important elements such as sounds as a mean of navigation as well as interface metaphors to help people who have mental incapability.

4.3 Evaluation Phase Results

4.3.1 Pretest Evaluation: Questionnaire

Based on the questionnaire constructed during the pretest evaluation done at St. John's Institution in Kuala Lumpur for the blind (only Form 6 students), about 70 of the disabled users have had an experience using the web, although it is not designed especially for them. Despite that, although there aren't any websites that cater their needs, there are a lot of softwares which enable them to use the web with ease. The softwares available are JAWS, Hal, Window Eyes and etc but the most popular among all is JAWS as it is the latest in the market and acceptable by many users.

When asked on what the users think about the interface, most of them have their own opinions on how effective they are but none had answered that the webs are neither highly effective or not effective at all. The answers vary from one to another as each user perceives things differently from others as they are blind. As expected, the most look out element that come across their mind is the sound as sound means everything to them, be it the navigation buttons, the way they perceive the information and etc.

Based on the questionnaires that have been conducted, there are many opinions that were gathered. For example, some had encountered a problem regarding the information while some with regards to the interface itself. All opinions and responds need to be referred to the user interface guidelines as well as human information processing capabilities or limitations. The effectiveness of information retrieved is also dependent on human perception and cognition.
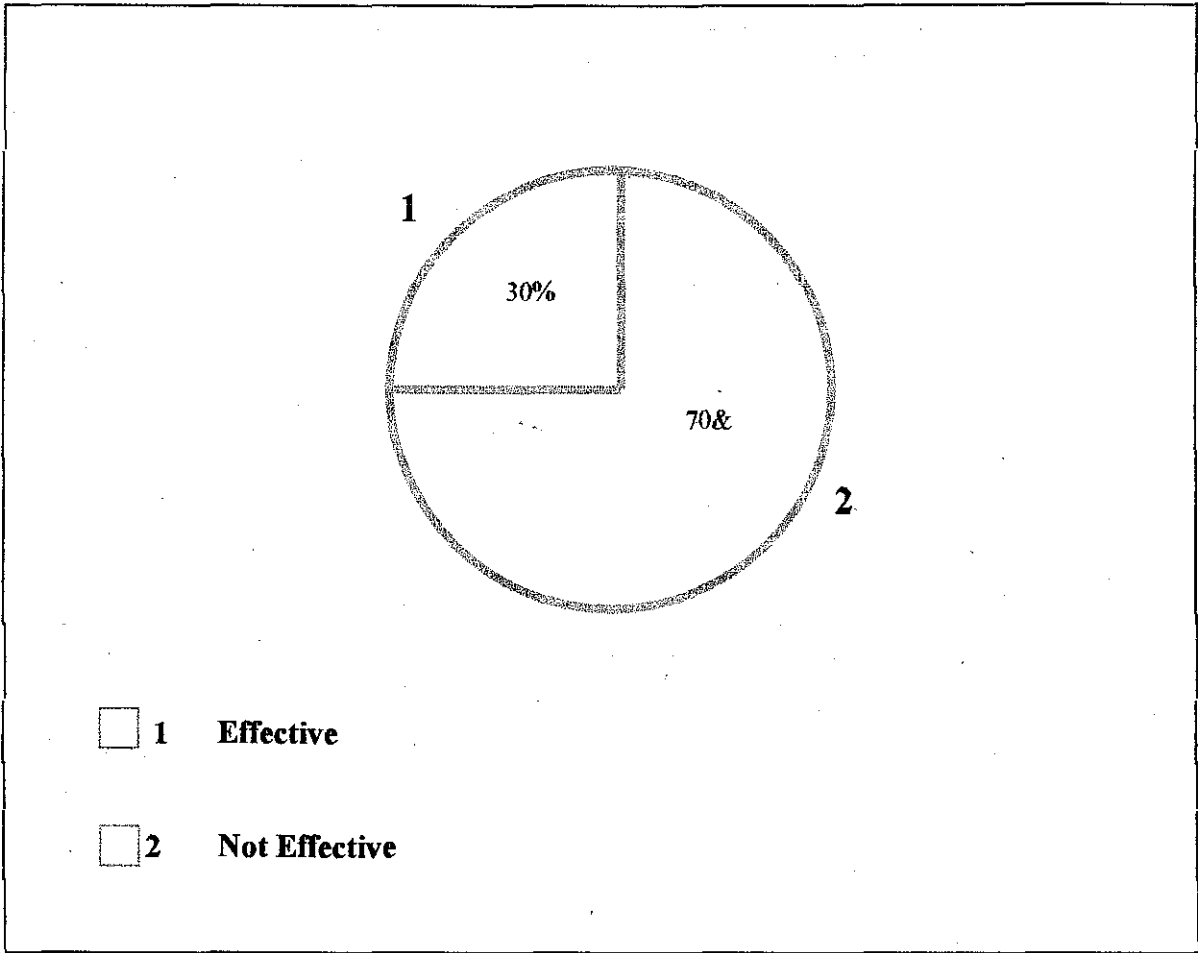
Figure 4.1 Result on pretest Questionnaire: Graph Construction. Existing web interface

About 70% of the respondents found that the interface of the existing web application is not effective because of various reasons. The other 30% of the respondents found that the interface is effective
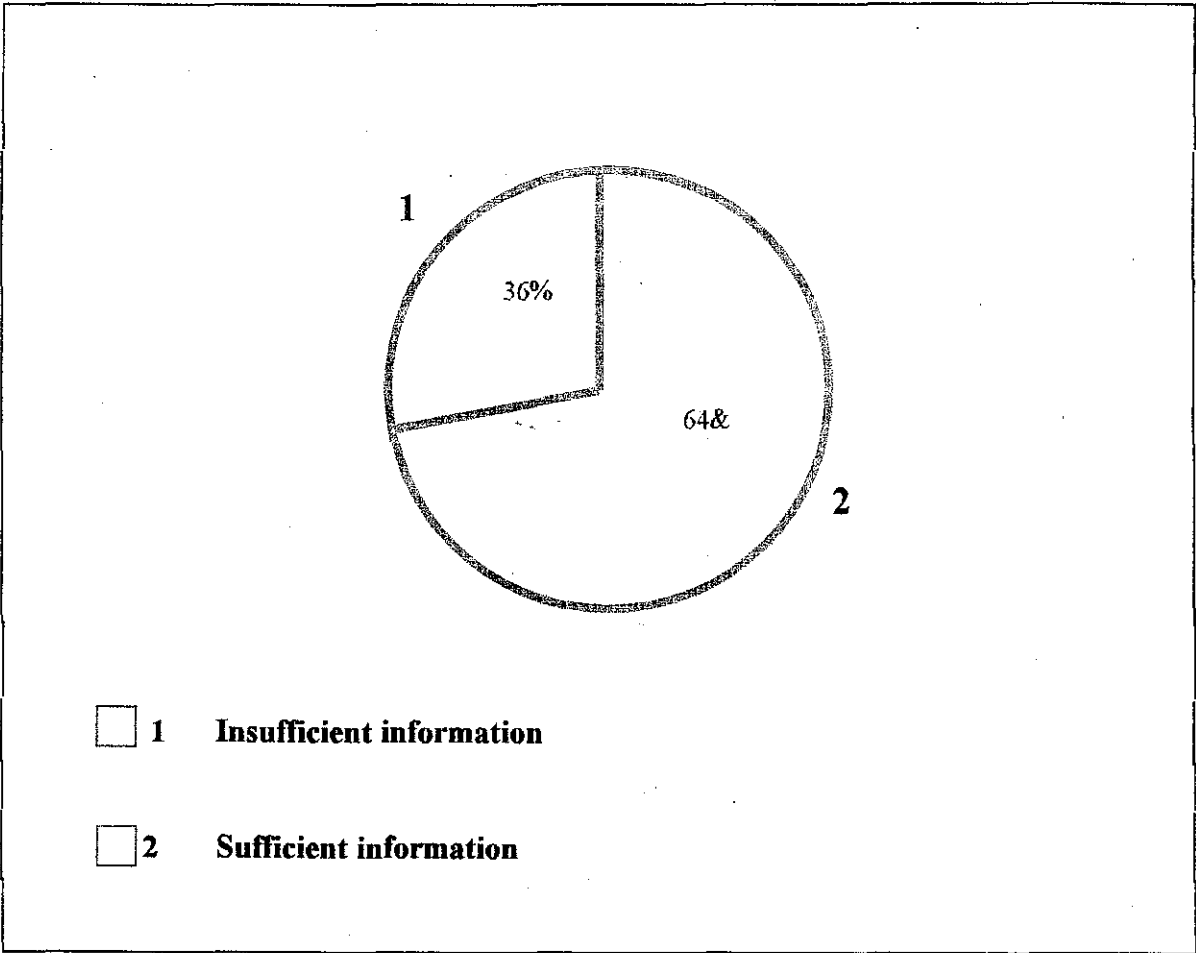
1   36%

64&

2

□ 1   **Insufficient information**

□ 2   **Sufficient information**

Figure 4.2 Result on pretest Questionnaire: Graph Construction. Information provided by the web.

About 64% of the respondents found that the information provided by the web is not enough because of some restrictions as they are blind. The other 36% found that the provided is sufficient.

1 Insufficient and necessary information

2 Wordings are not properly incorporated

3 Dull interface with unorganized information

4 Sufficient with necessary information
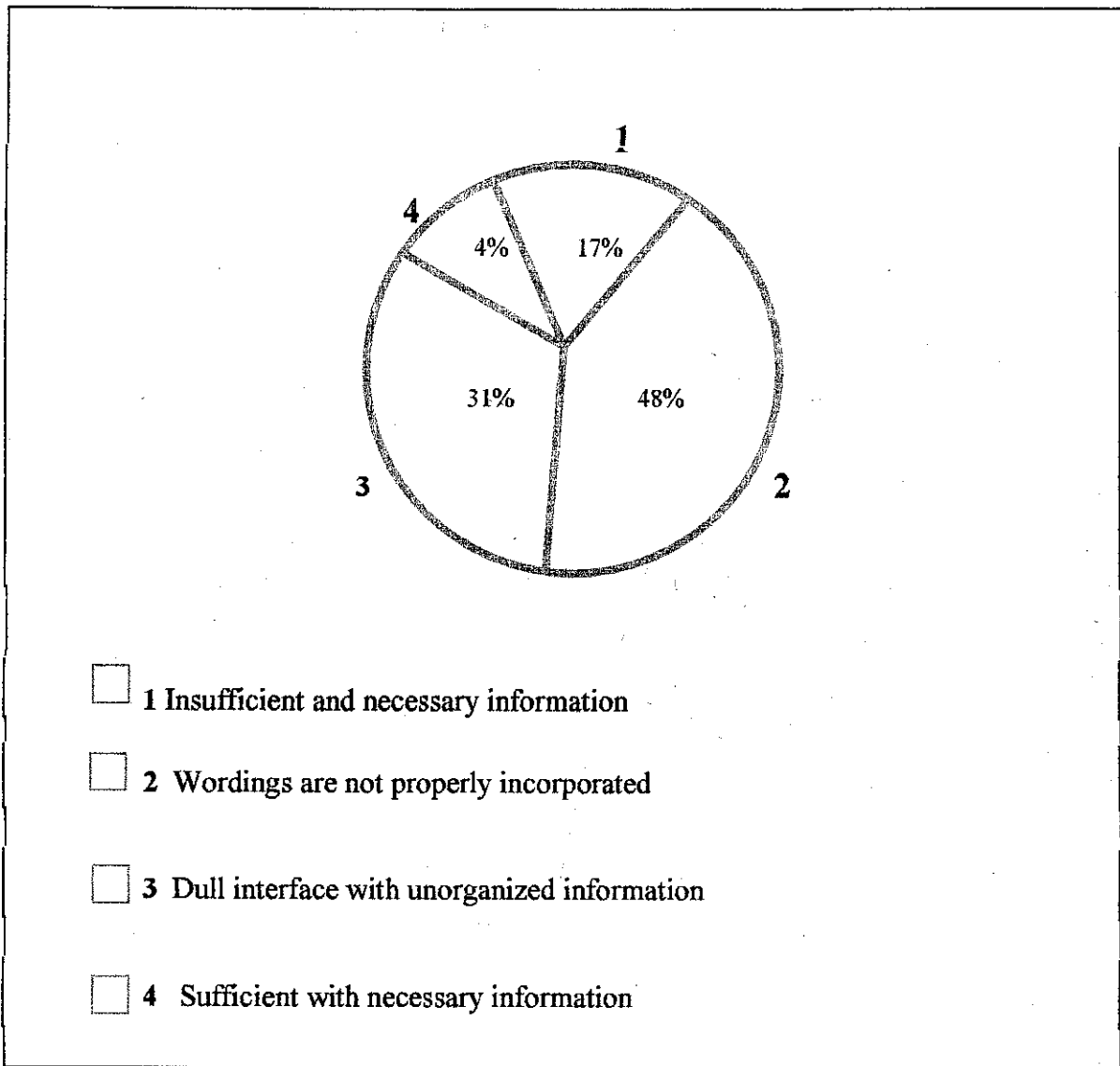
Figure 4.3 Result on pretest Questionnaire: Graph Construction. Personal Opinion on Web Application for the Disabled

The portion of pie chart shown several of respondents' personal opinion on the existent web application. About 48% of the respondents respond that the wordings displayed on the screen are not enough for the screen reader to speak out loud what's been written on the web's description.

4.3.2 Posttest Evaluation: Interview

Interview session was handled throughout the project development. After the questionnaire session is done, users are asked on their personal experience when viewing the interfaces. Some of them responded that conveying information through interface is very interesting while some may not think so. Some of the users thought that some important elements should be emphasized to ensure the information is perceptible and appreciable.

Some of the audiences do not realize the importance of the roles in cognitive aspects of human information processing in determining the interface's elements. The summarization of the evaluation phases which is based on the pretest, actual test and posttest, is included in Section 4.4.

As an addition to this section, an elaboration on the interview will be acknowledged here. The interview was done at the St. John's Institution. Five students were interviewed where each of them had their own opinions.

Full access of the computer is impossible as blind users cannot view all the images and as well the video playback shown in the web. Moreover computer games via computer cannot be played and enjoyed as there are no technology that enables the blind people to play computer games. When operating with Microsoft Word, JAWS has the advantage of reviewing or checking the spelling error .

4.4 Summary of Findings and Recommendations

4.4.1 Consistency

Certain aspects of an interface should behave consistently at all times for all screens. For example, icons, which are one of the metaphors, should be consistent between screens. To avoid misinterpretation and misunderstanding, the same icons need to be used for all the screens. Besides, in order to assist users' understanding, colors should be consistent between screens of similar functions. Normally, the best guideline is to use not more than three colors on the screens. This consideration is also based on the human information processing limitations. This applies especially for the cognitive and neurological disabilities.

4.4.2 Simplicity

Task is simplified by using icons, words or other objects that are familiar to the user. This come the roles of metaphor. Icon is pictographic symbols. It focuses on essential features. It represents underlying objects data structures processes in a form which corresponds to the real world. This applied perfectly to the cognitive and neurological disabilities.

4.4.3 Human Memory Limitations

Based on the observation and through information gathering, one of the factor that influence people in retrieving information effectively is because the matter of "too many too absorb". For these type of people, simple wordings and simple sentences need to be used so that it can be understood.

4.4.4 Sound

This is the most crucial element for the disabled people especially to those who are visually impaired. By using the navigation of sound, it can determine the location of where they are at. Shortcut keys will be used instead of using mouse. Moreover, it is faster and more reliable.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5. RESULTS AND RECOMMENDATIONS

5.1 Conclusions

The research title in the first place, has given a brief idea on what the project is all about. The issues arisen is based on the existing web interface application. Web developers or computer users seem to neglect the importance of computers to the disabled people, not only to the normal users. This leads the author to undergo a small case study on the human information processing and the element of usability. This is where the sound element comes in handy.

In order to produce a website that enables the disabled users to use it, one must first understand how disabled users, especially, the blind users perceive information. As known to all, sound plays a major role in visualizing the text as well as the environment of the web. Here the usage of sound will be fully utilized in order to achieve the primary goal which is to give access to the blind users to use computers.

As for the cognitive aspects, based on the research done, human memory limitations are neglected by normal society because it is something that could not be seen physically compared to the user interfaces. People are sometimes too excited to develop the interfaces overlooking human memory limitations. In the earlier phase, this research is

When it comes to the design phase, the research done has to be sufficient in order to produce a good end result. Research on JAWS, the screen reader software, has been done and a lot of information can be applied during the development of this project. JAWS has a few advantages over other screen reader softwares such as Hal, Window Eyes and etc. Hal is an old version whereas Window Eyes can only read interfaces with Windows Interfaces but JAWS has the advantage of reading in Windows as well as DOS Command Prompt.

Yet, not every individual has similar capabilities and limitations. In whatever that is designed, individuals or groups have to be considerate and fulfill all the necessities needed for these type of users. There are a lot of differences between novice and experts. This also can be applied to the normal, or cited users, compared to the blind as well as the neurological users.

5.2 Recommendations

It is only realized that there are still many elements especially on the human information processing that can be taken into considerations for revisions and enhancement. Same goes for sound element where it is important to realize that sound plays a crucial role in determining whether the blinds can have the access to the computers or not. All of these elements are included in ergonomics guidelines of user interfaces.

It is also important to revise deeply the elements of interface guidelines as well as ergonomics guidelines to produce good result or outcome in producing valuable information. Sound should also be revised in terms of its usage and its purposes so that in the near future, it can be totally utilized.

There is not many thing to discuss about the element sound for the visually impaired users as they only need sound to operate the computer but for the cognitive and neurological disability users, there are many things that can be pointed out here. Therefore, any elements no matter how they are classified, it is suggested that they are revised in order to assist the interface functionality. Evaluating phase should be enhanced especially with the expertise guidance.

As for the development of screen reader software, a range of softwares is available in the market but there are certain drawbacks that have been encountered. As for example, Window Eyes can only be used on Microsoft Operating Systems. for that reason, in the future, more softwares should be developed to make certain that the blind communities will have full access to computers just like normal people do.

This project is based on research, which explains in depth on the theoretical and conceptual part. Therefore, more concentration is given to the research based elements compared to the prototype development. That is why the prototype development consists only 30% of this project. This research is mainly based on the web usage by the disabled users using the navigation of sound as well as on the human information processing issues.

Human information processing is a broad research topic which has various emphasis areas that need to be taken into considerations. Therefore, for the future research enhancement as well as prototype enhancement, both of these elements need to be parallel, together with some additional elements.

As for the cognitive and neurological disability, the two major parts are about the psychology and the design. Each of the issues can still be synthesized with many other elements. For instance, eye monitoring technique as one for the cognitive aspects of human information processing can be included in future enhancement to get to know how human read as well as the capabilities of the retina and the elements of cones. Besides, human perception for example hear, smell, touch, sight can also be further examined to support this research issue in order to produce valuable information.

Nowadays, people are talking about artificial intelligence (AI). The significance of it needs to be taken into considerations in order to determine the existence of the cognitive aspects due to the technology advancement of AI, such as robotics, in perceiving information. Whether the system may be programmed to become AI technology so that it can replace 'human information processing', and react as a cognitive aspects, another research can also be done to explore further, as a future enhancement of this current, particular project.

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APPENDICES

Appendix 1-11: Interface Design Screenshots

Appendix 12-14: JAWS manual

Appendix 15: Questionnaire

Appendix 16: Gallery

Appendix 1: index .html

Links

Home

News

TheClub

Players

Managers

Fixtures

Gallery

Merchandise

ContactUs

Guestbook

Manchester United

Welcome!!!

Welcomelll You are now entering the most complete and comprehensive website in the planet on Manchester United Football Team. This website features all the information that you ever wanted to know on the team players, managers, matches etc. We also provide a gallery page for you to view and download pictures from our archive. Please feel free to browse through our webpage by simply clicking on the links on the left. We also provide Manchester United's FC merchandise which you can view and purchase online. Simply click on the merchandise button and you will be redirected to our online store. This website also offers its visitors membership. Once you register as a member, you will receive all the updates, latest news, fixtures regarding MUFC on your email. You will also be eligible to enter our contest which will be announced periodically. Should you require any assistance please visit the Contact Us page and submit your enquires. We will try to assist you as soon as possible. Thank you for visiting and please bookmark this site for your future reference. Also don't forget to sign our guestbook in the Guestbook page.

Appendix 5: news.html

Links

- **Home**
- **News**
- **TheClub**
- **Players**
- **Managers**
- **Fixtures**
- **Gallery**
- **Merchandise**
- **ContactUs**
- **Guestbook**

Manchester United

MANCHESTER UNITED's
Updated News

Latest News!!!

Gunners leave it late

24/8/02 4:54 PM

United's main title rivals achieved mixed results on Saturday.

Becks' pretty performance prompts

23/8/02 11:24 AM

Becks: we must beat the top sides - starting with Chelsea.

Appendix 4: club.html

Links

Home

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Manchester United

MUFC

MEMBERSHIP

Members Only

To register as a member, please fill in your username, password and other required fields

Once completed click on submit button ONCE. You will receive an email from us verifying your information. Once you have confirmed your details you are officially a member of the MUFC fan club

Username :   *This will be your ID*

Password :   *No longer than 10 char*

Retype Password:

Appendix 5: players.html

Links

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Manchester United

MANCHESTER UNITED
Players

Player	Number	Player	Number
Fabien Barthez ('GK)	1	Diego Forlan (Forward)	21
Gary Neville (Defender)	2	John O'Shea (Defender)	22
Phil Neville (Defender)	3	Rotan Dierdre (Reserves)	23
Juan Veron (Midfield)	4	Wes Brown (Defender)	24
Laurent Blanc (Defender)	5	Quinton Fortune (Midfield)	25
Rio Ferdinand (Defender)	6	Danny Pugh (Reserves)	26
David Beckham (Midfield)	7	Mikael Silvestre (Full-back)	27
Nicky Butt (Midfield)	8	Kirk Eaton (Reserves)	28

File Edit View Favorites Tools Help

Back →   Search   Favorites   History

Address C:\Project_submit\frame.html   Go

Search → Edit   Retrieving buttons from My Search...

Links

Home

News

TheClub

Players

Managers

Fixtures

Gallery

Merchandise

ContactUs

Guestbook

MANCHESTER UNITED
Managers

Choose a manager
They are arranged from past to present

Manchester United is arguably the biggest and best known football club in the world. Formed in 1878 as Newton Heath Lancashire and Yorkshire Railway FC and renamed as United in 1902, the club has acquired a reputation for attacking football on the field and pioneering development work off it. Legendary players such as George Best, Denis Law and Bobby Charlton, along with manager Sir Matt Busby, are part of a United history which is tinged with sadness as well as glory. The Munich air disaster of February 1958 marks the club's low point, when many members of the playing and coaching staff were killed. It is a testimony to Sir Matt that he rebuilt his team and within ten

My Computer

Start   FYP   ENU   Project_submit   Welcome t...   Canon BJC-1...   Microsoft Wo...   10:27 AM

Appendix 7: fixture.html

Browser window showing Manchester United Fixtures and Results page.

Links
- Home
- News
- TheClub
- Players
- Managers
- Fixtures
- Gallery
- Merchandise
- ContactUs
- Guestbook

MANCHESTER UNITED
Fixtures and Results

FA PREMIER LEAGUE 2002 - 2003		
17/8/2002	West Bromwich Albion	WON 1 - 0
23/8/2002	Chelsea	DRAW 2 - 2
31/8/2002	Sunderland	-
3/9/2002	Middlesbrough	-
11/9/2002	Bolton Wanderers	-
14/9/2002	Leeds United	-
21/9/2002	Tottenham Hotspur	-
28/9/2002	Charlton Athletic	-
7/10/2002	Everton	-

Appendix 8: gallery.html

Browser window showing the Manchester United Picture Gallery page, with a "Links" navigation menu on the left (Home, News, TheClub, Players, Managers, Fixtures, Gallery, Merchandise, ContactUs, Guestbook) and a main area titled "MANCHESTER UNITED's Picture Gallery" displaying photographs.

Links

Home

News

TheClub

Players

Managers

Fixtures

Gallery

Merchandise

ContactUs

Guestbook

MUFC Online Store

| Replica Kit | Nike Shop |
| Leisure Wear | Accessories |

Just Arrived!!! Pre-Order the 2002-03 Away Kit NOW!!!

Home Shorts
Replica Home short with inner
brief. mesh gusset at crotch and

Home Socks
Replica Home sock
with knit construction

Sleeveless Training Top
Authentic Cool-motion 2 layer
sleeveless training top. with mesh

Appendix 10: contacts.html

Links

⦿**Home**

⦿**News**

⦿**TheClub**

⦿**Players**

⦿**Managers**

⦿**Fixtures**

⦿**Gallery**

⦿**Merchandise**

⦿**ContactUs**

⦿**Guestbook**

Manchester United

Contact Us Page

Thank You for visiting our website!!!

Please fill in the required fields then click submit

Should you require any assistance or any complaints regarding the website please fill the comments section

Name:

Username: _____ *Fill if you are a member*

Password: _____ *Fill if you are a member*

E-mail:

Age [less than 20 ▾]

Appendix 16: Gallery

A student using a brailler to write what has been studied in class

A student using a computer to scan a book and transfer it to Braille script

Appendix 12: JAWS Manuals for Desktop

DESKTOP KEYSTROKES

For Reading Text:

Say Character	NUM PAD 5
Say Prior Character	LEFT ARROW
Say Next Character	RIGHT ARROW
Say Word	INSERT+NUM PAD 5
Spell Word	INSERT+NUM PAD 5 pressed twice quickly
Say Prior Word	INSERT+LEFT ARROW
Say Next Word	INSERT+RIGHT ARROW
Say Line	INSERT+UP ARROW
Say Prior Line	UP ARROW
Say Next Line	DOWN ARROW
Say Sentence	ALT+NUM PAD 5
Say Prior Sentence	ALT+UP ARROW
Say Next Sentence	ALT+DOWN ARROW
Say Paragraph	CTRL+NUM PAD 5
Say Prior Paragraph	CTRL+UP ARROW
Say Next Paragraph	CTRL+DOWN ARROW
Say to Cursor	INSERT+HOME
Say from Cursor	INSERT+PAGE UP
Say All	INSERT+DOWN ARROW
Say Color	INSERT+5
Say Font	INSERT+F

For Temporarily Changing Voice Rate

During SayAll:

Increase Voice Rate	PAGE DOWN
Decrease Voice Rate	PAGE UP

When not in SayAll:

Increase Voice Rate	ALT+CTRL+PAGE DOWN
Decrease Voice Rate	ALT+CTRL+PAGE UP
Restore Normal Voice Settings	INSERT+ESC

Informational:

Interrupt Speech	CTRL
Say Window Title	INSERT+T
Say Window Prompt and Text	INSERT+TAB
JAWS Find	CTRL+INSERT+F

JAWS Find Next	**INSERT+F3**
Say Top Line of Window	**INSERT+END**
Say Bottom Line of Window	**INSERT+PAGE DOWN**
Say Selected Text	**INSERT+SHIFT+DOWN ARROW**
Get Application Version	**CTRL+INSERT+V**

<u>For Cursors:</u>

PC Cursor	**NUM PAD PLUS**
JAWS Cursor	**NUM PAD MINUS**
Route PC Cursor to **JAWS** Cursor	**INSERT+NUM PAD PLUS**
Route **JAWS** Cursor to PC Cursor	**INSERT+NUM PAD MINUS**
Left Mouse Button	**NUM PAD SLASH**
Right Mouse Button	**NUM PAD STAR**
Drag and Drop	**CTRL+INSERT+NUM PAD SLASH**
Restrict **JAWS** Cursor	**INSERT+R**

<u>For Dialogs:</u>

Say Default Button of Dialog Box	**INSERT+E**
Read Box in Tab Order	**INSERT+B**
Read Word in Context	**INSERT+C**
Say Current Control Hot Key	**SHIFT+NUM PAD 5**
Open Combo Box	**ALT+DOWN ARROW**
Close Combo Box	**ALT+UP ARROW**

<u>For Help:</u>

Screen Sensitive Help	**INSERT+F1**
Keyboard Help	**INSERT+1**
JAWS Help for Applications	**INSERT+F1 pressed twice quickly**
Hot Key Help	**INSERT+H**
Window Key Help	**INSERT+W**

<u>Miscellaneous:</u>

JAWS Window	**INSERT+J**
Refresh Screen	**INSERT+ESCAPE**
Adjust **JAWS** Verbosity	**INSERT+V**
Run **JAWS** Manager	**INSERT+F2**
Shut Down **JAWS**	**INSERT+F4**
Minimize All Applications	**WINDOWS KEY+M**
Window List Dialog	**INSERT+F10**
Select a System Tray Icon Dialog	**INSERT+F11**
Say System Time	**INSERT+F12**

Graphics Labeler	**INSERT+G**
AutoGraphics Labeler	**CTRL+INSERT+G**
Pass Key Through	**INSERT+3**

For Frames

Frame Get Top Left	**CTRL+SHIFT+LEFT BRACKET**
Frame Get Bottom Right	**CTRL+SHIFT+RIGHT BRACKET**
Frame Set to Window	**CTRL+SHIFT+LEFT BRACKET** **Pressed twice quickly**

Appendix 13: JAWS Manuals for Laptop

LAPTOP KEYSTROKES

For Reading Text:

Say Character	CAPS LOCK+COMMA
Say Prior Character	CAPS LOCK+M
Say Next Character	CAPS LOCK+PERIOD
Say Word	CAPS LOCK+K
Spell Word	CAPS LOCK+K pressed twice quickly
Say Prior Word	CAPS LOCK+J
Say Next Word	CAPS LOCK+L
Say Line	CAPS LOCK+H
Say Prior Line	CAPS LOCK+Y
Say Next Line	CAPS LOCK+N
Say Sentence	CAPS LOCK+I
Say Prior Sentence	CAPS LOCK+U
Say Next Sentence	CAPS LOCK+O
Say Paragraph	CAPS LOCK+CTRL+I
Say Prior Paragraph	CAPS LOCK+CTRL+ U
Say Next Paragraph	CAPS LOCK+CTRL+ O
Say to Cursor	CAPS LOCK+SHIFT+J
Say from Cursor	CAPS LOCK+SHIFT+L
Say All	CAPS LOCK+A
Say Color	CAPS LOCK+5
Say Font	CAPS LOCK+F

For Temporarily Changing Voice Rate

During SayAll:

Increase Voice Rate	PAGE DOWN
Decrease Voice Rate	PAGE UP

When not in SayAll:

Increase Voice Rate	ALT+CTRL+PAGE DOWN
Decrease Voice Rate	ALT+CTRL+PAGE UP
Restore Normal Voice Settings	CAPS LOCK+ESC

Informational:

Interrupt Speech	CTRL
Say Window Title	CAPS LOCK+T
Say Window Prompt and Text	CAPS LOCK+TAB
JAWS Find	CAPS LOCK+CTRL+ F
JAWS Find Next	CAPS LOCK+F3
Say Top Line of Window	CAPS LOCK+SHIFT+Y

Say Bottom Line of Window	**CAPS LOCK+SHIFT+N**
Say Selected Text	**CAPS LOCK+SHIFT+A**
Get Application Version	**CAPS LOCK+CTRL+ V**

For Cursors:

PC Cursor	**CAPS LOCK+SEMICOLON**
JAWS Cursor	**CAPS LOCK+P**
Route PC Cursor to **JAWS** Cursor	**CAPS LOCK+APOSTROPHE**
Route **JAWS** Cursor to PC Cursor	**CAPS LOCK+LEFT BRACKET**
Left Mouse Button	**CAPS LOCK+8**
Right Mouse Button	**CAPS LOCK+9**
Left Mouse Button Lock	**CTRL+8**
Drag and Drop	**CAPS LOCK+CTRL+ 8**
Restrict **JAWS** Cursor	**CAPS LOCK+R**

For Dialogs:

Say Default Button of Dialog Box	**CAPS LOCK+E**
Read Box in Tab Order	**CAPS LOCK+B**
Read Word in Context	**CAPS LOCK+C**
Say Current Control Hot Key	**CAPS LOCK+SHIFT+COMMA**
Open Combo Box	**ALT+DOWN ARROW**
Close Combo Box	**ALT+UP ARROW**

For Help:

Screen Sensitive Help	**CAPS LOCK+F1**
Keyboard Help	**CAPS LOCK+1**
JAWS Help for Applications	**CAPS LOCK+F1 pressed twice**
quickly	
Hot Key Help	**CAPS LOCK+H**
Window Key Help	**CAPS LOCK+W**

Miscellaneous:

JAWS Window	**INSERT+J**
Refresh Screen	**CAPS LOCK+ESCAPE**
Adjust **JAWS** Verbosity	**CAPS LOCK+V**
Run **JAWS** Manager	**CAPS LOCK+F2**
Shut Down **JAWS**	**CAPS LOCK+F4**
Minimize All Applications	**WINDOWS LOGO KEY+M**
Window List Dialog	**CAPS LOCK+F10**
Select a System Tray Icon Dialog	**CAPS LOCK+F11**
Say System Time	**CAPS LOCK+F12**
Graphics Labeler	**CAPS LOCK+G**
AutoGraphics Labeler	**CAPS LOCK+CTRL+ G**

Pass Key Through   **CAPS LOCK+3**

For Frames
Frame Get Top Left   **CTRL+SHIFT+LEFT BRACKET**
Frame Get Bottom Right   **CTRL+SHIFT+RIGHT BRACKET**
Frame Set to Window   **CTRL+SHIFT+LEFT BRACKET**
                                          Pressed twice quickly

Appendix 14: JAWS Manuals for Windows

WINDOW KEYSTROKES

General:
Get Help	**F1**
Open the Start menu	**WINDOWS LOGO KEY or CTRL+ESC**
Open Windows Explorer	**WINDOWS LOGO KEY+E**
Open Run Dialog	**WINDOWS LOGO KEY+R**
Find File or Folder from Desktop	**F3**
Minimize All Applications	**WINDOWS LOGO KEY+M**
Switch between open applications	**ALT+TAB**
Quit the active application	**ALT+F4**

For Windows and Menus
Open the application control menu	**ALT+SPACE BAR**
Move to the Menu bar in application	**ALT**
Choose a Menu item	**ENTER**
Move between menus	**ALT, ARROW KEYS**
Cancel or close a menu	**ESC**
Cancel or close a cascading menu	**ALT**
Open a child window control menu	**ALT+DASH**
Close a child window	**CTRL+F4**
Open the applications menu	**APPLICATIONS KEY or SHIFT+F10**

For Dialogs:
Move through dialog controls	**TAB**
Move backward through dialog controls	**SHIFT+TAB**
Move to another page	**CTRL+TAB**
Reverse direction through pages	**CTRL+SHIFT+TAB**
Move to first item	**HOME**
Move to last item	**END**
Select or deselect in list view	**SPACEBAR OR CTRL+SPACEBAR**
Toggle a check box on/off	**SPACEBAR**

For Reading Text
Move One Character Left	**LEFT ARROW**
Move One Character Right	**RIGHT ARROW**
Move One Word Left	**CTRL+LEFT ARROW**
Move One Word Right	**CTRL+RIGHT ARROW**
Move to Beginning of Line	**HOME**
Move to End of Line	**END**

Move One Paragraph Up	**CTRL+UP ARROW**
Move One Paragraph Down	**CTRL+DOWN ARROW**
Scroll up one screen	**PAGE UP**
Scroll down one screen	**PAGE DOWN**
Move to beginning	**CTRL+HOME**
Move to end	**CTRL+END**

For Editing Text:

Copy	**CTRL+C**
Cut	**CTRL+X**
Paste	**CTRL+V**
Undo	**CTRL+Z**
Delete current character	**DELETE**
Delete prior character	**BACKSPACE**
Select One Character Left	**SHIFT+LEFT ARROW**
Select One Character Right	**SHIFT+RIGHT ARROW**
Select One Word Left	**CTRL+SHIFT+LEFT ARROW**
Select One Word Right	**CTRL+SHIFT+RIGHT ARROW**
Select to Beginning of Line	**SHIFT+HOME**
Select to End of Line	**SHIFT+END**
Select to beginning	**CTRL+SHIFT+HOME**
Select to end	**CTRL+SHIFT+END**
Select All	**CTRL+A**

For Windows Explorer:

Delete files	**DELETE**
Rename a file or folder	**F2**
Open Properties for	
Selected File or Folder	**ALT+ENTER**
Refresh a window	**F5**
Switch between windows	**F6 or TAB**
Go to a folder	**CTRL+G**
Go up one level	**BACKSPACE**

Appendix 15: Questionnaires for St. John's Students

PRE-TEST QUESTIONNAIRE
Web Application for Disabled Users

1) Have you had any experience using the web which is especially designed for the disabled users?

    ☐   Yes

    ☐   No

2) How do you find the interface?

    ☐   Effective

    ☐   Not Effective

    ☐   Others:_____

3) Does the information or the help provided is enough for your own view?

    ☐   Yes

    ☐   No

4) If Yes, how is the information or help is suffice?

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5) If Not, how is the information or help does not suffice?