Navigation and Learning in Electronic Texts

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Table of Contents – Volume 2

Appendix 2.1. Illustrations of different types of navigation aids.

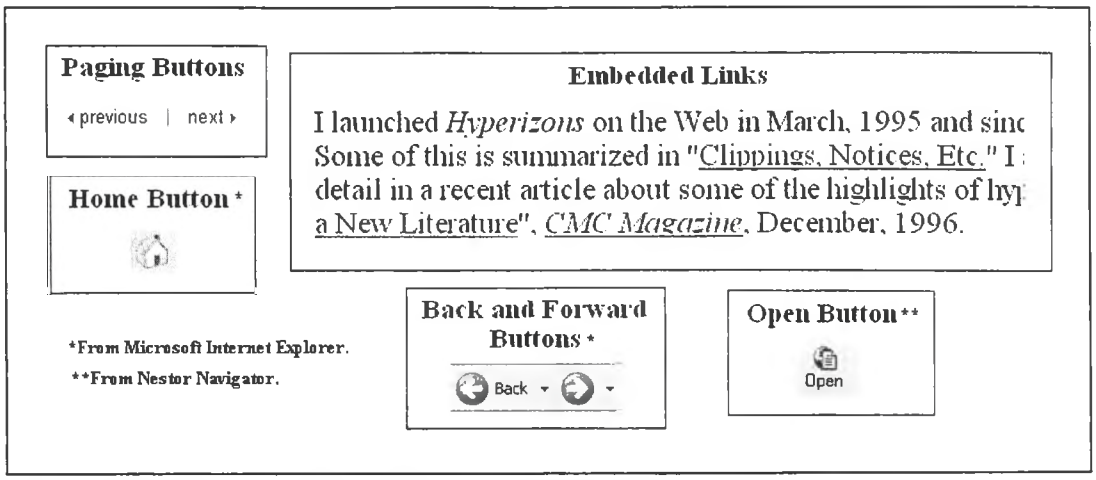


Figure 1. Illustrations of examples of singular navigation aids (all are static).

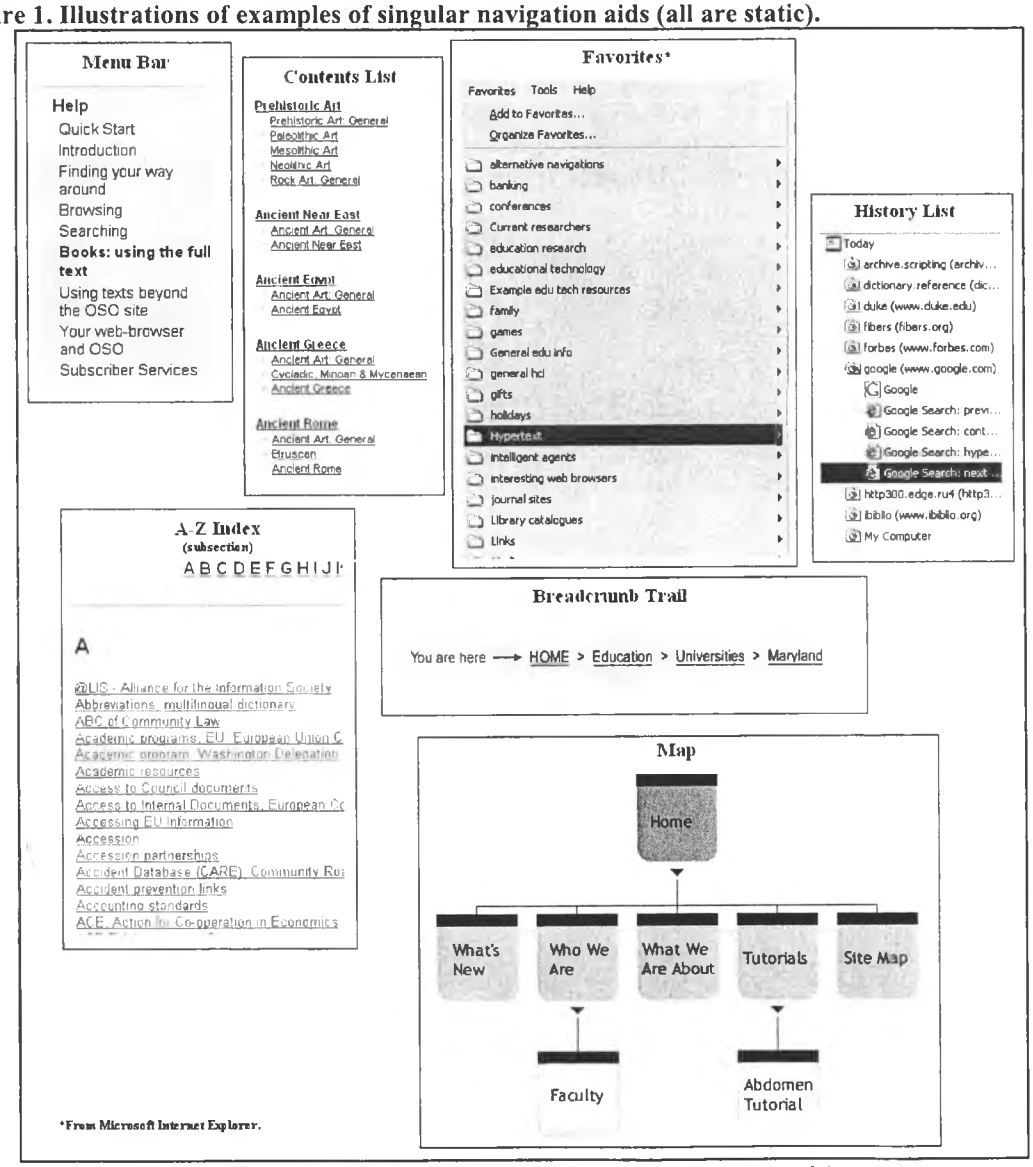


Figure 2. Illustrations of examples of aggregate navigation aids (all are static).

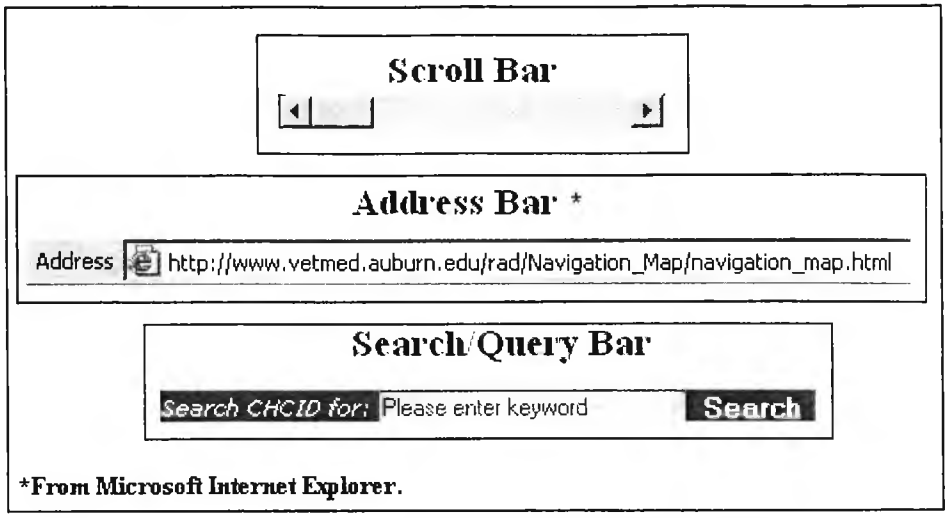


Figure 3. Illustrations of some examples of singular dynamic navigation aids.

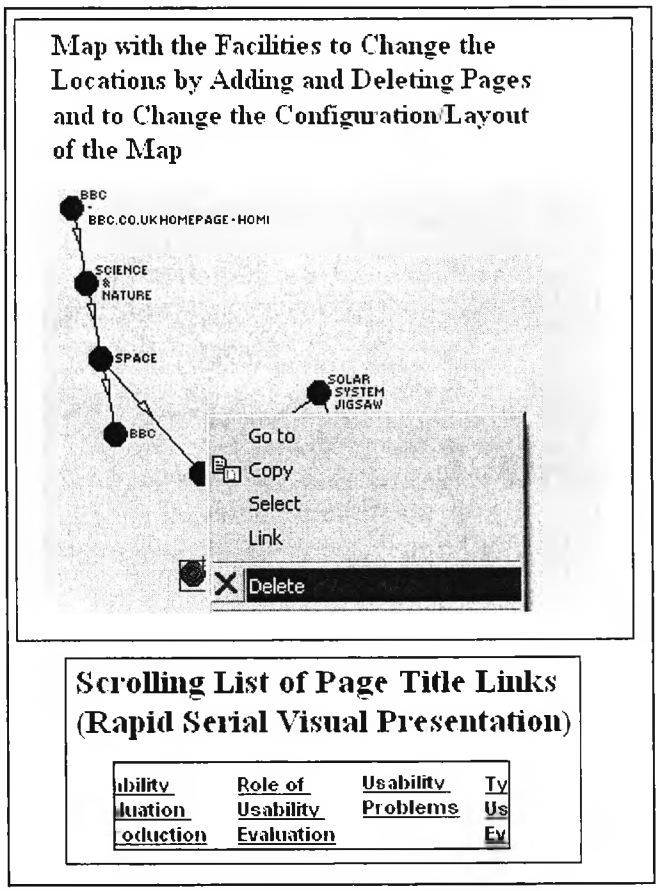


Figure 4. Illustrations of examples dynamic aggregate navigation aids.

Appendix 4.1 The Usability Evaluation Text used in experiments 1, 2 and 3.

N.B. The text is presented here in a linear format as in the paging buttons condition in experiment 1.

Usability

Usability, according to the ISO definition, is 'the *effectiveness*, *efficiency*, and *satisfaction* with which specified users achieve specified goals in particular environments'. Usability is about the utility of a system, how well users' tasks are supported and how easy the system is to learn and use. Because usability is so important to whether a system is accepted and ultimately used by people, it is helpful to have some way of evaluating the level to which a system is usable and ways that the system can be improved.

Usability Evaluation- Introduction

These electronic text materials aim to give you an overview of usability evaluation and a sample of different forms of usability evaluation techniques.

Usability evaluation is the assessment of usability and may be employed to ascertain the usability of either a design or a finished product. It is about determining whether a system does what we want it to do and whether requirements have been met. Usability evaluation can be used to identify usability problems and/or to determine some measure of usability.

Usability evaluation has a central role in an iterative design process. There are two main approaches to usability evaluation, formative evaluation and summative evaluation. Which approach is used depends on when the usability evaluation is performed and the goals of the evaluation.

The usability evaluation techniques to be presented here are observational evaluation and expert reviews. However, it should be noted there are other techniques that may be used in usability evaluations.

Role of Usability Evaluation

In the context of a user centred design process, usability evaluation is a central activity that can occur at any and all stages of the design process. It can be used to test the usability and functionality of a system and may lead and drive entire design activities.

It can take place in the controlled environment of a laboratory and/or in the more natural setting of a field environment, as well as taking place with or without user involvement. The overall aim of this process is to encourage the development of more usable products. This should be kept in mind when making decisions about how to employ the techniques presented in these materials.

Usability Problems

A usability problem is any aspect of the user interface that reduces the level of usability for a user. In other words, it may be any aspect of a system that could be changed to bring about an improvement in usability.

Types of Usability Evaluation

There are two main ways that usability evaluation can be employed.

Formative evaluation is an approach used to assess usability throughout the design process where the results of the evaluation feed back into design. The focus of formative evaluation is on product improvement, and techniques for formative evaluation centre around identifying usability problems.

Summative evaluation, in contrast, is usually performed on final design solutions at the end of the design process to measure the usability of a final product. The results of summative evaluations can then be used in comparisons against metrics or standards, such as those set by the British Standards Institute (BSI). Other uses of the results include benchmarking and quality assurance.

The information presented in these materials will concentrate on techniques used in formative evaluation. However, it must be noted that **the techniques presented here may also be applied in summative evaluations**, although when applied in this way their focus and their use may be slightly different.

Observational Evaluation- Introduction

Observational evaluation involves observing users interacting with either early prototypes, such as paper mock-ups, or higher fidelity software-based prototypes. It can occur in a laboratory setting or in the user's natural environment. Observational evaluation is an empirical approach that when supplemented with interviews or questionnaires may also be referred to as *usability testing* or *user testing*.

A typical method for formative observational evaluations focuses on identifying usability problems and diagnosing why these problems occur.

Observational evaluations lead to rich data about users' interactions with a system, giving this technique several advantages and disadvantages.

Observational Evaluation- Method

The following steps represent a typical method for the use of observations in formative usability evaluation.

1. Select 'representative' users.
2. Administer a pre-test.
3. Ask the users to complete a set of predetermined typical, or critical, tasks with the system.
4. As they complete these tasks users are typically asked to 'think aloud'. This is where they say what they think is happening, why they make an action and describe what they are trying to do. This is known as giving concurrent verbal protocols.
5. Record the interaction between the user and the system. This can be done in several ways: pen and paper, audio recording, video recording, user notebooks and computer logging.
6. Conduct a post-task interview or questionnaire.
7. The information is then analysed for usability problems and suggestions for redesign.

Generally in observational evaluations the evaluator does not intervene, although there are variants on this such as co-operative evaluation (Monk et al, 1993).

Observational Evaluation- Data Analysis

Observational evaluations commonly yield both quantitative and qualitative data. Quantitative data refers to numerical data that can be quantified. The term 'qualitative data' is used to refer to categorical data, or verbal or narrative data.

Quantitative data may be collected from computer logging tools that can record information about task completion times, errors, and the aspects of the interface that were used. This data can be statistically analysed and may give pointers to usability problems. For example, it might be found that users spend a long time completing a particular task on a website. This might indicate that there is a usability problem, or problems, in areas of the website associated with that task.

However, in formative observational evaluations the most useful data tends to be qualitative, since qualitative data tends to give more information about the nature of particular usability problems and leads more directly to redesign solutions.

Qualitative data from observations, such as verbal protocols, audio transcripts, video data, or post-task interviews, may be analysed through categorisation. These analyses can be performed at different levels of detail, from fine-grained analyses where single words, phrases and utterances are examined, or at higher levels where the analyst looks for patterns or critical incidents.

Critical incidents during observations might include silences or incidents when users are obviously stuck. These critical incidents may give indicators of usability problems.

Another approach to categorising qualitative data is content analysis. This is where researchers categorise data into meaningful, mutually exclusive categories. Comparing analyses of the same data done by two or more separate evaluators, using the given categorisation, may be used to check the reliability of a given categorisation.

Observational Evaluation- Advantages

As Dix et al (1998) point out, observational evaluations at their simplest level have the advantage of requiring little expertise to perform and may provide useful insight into the way a system is used and problems that may occur with it. They can yield rich data about the users interactions with the system.

Observational evaluations also have the advantage of using real end-users and therefore identify real user problems.

Observational Evaluation- Disadvantages

A disadvantage of observational evaluations is that the data may be subjectively analysed by evaluators. Data may also be selective, depending on the tasks observed. Also, the cost of performing observational evaluations can potentially be quite high and data analysis can be time consuming.

Another disadvantage is that the process of observation can change the way that people perform tasks, leading to a biased view. Thinking aloud whilst performing a task may interfere with the way the task is performed and may alter the way that the user behaves. This change is particularly significant to measures such as task completion times.

Expert Reviews- Introduction

An alternative to performing usability evaluations with real users is to get experts to identify usability problems. Examples of these expert review techniques, or expert evaluations, include heuristic evaluations and cognitive walkthroughs. When performing expert reviews, experts predict the ways that a system might be used and the problems that users might encounter.

According to Preece et al (2002) the best experts have expertise in interaction design as well as the product domain. Expert review techniques may be employed at any stage of the design lifecycle, including early prototypes, such as paper prototypes.

Heuristic Evaluation- Introduction

A heuristic is a 'rule of thumb', or general principle, that may be used to guide a design decision or to critique an existing design (Dix et al, 1998). Heuristic evaluation involves examining how well a system conforms to a set of heuristics. It can be used to assess early designs as well as fully working systems.

Heuristic evaluation is a method performed by expert evaluators for identifying problems with designs and suggesting improvements to a design. The technique was developed by Nielsen and colleagues (e.g. Molich and Nielsen, 1990).

Nielsen's heuristics were refined from an earlier set through the factor analysis of 249 usability problems and they can be used in a typical method for heuristic evaluation. However, as noted by Preece et al (2002), this set of core heuristics may be too general for some products and there is a need to create more tailored heuristics for specific applications such as websites, mobile devices, computerised toys and educational software. Brink et al (2002), for example, presented a set of principles that were specifically about usability for the web, including guidelines about 'Speed' and 'Navigation'. These issues are not given special attention in Nielsen's recommended heuristics.

As compared to other evaluation techniques, the employment of heuristics in usability evaluation has several advantages, as well as disadvantages.

Heuristic Evaluation- Jakob Nielsen's 10 Heuristics

The recommended 10 heuristics are:

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, rather than using system-oriented terms. Information should appear in a natural and logical order.

3. User control and freedom- Give clearly marked exits. 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.

Heuristic Evaluation- Method

The following steps represent a typical method for the use of heuristic evaluation in formative usability evaluation.

1. Preparation. This involves creating a prototype, selecting evaluators and preparing a coding sheet to record usability problems.
2. Select part of the interface to evaluate. In some cases it might be appropriate or necessary to inspect the entire interface. However, a simpler alternative is to select typical tasks that users would be expected to perform with the system. These tasks should be explicitly expressed in terms of the user's goal. For example, when using an online banking system a typical user task might be to 'check account balance'.
3. Conduct the evaluation. Evaluators go through each of the tasks in turn. At each stage of a task they ask themselves whether the interface complies with the heuristics. Any problems identified may be recorded on a coding sheet detailing what the problem is, where it occurred on the interface, how severe the problem is, and which heuristic is violated.
4. The information from the evaluation can then be analysed.

Heuristic Evaluation- Analysis

After the heuristic evaluation is completed evaluators should examine the problems they identified. For example, they may group problems and create a list of the top ten most serious usability problems.

Nielsen's 10 heuristics can be used by several evaluators to come up with usability problems. Nielsen's research has found that the work of about 5 evaluators usually results in the identification of 75% of usability problems.

From these problems evaluators may suggest how the evaluated system may be improved through re-design.

Heuristic Evaluation- Advantages

Heuristic evaluation is explicitly intended as a 'discount usability engineering' method because it is relatively quick, cheap and easy to perform and can be useful when access to real users is difficult. It is quick for experts to learn and has few practical issues. Typical users can also be taught heuristic evaluation, but there have been claims that this is not very successful (Nielsen, 1994).

Heuristic evaluation may be a rich source of comments about usability problems. It also has the advantage that the expert evaluators can suggest solutions to the usability problems identified.

Heuristic Evaluation- Disadvantages

Heuristic evaluations may miss problems (Karat, 1994). Experts are not real users and may have biases.

False alarms are also an issue for the effectiveness of heuristic evaluation. This is where experts predict problems that are not real problems for end users. Bailey (2001), cited in Preece et al (2002), refers to work from published sources implying that about 43% of the usability problems identified by experts were not problems at all! Preece et al suggest that this signifies the importance of using complementary techniques and that heuristic evaluation should not be thought of as a replacement for user testing.

Cognitive Walkthrough- Introduction

Cognitive walkthrough is another form of the expert review approach. It provides an alternative technique to heuristic evaluation for predicting users' problems without user testing. It attempts to bring psychological theory into the evaluation process, and has advantages and disadvantages.

The method involves the detailed review of a sequence of actions that users have to perform to complete a given task. The expert simulates a user's problem solving process to see whether user's goals and memory for actions can be expected to lead to the next correct action (Preece et al, 2002).

The main focus of this type of evaluation is to check how easy it is to learn how to use a system through exploration. The user interface is often presented in the form of a paper mock-up, working prototype or design specification, but it can also be a fully developed interface. Cognitive walkthrough is a method for formative evaluations and the results are fed-back into design.

Cognitive Walkthrough- Method

Preece et al (2002) suggest the following steps when undertaking a cognitive walkthrough:

1. Identify characteristics of typical users, develop sample tasks and develop a description/prototype of the interface. Identify a clear sequence of actions required for a user to complete a task using the prototype interface.
2. A designer and one or more experts perform the walkthrough.
3. The evaluators walk through the action sequences for each task within the context of a typical user scenario. As they do this they try to answer the following questions:
   - Will the correct action be sufficiently evident?
   - Will users notice that the correct action is available?
   - Will users associate and interpret the response from the action correctly?

   Negative answers to these questions indicate a usability problem. These can be recorded on a separate sheet and should include details of the system, version number, date, the names of the evaluators, and the severity of the usability problem (how likely it is to occur and how serious the problem is for users).
4. Critical information is compiled during the walkthrough. This includes usability problems, assumptions about what causes problems, explanations of why users would face difficulties, notes about issues and design changes, and a summary of the results.
5. The results of the evaluation can then be analysed and the design is revised to fix the problems presented.

Cognitive Walkthrough- Analysis

After the walkthrough has been completed evaluators should examine the problems they identified. For example, they may group problems and create a list of the top ten most serious usability problems.

From these problems evaluators may suggest how the evaluated system can be improved through re-design.

Cognitive Walkthrough- Advantages

Using a cognitive walkthrough technique in formative usability evaluation is advantageous in that it encourages evaluators to focus on user's problems in detail without the need for users to be present.

Like other forms of expert reviews, cognitive walkthroughs have the advantage of being cheap to perform (as compared to usability testing), and are useful when access to real users is difficult.

Cognitive Walkthrough- Disadvantages

Compared to heuristic evaluations, cognitive walkthroughs are more costly to perform and can be time consuming and labour intensive. Whereas its focus on learning by exploration may be beneficial to some types of system this may be too narrow, or inappropriate, for other systems.

Like heuristic evaluation, cognitive walkthroughs suffer from problems due to expert biases. There are problems of false alarms where experts identify problems that are not actually real user problems. Also, expert evaluators may miss real user problems.

References

Brink, T., Gergle, D. & Wood (2002). Usability For The Web- Design Web Sites That Work. London: Academic Press.

Dix, A., Finlay, J., Abowd, G. & Beale, R. (1998). *Human Computer Interaction*. 2nd Addition. London: Prentice Hall.

Karat, C. M. (1994). A comparison of user interface evaluation methods. In J. Nielsen & R. L. Mack (Eds.), *Usability Inspection Methods*, New York: John Wiley & Sons.

Molich, R., and Nielsen, J. (1990). Improving a human-computer dialogue, *Communications of the ACM* **33**, 3 (March), 338-348.

Nielsen, J. (1994). Heuristic evaluation. In Nielsen, J., and Mack, R.L. (Eds.), *Usability Inspection Methods*, New York: John Wiley & Sons.

Preece, J., Rogers, Y. & Sharp, H. (2002). *Interaction Design- Beyond Human Computer Interaction*. New York: John Wiley & Sons.

Monk, A., Wright, P., Haber, J., & Davenport, L. (1993). *Improving your human-computer interface: a practical technique,* Hemel Hempstead, Hertfordshire, UK: Prentice Hall.

Appendix 4.2 The experimental script for experiments 1 and 2.

Experimental Script

Pre-checks

- Pack contents
  - Task1- pretest.
  - Task 2- training.
  - Task 3.
  - Task 4- ownership questionnaire.
  - Task 5- Report + paper.
  - Task 6- Concept maps + paper.
- Pencils, rubbers.
- Clear IE history.
- Open training materials from **C** drive.
- Check materials are from **C**.
- Only Nestor open.
- Check Nestor browser toolbar is clear.
- Check Nestor browser window is fully maximised.
- VHS, camera all turned on.

Intro

- I will be reading from my notes to make sure I remember everything and that I keep everything consistent.
- I'm doing a study investigating factors that affect the way that people use electronic texts.
- We're going to run through six tasks. The entire session should take about 2 hours.
- Do you have any questions?

Administer consent form

Pre-test and Demographic Questionnaire

First of all I'd like you to complete a pre-test questionnaire. Don't worry if you don't know the answer to some of the questions- you are not expected to. It is not a test of your abilities, it is just to find out about your background knowledge. If you don't know the answer just write 'N/A'.

Training Task

- Open Nestor
- These are some training materials- they are just to give you a chance to use some electronic texts.
- Have a quick read through and tell me if you have any questions.
- You have 10 minutes to read through the training sheet and explore the materials.

- Think aloud.
  - I want you to think aloud as you explore the materials- that is- say any thoughts or reactions that come to mind as you work. If you remain silent for a while then I may occasionally prompt you to start speaking again.

- Your start time is……., you have 10mins, your stop time is……..

After training...

Experiment 1

Paging buttons condition

- Are you happy with:
  - Next and previous buttons
    - Colour changes
  - Scroll bar.

Embedded links condition

- Are you happy with:
  - Embedded links- colour changes
  - Back button
  - Scroll bar
  - Please don't press back on the first page. If you do press back on p1 then slide window and click on map home page

A-Z condition

- Are you happy with:
  - A-Z index
    - Notice strict alphabetical order?
    - Accessing pages using page bullet
  - Scroll bar- only really need to use the one on the text window
  - Window divider- use it if you want to see more of the text, please only use that particular divider.
  - Bag and bin- these are just part of the program- don't worry about them

Map condition

- Are you happy with:
  - Map
    - Accessing pages using page bullet
  - Scroll bar- only really need to use the one on the text window.
  - Window divider- use it if you want to see more of the text, please only use that particular divider
  - Bag and bin- these are just part of the program- don't worry about them

Experiment 2

Using map condition

- Are you happy with:
  - Map
    - Accessing pages using page bullet
  - Scroll bar- only really need to use the one on the text window
  - Window divider- use it if you want to see more of the text Please only use that particular divider
  - Bag and bin- these are just part of the program- don't worry about them
  - Please don't press back on the first page. If you do press back on p1 then slide window and click on map home page

Creating map condition

- Are you happy with:
  - Creating Map
    - Accessing pages using page bullet
    - Moving pages into position
  - Embedded links- colour changes
  - Back button
  - Scroll bar- only really need to use the one on the text window.
  - Window divider- use it if you want to see more of the text, please only use that particular divider
  - Bag and bin- these are just part of the program- don't worry about them

Using A-Z condition

- ❑ Are you happy with:
  - A-Z
    - Accessing pages using page bullet
    - Strict alphabetical order
  - Embedded links- colour changes
  - Back button
  - Scroll bar- only really need to use the one on the text window
  - Window divider- use it if you want to see more of the text, please only use that particular divider.
  - Bag and bin- these are just part of the program- don't worry about them
  - Please don't press back on the first page. If you do press back on p1 then slide window and click on map home page

Using contents list condition

- ❑ Are you happy with:
  - Content List
    - notice logical order
    - Accessing pages using page bullet
  - Scroll bar- only really need to use the one on the text window.
  - Window divider- use it if you want to see more of the text, please only use that particular divider
  - Bag and bin- these are just part of the program- don't worry about them
  - Please don't press back on the first page. If you do press back on p1 then slide window and click on map home page

- ❑ Any questions?

- ❑ CLOSE TRAINING MATERIALS.

---------- Quick break?----------

Task using the electronic text

- ❑ Please have a quick read through the task information sheet and tell me when you have finished reading.

- ❑ PRESS RECORD ON CAMERA
- ❑ PRESS RECORD ON VHS

- ❑ Open materials from **C drive**.
- ❑ Check it is open from **C drive**.

- ❑ Do you have any questions?

- ❑ You will be given some electronic text materials on usability and usability evaluation.

- ❑ This information is very relevant to the module you are taking.

- ❑ I would like you to use the information in these materials to choose a usability evaluation technique or combination of techniques that are appropriate for this setting.

- ❑ For creating map, creating A-Z and creating contents list conditions:

  - ❑ You're also asked to create a map/A-Z/contents list of the pages in the materials, you can add links, delete links, delete page bullets and rearrange the pages.

- ❑ When you have finished I would like you to explain your decision and say why you have chosen a technique, or combination of techniques, over the other ones in the materials.

- ❑ Think aloud.
  - ❑ Again, as you use the electronic text materials, I would like you to think aloud. So, say any thoughts or reactions that come to mind as you work. If you remain silent for a while, I may occasionally prompt you to start speaking again.

- ❑ Please do not take notes.

- I'm not supposed to talk to you or answer your questions once we have started...
- But, if you get into any major difficulties using the electronic texts let me know.
- Do you have any questions?
- Now it's Xtime. Your start time is.... And you have 45 minutes so your stop time is.... (fill in on sheet). Go ahead...

Prompts
- What are you doing now?
- Why are you doing that?
- Why did you just do that?
- [End of task] Please explain your decision.

- STOP CAMERA AND VHS

Ownership Questionnaire

- Close the materials.
- Here is a questionnaire to complete. Please respond according to your first reaction to each question. Let me know when you have completed the questionnaire.

Written Transfer Task

- Please have a quick read through the task information sheet and tell me when you have finished reading.
- Do you have any questions?
- This is similar to the previous task. I would like you to choose a usability evaluation technique (or combination) for this setting and write a report explaining your decision. Please include the following information:
  - what usability evaluation is
  - brief details of each of the techniques presented in the materials
  - an explanation of why or why not each technique is/is not suitable for the given context
  - conclude with your selected technique(s) and give a brief description of how they will be employed
- Do your best, but remember this is not a test of your personal abilities.
- Now it's ... time. Your start time is.... And you have 30 minutes so your stop time is.... (fill in on sheet). Go ahead...

Concept mapping task

- Last task. Here's the information sheet, please have a quick read through it.
- Do you have any questions?
- I would like you to draw a concept map on usability and usability evaluation techniques from the info you can remember from the materials.
- Do your best but remember it is not a test of your personal abilities.
- Do you have any questions?
- Now it's ... time. Your start time is.... And you have 10 minutes so your stop time is.... (fill in on sheet). Go ahead...

De-briefing

OK! This is the end of the study. Thanks very much for your participation!!!

When I write a report of the studies I can send you a copy.

The overall aim of the study is to look at the way people use electronic text materials with different navigation aids.

Please don't discuss this study with any of your classmates until after your lecture on usability evaluation.

Appendix 4.3 The demographic questionnaire and pre-test for experiments 1, 2 and 3.

Note: the formatting is slightly different here to the original questionnaire e.g. the space allocated for responses to questions has been reduced here to save space.

Please complete the following questionnaire. Your responses are anonymous. The purpose of this questionnaire is to find out about your background and knowledge of usability evaluation. This is not a test of your abilities.

1. About You

Participant number: _____

1.1. Age (circle as appropriate): under 18 18-29 30-39 40-49 50 or over

1.2. Gender (circle as appropriate): female male

1.3. Previous Educational Attainment (circle as appropriate):

GCSE

A' Level

Bachelor's degree
Please give title_____

Postgraduate qualification
Please give title_____

1.4. If studying at present, please give programme title (e.g. BSc Computer Science).

_____

1.5. Work experience

Please give the job title and type of organisation for your 2 most recent work experiences:

1. _____
_____

2. _____
_____

1.6. Have you ever taken a web design course (circle as appropriate)? Yes No

If yes, were usability issues given any attention (circle as appropriate)?

Little attention Some attention Great attention

1.7. Have you ever taken an HCI course before (circle as appropriate)?Yes No

If yes, please give details of the circumstances: _____
_____
_____

1.8. Have you ever conducted a usability evaluation (circle as appropriate)? Yes No

If yes please give details of the circumstances: _____
_____

1.9. Have you ever been an experimental participant in a psychological or HCI related experiment (circle as appropriate)? Yes No

If yes, how many times have you been an experimental participant? _____

2. Computer experience

2.1. How long have you used computers (circle as appropriate)?

under 1 year 1-3 years 4-5 years over 5 years

2.2. Which operating system(s) do you use regularly (circle as appropriate)?

DOS Windows Mac Unix Other _____

2.3. How long have you used the web/internet (circle as appropriate)?

under 1 year 1-3 years 4-5 years over 5 years

2.4. How often do you use the web/internet (circle as appropriate)?

daily weekly monthly rarely

2.5. Which web browser(s) do you regularly use (circle as appropriate)?

Netscape Internet Explorer Other _____

3. Knowledge of Usability Evaluations

Please answer the following questions on usability and usability evaluation. If you do not know the answer to a particular question just write 'N/A'. Note that this is not an exam, the purpose is to find out about your background knowledge.

3.1. What is usability?

3.2. What is a usability problem?

3.3. What is the purpose of usability evaluation?

3.4. What is formative usability evaluation?

3.5. What is summative usability evaluation?

3.6. List as many usability evaluation techniques as you can.

3.7. Give brief details of the techniques you have listed and how they might be used in formative usability evaluations.

Appendix 4.4 The training instructions for conditions in experiments 1 and 2.

EXPERIMENT 1 – PAGING BUTTONS CONDITION

Training materials: The American Museum in Britain

The purpose of these training materials is to give you a chance to use some electronic text materials. The materials contain information about the American Museum in Britain.

You have 10 minutes to read through this training information and explore the materials. As you read and browse through the electronic text materials, I would like you to think aloud. This means saying any thoughts or reactions that come to mind as you work. If you remain silent for a while, I may occasionally prompt you to start speaking again.

If you have any questions please ask the experimenter.

Your start and stop times will be shown below (to be completed by the experimenter):

Start time_____ Stop time_____

How to use the materials

1. Text about the museum is presented in the browser window. You can move from one page to another using the paging buttons: the 'NEXT' and 'PREVIOUS' buttons (see figure 1). These are located at the bottom of each page. 'NEXT' takes you to the next page in the materials. 'PREVIOUS' takes you the previous page in the materials. Once you have already visited a page the paging buttons that link to that page will change colour. Please practice accessing pages using the paging buttons.

2. If the text goes off the bottom of one screen you can scroll down to see the remainder of the text using the scroll bar on the right hand side of the screen (see figure 1). Try this out on the 'Main Collection' page of the materials.

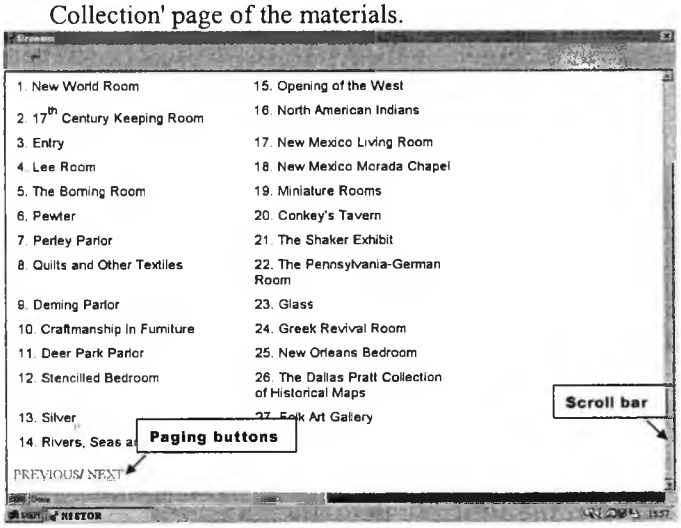


Figure 1 - The Nestor Browser window.

If you want to find out more about the American Museum in Britain, when the experiment is over, you can visit their website at http://www.americanmuseum.org/.

EXPERIMENT 1 – EMBEDDED LINKS CONDITION

Training materials: The American Museum in Britain

The purpose of these training materials is to give you a chance to use some electronic text materials. The materials contain information about the American Museum in Britain.

You have 10 minutes to read through this training information and explore the materials. As you read and browse through the electronic text materials, I would like you to think aloud. This means saying any thoughts or reactions that come to mind as you work. If you remain silent for a while, I may occasionally prompt you to start speaking again.

If you have any questions please ask the experimenter.

Start time_____ Stop time_____

How to use the materials

1. Text about the museum is presented in the browser window. You can move between pages by clicking on the embedded links in the text. These appear as blue underlined text (see figure 1). Some pages contain several embedded links, some pages have no embedded links. Once you have already visited a page the embedded links that link to that page will change colour. Please practice accessing pages using the embedded links in the materials.

2. You can access the last page you visited using the 'Back' button on the browser toolbar (see figure 1). Now use the back button to go back to the last page you visited.

3. If the text goes off the bottom of one screen you can scroll down to see the remainder of the text using the scroll bar on the right hand side of the screen (see figure 1). Try this out on the 'Main Collection' page of the electronic text materials.

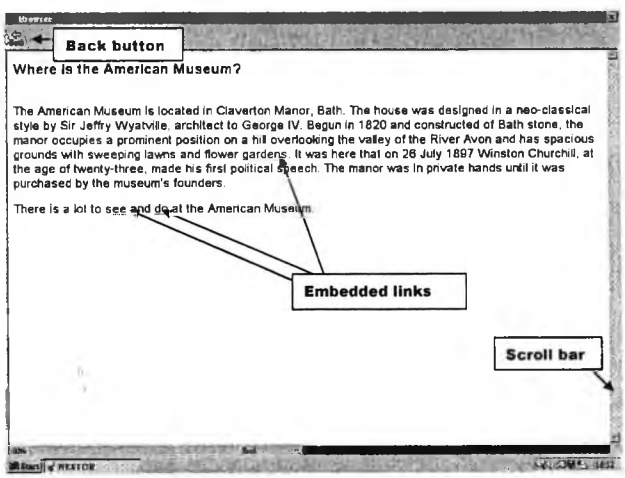


Figure 1- The Nestor Browser window.

NOTE- Please do not press the Back button on the first page of the materials- 'Where is the American Museum'.

If you want to find out more about the American Museum in Britain, when the experiment is over, you can visit their website at http://www.americanmuseum.org/.

EXPERIMENT 1 – A-Z INDEX CONDITION

Training Materials: The American Museum in Britain

The purpose of these training materials is to give you a chance to use some electronic text materials. The materials contain information about the American Museum in Britain.

You have 10 minutes to read through this training information and explore the materials. As you read and browse through the electronic text materials, I would like you to think aloud. This means saying any thoughts or reactions that come to mind as you work. If you remain silent for a while, I may occasionally prompt you to start speaking again.

If you have any questions please ask the experimenter.

Your start and stop times will be shown below (to be completed by the experimenter):

Start time_____ Stop time_____

How to use the materials

1. Text about the museum is presented in the text window on the right-hand side of the screen. In the left-hand window an A-Z index of pages in the materials is displayed. This shows a list of the pages in the materials in alphabetical order. You can visit any of the pages by clicking on the square bullet next to the title of the page that you want to visit (see figure 1). Practice accessing pages using the A-Z index.

2. If the text goes off the bottom of the browser window you can scroll down to see the remainder of the text using the scroll bar on the right-hand side of the text window (see figure 1). Try this out on the 'Main Collection' page of the electronic text materials.

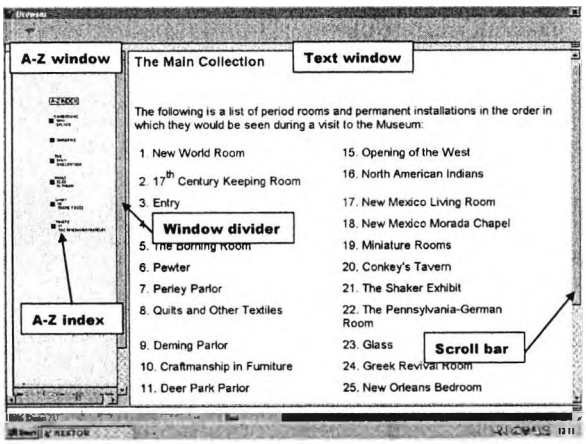


Figure 1- The electronic text materials.

3. If you want to see more/less of the text or A-Z, you can move the window divider between the text and the A-Z windows by clicking on the divider and dragging it into a desired position (see figure 1). Please practice this now.

If you want to find out more about the American Museum in Britain, when the experiment is over, you can visit their website at http://www.americanmuseum.org/.

EXPERIMENT 1 – MAP CONDITION

Training Materials: The American Museum in Britain

The purpose of these training materials is to give you a chance to use some electronic text materials. The materials contain information about the American Museum in Britain.

You have 10 minutes to read through this training information and explore the materials. As you read and browse through the electronic text materials, I would like you to think aloud. This means saying any thoughts or reactions that come to mind as you work. If you remain silent for a while, I may occasionally prompt you to start speaking again.

If you have any questions please ask the experimenter.

Start time_____ Stop time_____

How to use the materials

1. Text about the museum is presented in the text window on the right-hand side of the screen. In the map window, a map of pages in the materials is displayed. You can visit any of the pages by clicking on the square bullet next to the title of the page that you want to visit. Lines with arrows on them represent links between pages (see figure 1). Now practice accessing pages using the map.

2. If the text goes off the bottom of the text window you can scroll down to see the remainder of the text using the scroll bar on the right-hand side of the text window (see figure 1). Try this out on the 'Main Collection' page of the electronic text materials.

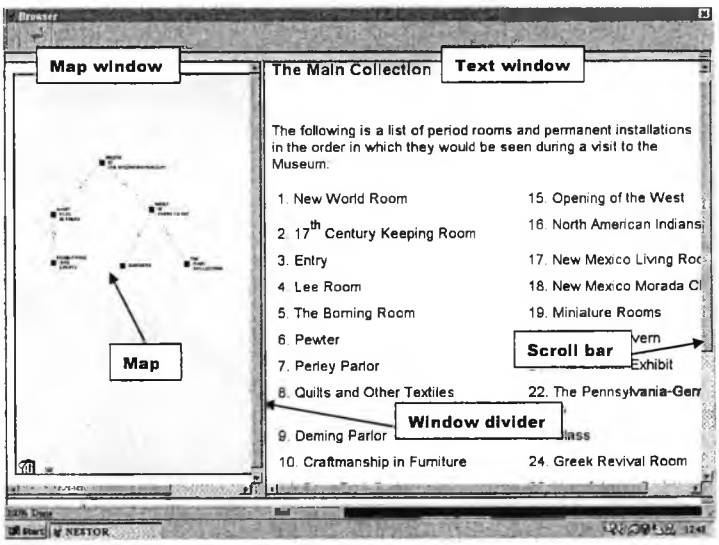


Figure 1- The electronic text materials.

3. If you want to see more/less of the text or map, you can move the window divider between the text and the map windows by clicking on the divider and dragging it into a desired position (see figure 1). Please practice this now.

If you want to find out more about the American Museum in Britain, when the experiment is over, you can visit their website at http://www.americanmuseum.org/.

EXPERIMENT 2A – USING MAP CONDITION

Training Materials: The American Museum in Britain

The purpose of these training materials is to give you a chance to use some electronic text materials. The materials contain information about the American Museum in Britain.

You have 10 minutes to read through this training information and explore the materials. As you read and browse through the electronic text materials, I would like you to think aloud. This means saying any thoughts or reactions that come to mind as you work. If you remain silent for a while, I may occasionally prompt you to start speaking again.

If you have any questions please ask the experimenter.

Start time_____ Stop time_____

How to use the materials

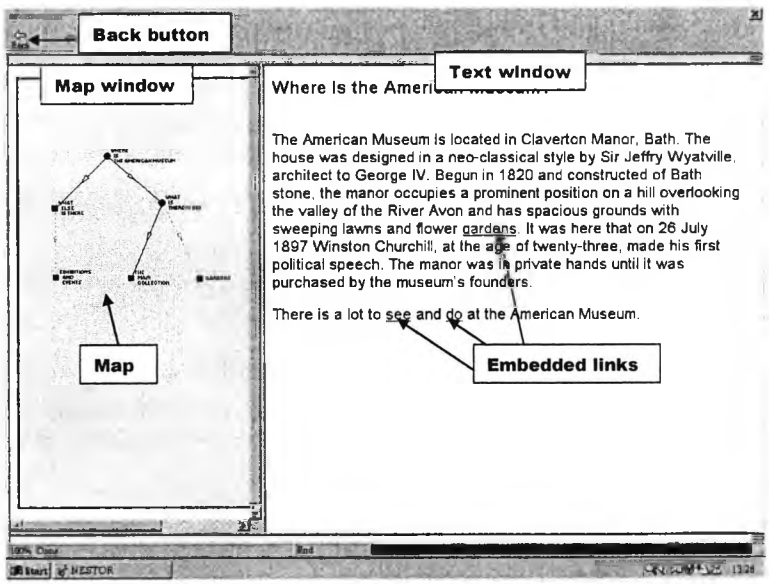


Figure 1. The electronic text materials.

The Text Window

1. Text about the museum is presented in the text window. You can move between pages by clicking on the embedded links in the text. These appear as blue underlined text (see figure 1). Some pages contain several embedded links, some pages have no embedded links. Once you have already visited a page the embedded links that link to that page will change colour. Please practice accessing pages using the embedded links in the materials.

2. You can access the last page you visited using the 'Back' button on the browser toolbar (see figure 1). Now use the back button to go back to the last page you visited.

3. If the text goes off the bottom of the window you can scroll down to see the remainder of the text using the scroll bar on the right hand side of the text window (see figure 2). Try this out on the 'Main Collection' page of the electronic text materials.

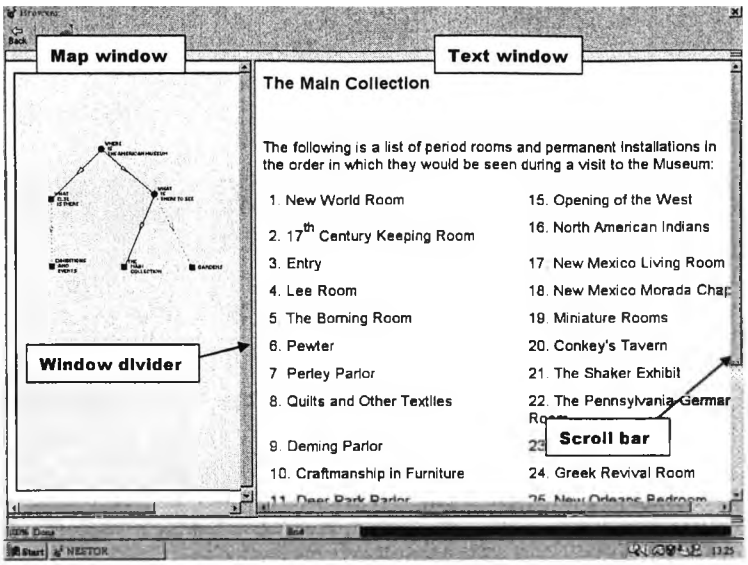


Figure 2. The electronic text materials- the scroll bar and window divider.

The Map Window

1. In the map window, a map of pages in the materials is displayed. You can visit any of the pages by clicking on the bullet next to the title of the page that you want to visit. Round bullets represent pages containing embedded links, square bullets represent pages with no embedded links. Lines with arrows on them represent links between pages. Complete lines represent actual embedded link links between pages, whereas dotted lines represent additional conceptual links between pages (see figures 1 and 2). Now practice accessing pages using the map.
2. If you want to see more/less of the text or map, you can move the window divider between the text and the map windows by clicking on the divider and dragging it into a desired position (see figure 2). Please practice this now.

If you want to find out more about the American Museum in Britain, when the experiment is over, you can visit their website at http://www.americanmuseum.org/.

EXPERIMENT 2A – CREATING MAP CONDITION

Training Materials- The American Museum

The purpose of these training materials is to give you a chance to use some electronic text materials. The materials contain information about the American Museum in Britain.

You have 10 minutes to read through this training information and explore the materials. As you read and browse through the electronic text materials, I would like you to think aloud. This means saying any thoughts or reactions that come to mind as you work. If you remain silent for a while, I may occasionally prompt you to start speaking again.

If you have any questions please ask the experimenter.

Your start and stop times will be shown below (to be completed by the experimenter):

Start time_____ Stop time_____

How to use the materials

The Text Window

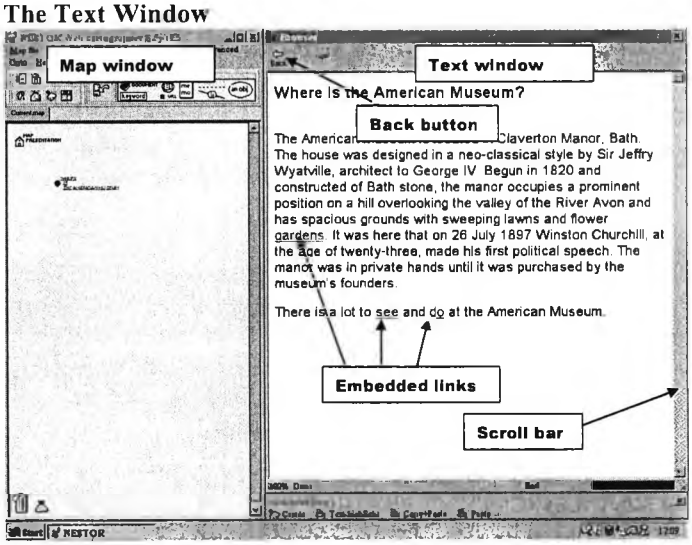


Figure 1. Nestor Navigator- Aspects of the embedded links and browser window.

1. Text about the museum is presented in the text window. You can move between pages by clicking on the embedded links in the text. These appear as blue underlined text (see figure 1). Some pages contain several embedded links, some pages have no embedded links. Once you have already visited a page the embedded links that link to that page will change colour. Please practice accessing pages using the embedded links in the materials.

2. You can access the last page you visited using the 'Back' button on the browser toolbar (see figure 1). Now use the back button to go back to the last page you visited.

3. If the text goes off the bottom of the window you can scroll down to see the remainder of the text using the scroll bar on the right hand side of the text window (see figure 1). Try this out on the 'Main Collection' page of the electronic text materials.

The Map Window

1. As you move through the text a trace of your path through the materials is generated in the map window on the left-hand side of the screen. This shows the titles of the pages you have visited, and

links between them that you have traversed using embedded links (see figure 2). Notice this as you navigate the embedded links in the text.

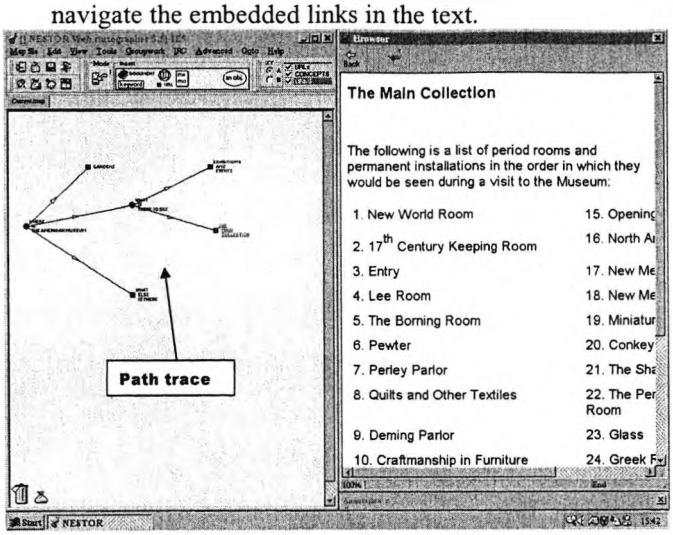


Figure 2. Trace of a path through the electronic text materials.

Representations of a Page. When you open a new page the page title will appear in the Nestor window. There will be a bullet point next to this title (see figure 3). The bullet for the page you are currently displaying will be shown in red. All other bullets are shown in blue. Circular bullets represent pages that contain embedded links, square bullets represent pages with no embedded links.

Representations of Links. Lines with arrows on them represent links between pages. The arrow shows the direction of the link (see figure 3).

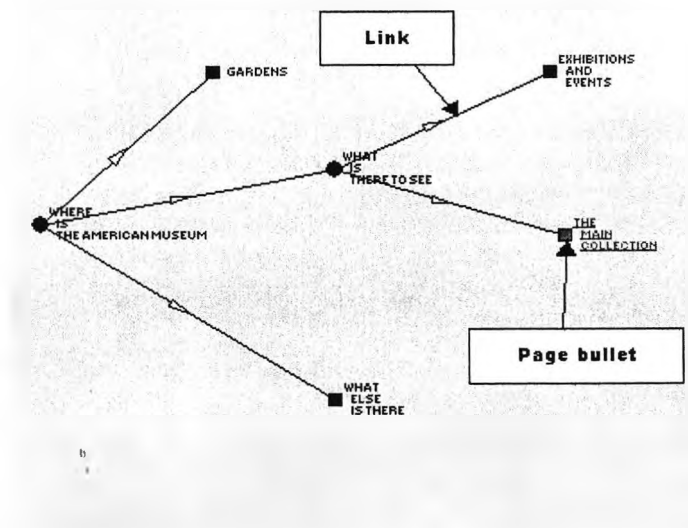


Figure 3. Representations of links and pages in the Nestor window.

2. You can access pages by clicking on the bullet next to the title of the page you want to visit, as well as by using the embedded links and the back button (see section 1). As you explore the materials re-arrange the bullets in the map to create your own map of the materials. Rearrange the shape of the map by clicking and dragging the page bullets into a desired position. You can use this map to access pages in the electronic texts. Practice using the map to access pages.

3. Delete pages from the map by moving the pointer over their corresponding bullet for a page until a red square appears around the bullet. Then click on the right mouse button. From the displayed menu you can then select 'Delete' (see figure 4). Practice this by deleting the 'Gardens' page from the map.

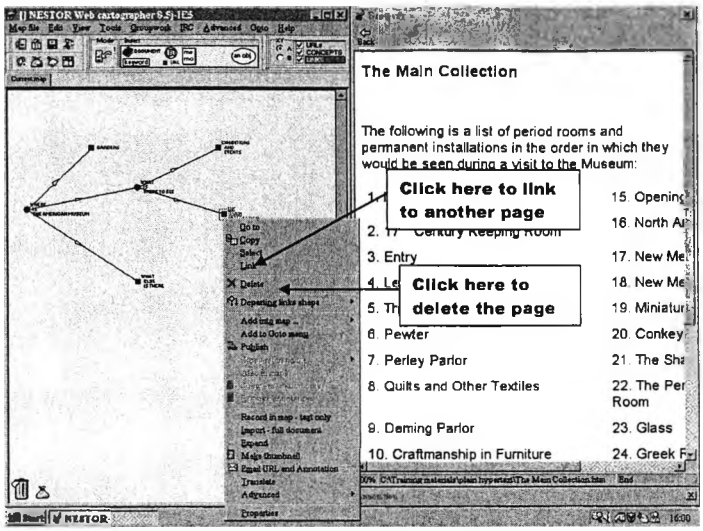


Figure 4. Deleting a page and adding a link.

4. Add a link between 2 pages by moving the mouse pointer over the page bullet, until the red square appears around the bullet. Then click on the right mouse button. From the displayed menu select 'Link' (see figure 4). A dotted line is then shown attached to the page bullet. You can click and drag this line so it links to another page bullet on the map. When you do this a embedded link for the linked page appears in the annotation window (see figure 5). Practice this by linking 'The Main Collection' page to the 'Exhibitions and Events' page.

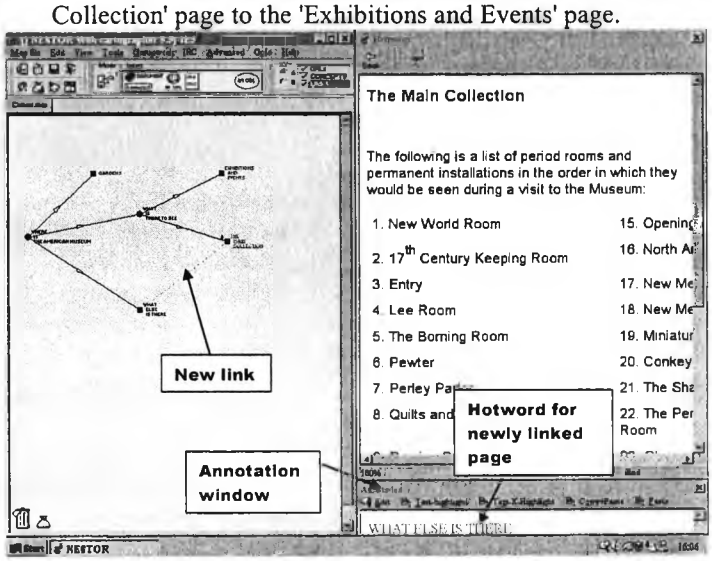


Figure 5. Adding new links.

5. You can also delete links. Click the right mouse button on the link you want to delete. Next select 'Delete' from the displayed menu (see figure 6). Practice this by deleting the link between 'Where is the American Museum?' and 'What is there to see?'.

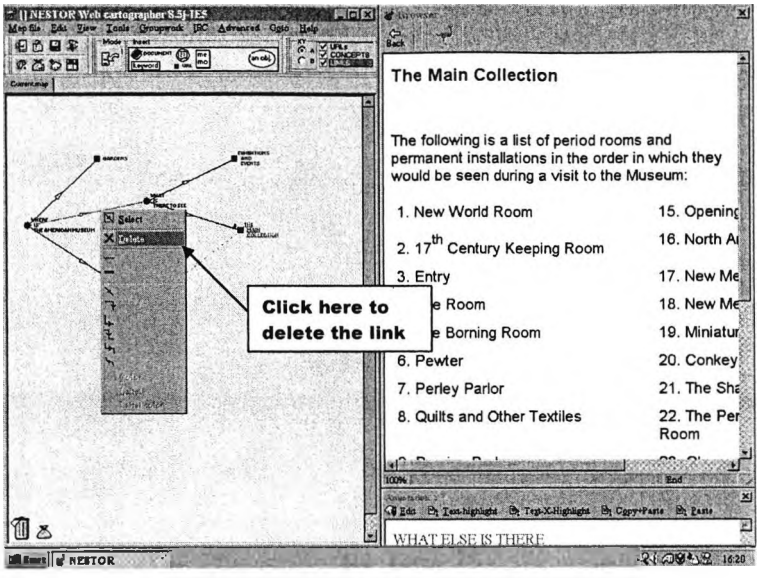


Figure 2. Deleting links.

6. Maps can be saved by clicking on the Map file menu and selecting 'Save' or 'Save as'. Save your map as Participant <<participant number>>.

Figure 7 shows an example of the type of map you might create for the materials on the American Museum in Britain.

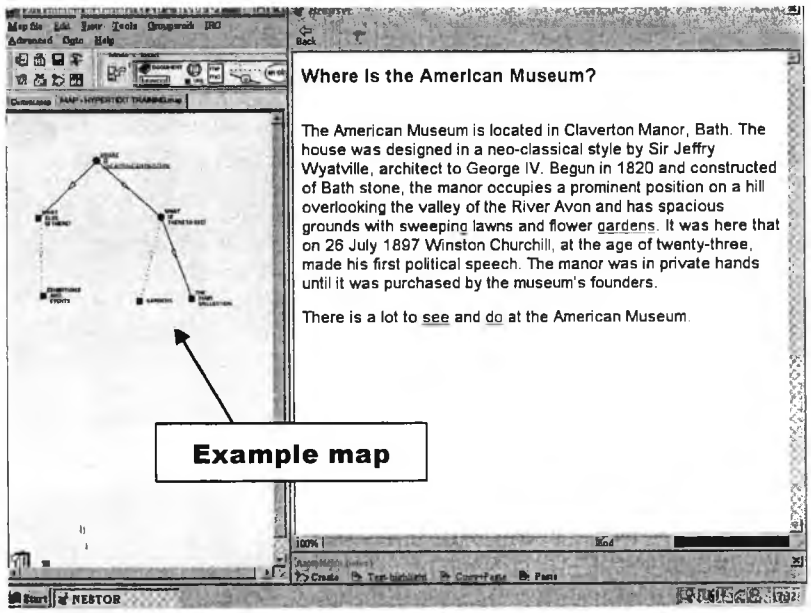


Figure 7. Example map of the materials.

If you want to find out more about the American Museum in Britain, when the experiment is over, you can visit their website at http://www.americanmuseum.org/.

Additional Points to Note

Bin and Bag- these are located in the bottom left-hand corner of the map window (see figure 8). *You will not need to use these during the experiment.*
Pop-up previews- text summaries of a page pop up when you hold the mouse pointer over a page bullet (see figure 8). These previews appear for a few seconds then disappear. Please try to *avoid using these* during the experiment, as the aim of the experiment is to see the way that you use the text in the text window.

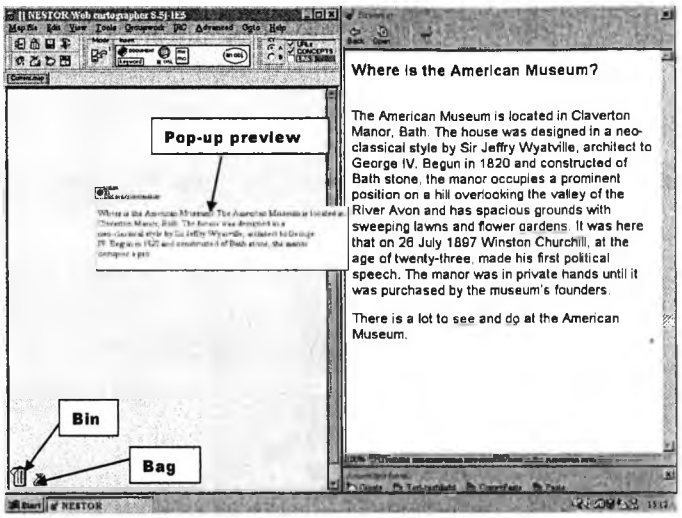


Figure 8. Additional points- the bin, the bag and the pop-up preview.

EXPERIMENT 2B – USING A-Z CONDITION

Training materials: The American Museum in Britain

The purpose of these training materials is to give you a chance to use some electronic text materials. The materials contain information about the American Museum in Britain.

You have 10 minutes to read through this training information and explore the materials. As you read and browse through the electronic text materials, I would like you to think aloud. This means saying any thoughts or reactions that come to mind as you work. If you remain silent for a while, I may occasionally prompt you to start speaking again.

If you have any questions please ask the experimenter.

Your start and stop times will be shown below (to be completed by the experimenter):

Start time_____ Stop time_____

How to use the materials

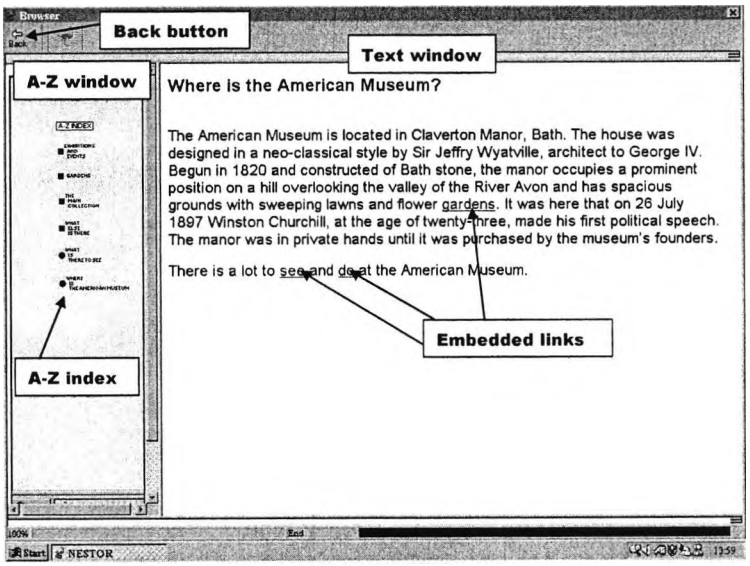


Figure 1. The electronic text materials.

The Text Window

1. Text about the museum is presented in the text window. You can move between pages by clicking on the embedded links in the text. These appear as blue underlined text (see figure 1). Some pages contain several embedded links, some pages have no embedded links. Once you have already visited a page the embedded links that link to that page will change colour. Please practice accessing pages using the embedded links in the materials.

2. You can access the last page you visited using the 'Back' button on the browser toolbar (see figure 1). Now use the back button to go back to the last page you visited.

3. If the text goes off the bottom of the browser window you can scroll down to see the remainder of the text using the scroll bar on the right hand side of the text window (see figure 2). Try this out on the 'Main Collection' page of the electronic text materials.

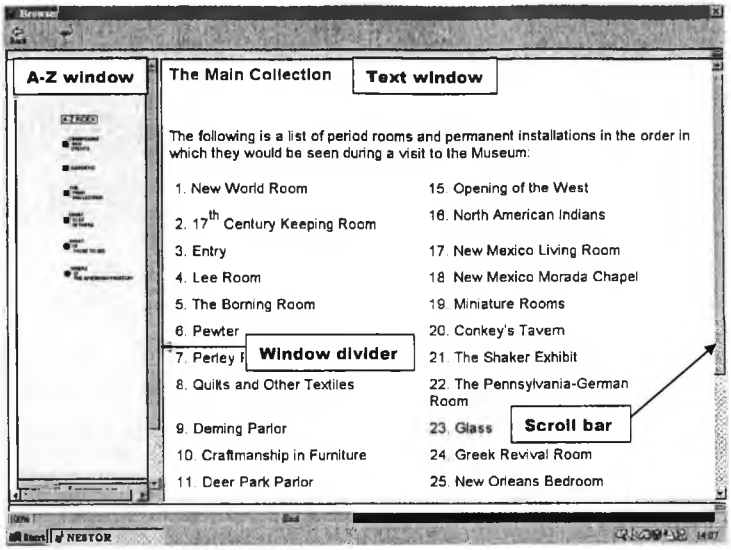


Figure 2. The electronic text materials- the scroll bar and window divider.

The A-Z Index

1. In the left-hand window an A-Z index of pages in the materials is displayed. You can visit any of the pages by clicking on the bullet next to the title of the page that you want to visit. Round bullets represent pages containing embedded links, square bullets represent pages with no embedded links (see figures 1 and 2). Now practice accessing pages using the A-Z index.
2. If you want to see more/less of the text or A-Z, you can move the window divider between the text and the A-Z windows by clicking on the divider and dragging it into a desired position (see figure 2). Please practice this now.

If you want to find out more about the American Museum in Britain, when the experiment is over, you can visit their website at http://www.americanmuseum.org/.

EXPERIMENT 2B – CREATING A-Z CONDITION

Training materials- The American Museum in Britain

The purpose of these training materials is to give you a chance to use some electronic text materials. The materials contain information about the American Museum in Britain.

You have 10 minutes to read through this training information and explore the materials. As you read and browse through the electronic text materials, I would like you to think aloud. This means saying any thoughts or reactions that come to mind as you work. If you remain silent for a while, I may occasionally prompt you to start speaking again.

If you have any questions please ask the experimenter.

Your start and stop times will be shown below (to be completed by the experimenter):

Start time_____ Stop time_____

How to use the materials

The Text Window

1. Text about the museum is presented in the text window. You can move between pages by clicking on the embedded links in the text. These appear as blue underlined text (see figure 1). Some pages contain several embedded links, some pages have no embedded links. Once you have already visited a page the embedded links that link to that page will change colour. Please practice accessing pages using the embedded links in the materials.

2. You can access the last page you visited using the 'Back' button on the browser toolbar (see figure 1). Now use the back button to go back to the last page you visited.

3. If the text goes off the bottom of the window you can scroll down to see the remainder of the text using the scroll bar on the right hand side of the text window (see figure 1). Try this out on the 'Main Collection' page of the electronic text materials.

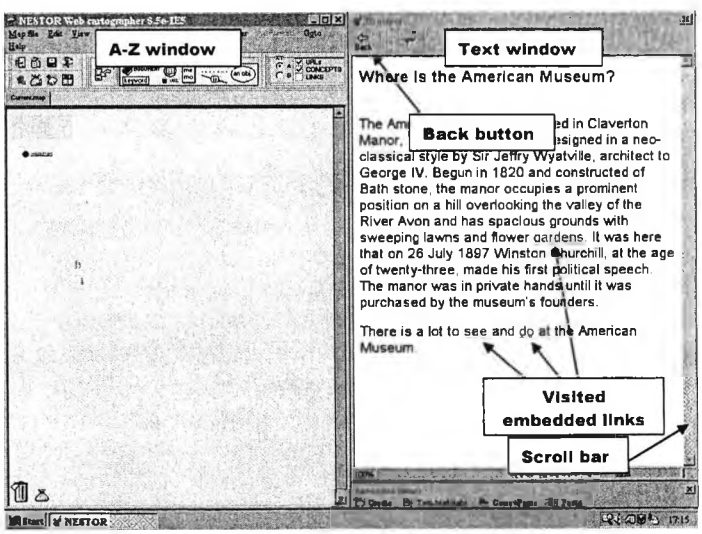


Figure 1. Electronic text materials- Aspects of the A-Z and Text windows.

The A-Z Window

1. When you open a new page the page title will appear in the Nestor window on the left-hand side of the screen. There will be a bullet point next to this title (see figure 2). The bullet for the page you are currently displaying will be shown in red. All other bullets are shown in blue. Circular bullets represent pages that contain embedded links, square bullets represent pages with no embedded links. Notice this as you access pages in the materials.

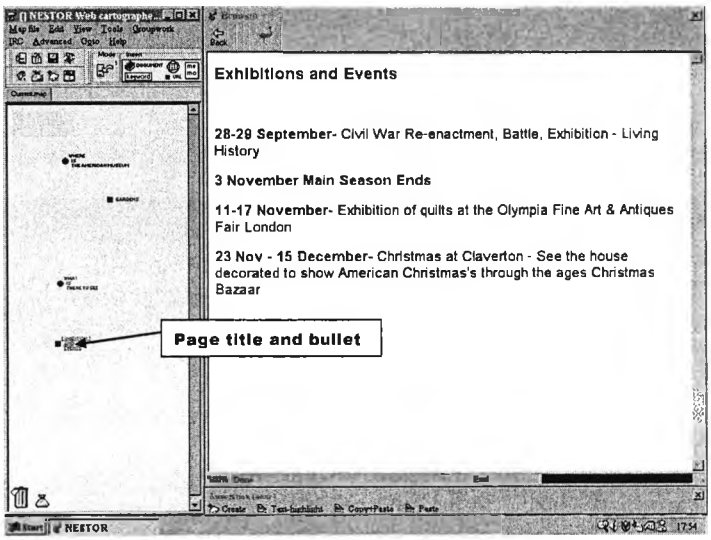


Figure 3. Electronic text materials- Representations of pages in the A-Z window.

2. You can access pages in the materials by clicking on the bullet next to the title of the page you want to visit, as well as by using the embedded links and the back button (see section 1 above). Practice accessing pages using the bullets in the Nestor window.

3. Arrange the page titles and bullets into alphabetical order to create an A-Z index of the materials by dragging the page bullets into position (see the example A-Z index in figure 3). You can use this A-Z index to access pages in the materials.

4. If you want to see more/less of the text or A-Z, you can move the window divider between the text and the A-Z windows by clicking on the divider and dragging it into a desired position (see figure 3). Please practice this now.

If you want to find out more about the American Museum in Britain, when the experiment is over, you can visit their website at http://www.americanmuseum.org/.

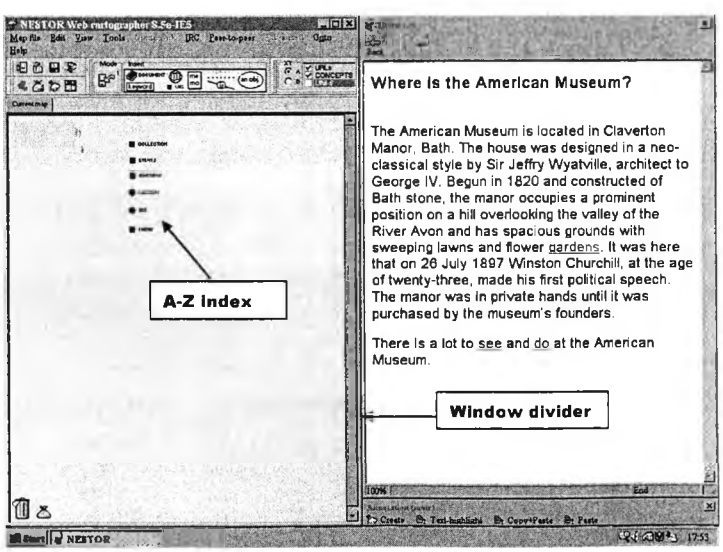


Figure 3. Example of finished A-Z index.

Additional Points to Note

Bin and Bag- these are located in the bottom left-hand corner of the A-Z window (see figure 4). You will not need to use these during the experiment.

Pop-up previews- text summaries of a page pop up when you hold the mouse pointer over a page bullet (see figure 4). These previews appear for a few seconds then disappear. Please try to avoid using these during the task, as the aim of the experiment is to see the way that you use the text in the text window.

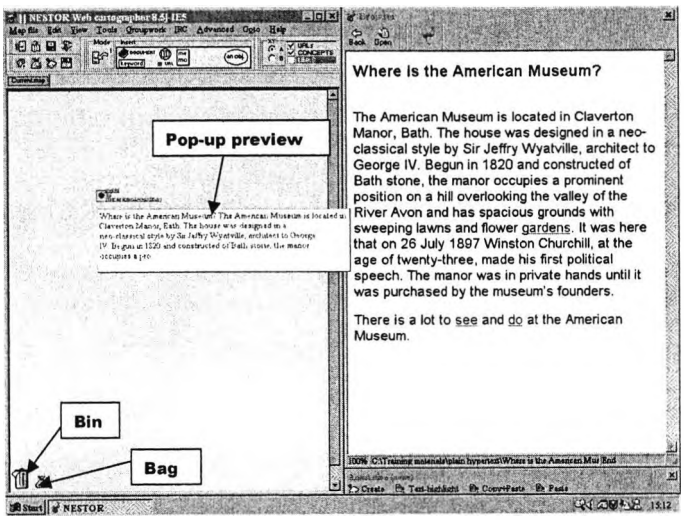


Figure 4. Additional points- the bin, the bag and the pop-up preview.

EXPERIMENT 2C – USING CONTENTS LIST CONDITION

Training materials: The American Museum in Britain

The purpose of these training materials is to give you a chance to use some electronic text materials. The materials contain information about the American Museum in Britain.

You have 10 minutes to read through this training information and explore the materials. As you read and browse through the electronic text materials, I would like you to think aloud. This means saying any thoughts or reactions that come to mind as you work. If you remain silent for a while, I may occasionally prompt you to start speaking again.

If you have any questions please ask the experimenter.

Your start and stop times will be shown below (to be completed by the experimenter):

Start time_____ Stop time_____

How to use the materials

The Text Window

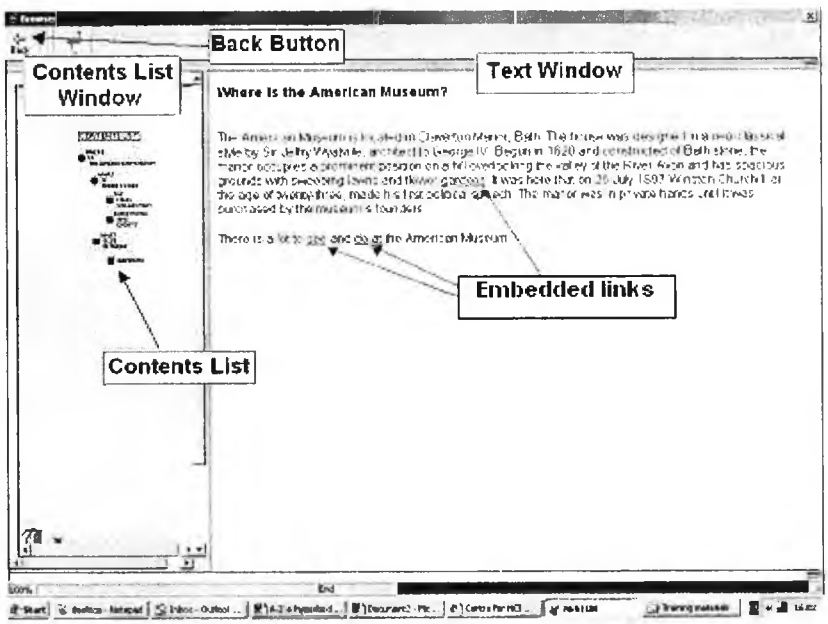


Figure 1. The electronic text materials.

1. Text about the museum is presented in the text window. You can move between pages by clicking on the embedded links in the text. These appear as blue underlined text (see figure 1). Some pages contain several embedded links, some pages have no embedded links. Once you have already visited a page the embedded links that link to that page will change colour. Please practice accessing pages using the embedded links in the materials.

2. You can access the last page you visited using the 'Back' button on the browser toolbar (see figure 1). Now use the back button to go back to the last page you visited.

3. If the text goes off the bottom of the browser window you can scroll down to see the remainder of the text using the scroll bar on the right hand side of the text window (see figure 2). Try this out on the 'Main Collection' page of the electronic text materials.

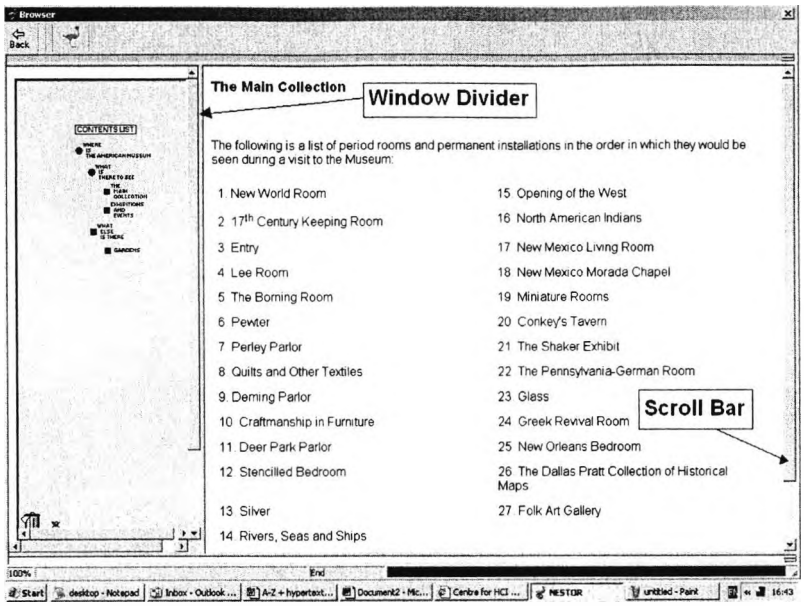


Figure 2. The scroll bar and the window divider.

The Contents List Window

1. In the left-hand window a contents list of pages in the materials is displayed. You can visit any of the pages by clicking on the bullet next to the title of the page that you want to visit. Round bullets represent pages containing embedded links, square bullets represent pages with no embedded links (see figures 1 and 2). Also notice that some pages are indented in the contents list to show how the pages are logically organised. Now practice accessing pages using the contents list.
2. If you want to see more/less of the text or contents list, you can move the window divider between the text and the contents list windows by clicking on the divider and dragging it into a desired position (see figure 2). Please practice this now.

If you want to find out more about the American Museum in Britain, when the experiment is over, you can visit their website at http://www.americanmuseum.org/.

EXPERIMENT 2C – CREATING CONTENTS LIST CONDITION

Training materials- The American Museum in Britain

The purpose of these training materials is to give you a chance to use some electronic text materials. The materials contain information about the American Museum in Britain.

You have 10 minutes to read through this training information and explore the materials. As you read and browse through the electronic text materials, I would like you to think aloud. This means saying any thoughts or reactions that come to mind as you work. If you remain silent for a while, I may occasionally prompt you to start speaking again.

If you have any questions please ask the experimenter.

Your start and stop times will be shown below (to be completed by the experimenter):

Start time_____ Stop time_____

How to use the materials

The Text Window

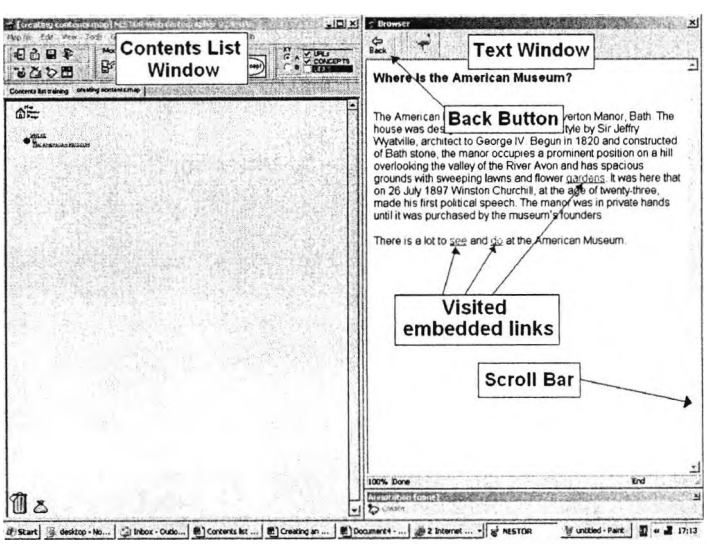


Figure 1. Electronic text materials - Aspects of the Contents List and Text windows.

1. Text about the museum is presented in the text window. You can move between pages by clicking on the embedded links in the text. These appear as blue underlined text (see figure 1). Some pages contain several embedded links, some pages have no embedded links. Once you have already visited a page the embedded links that link to that page will change colour. Please practice accessing pages using the embedded links in the materials.

2. You can access the last page you visited using the 'Back' button on the browser toolbar (see figure 1). Now use the back button to go back to the last page you visited.

3. If the text goes off the bottom of the window you can scroll down to see the remainder of the text using the scroll bar on the right hand side of the text window (see figure 1). Try this out on the 'Main Collection' page of the electronic text materials.

The Contents List Window

1. When you open a new page the page title will appear in the Nestor window on the left-hand side of the screen. There will be a bullet point next to this title (see figure 2). The bullet for the page you are currently displaying will be shown in red. All other bullets are shown in blue. Circular bullets represent pages that contain embedded links, square bullets represent pages with no embedded links. Notice this as you access pages in the materials.

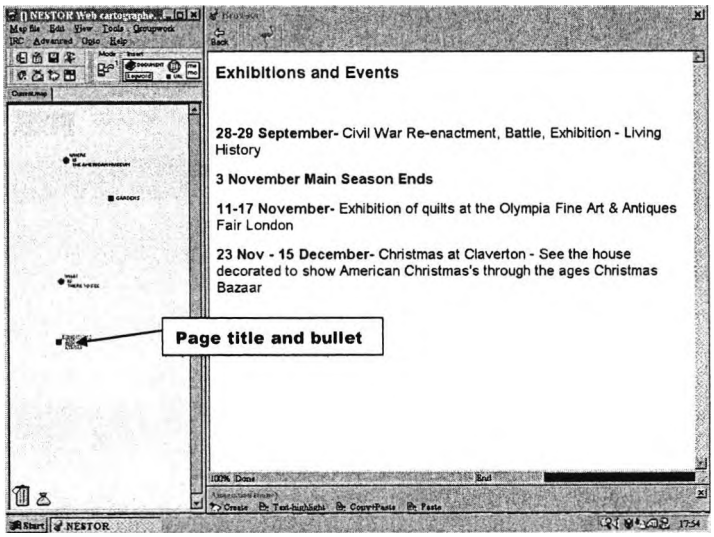


Figure 2. Electronic text materials- Representations of pages in the Contents List window.

2. You can access pages in the materials by clicking on the bullet next to the title of the page you want to visit, as well as by using the embedded links and the back button (see section 1 above). Practice accessing pages using the bullets in the Nestor window.

3. Arrange the page titles and bullets into logical order to create a contents list of the materials by dragging the page bullets into position (see the example contents list in figure 3). Note that you can use indentations in the list if you desire. You can use this contents list to access pages in the materials.

4. If you want to see more/less of the text or contents list, you can move the window divider between the text and the contents list windows by clicking on the divider and dragging it into a desired position (see figure 3). Please practice this now.

If you want to find out more about the American Museum in Britain, when the experiment is over, you can visit their website at http://www.americanmuseum.org/.

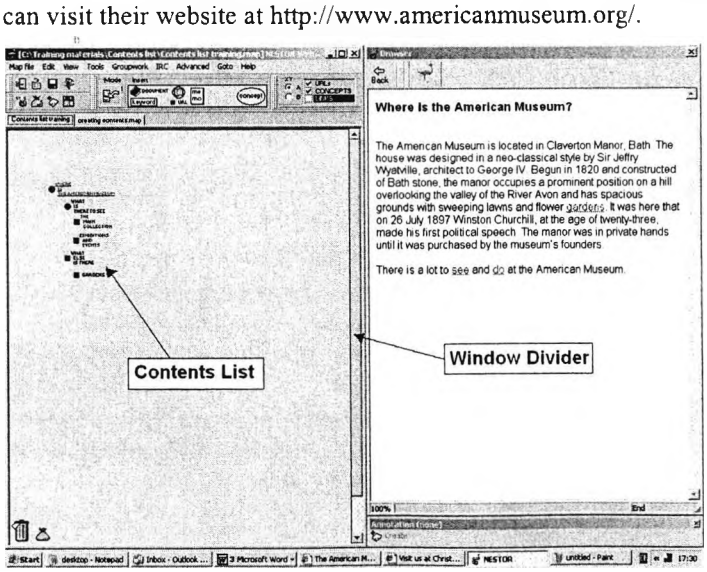


Figure 3. Example of finished contents list.

Additional Points to Note

Bin and Bag- these are located in the bottom left-hand corner of the contents list window (see figure 4). You will not need to use these during the experiment.

Pop-up previews- text summaries of a page pop up when you hold the mouse pointer over a page bullet (see figure 4). These previews appear for a few seconds then disappear. Please try to avoid using these during the task, as the aim of the experiment is to see the way that you use the text in the text window.

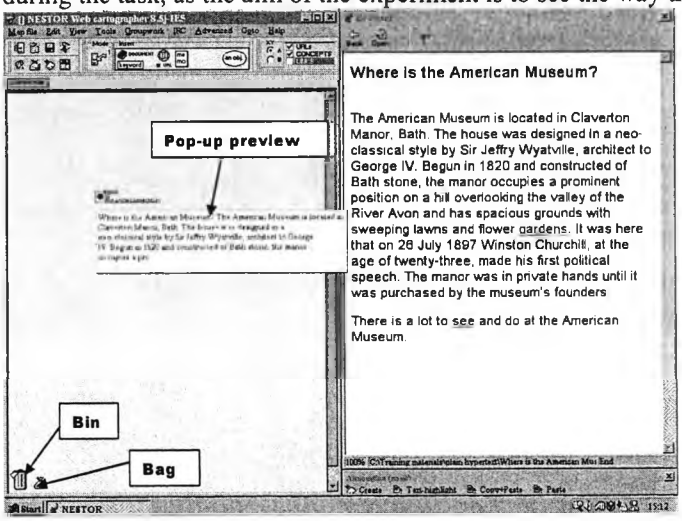


Figure 4. Additional points- the bin, the bag and the pop-up preview.

Appendix 4.5 Task sheet for the task while participants used the electronic text in experiments 1 and 2.

FOR ALL CONDITIONS IN EXPERIMENT 1 AND THE USING MAP, USING A-Z AND USING CONTENTS LIST CONDITIONS IN EXPERIMENT 2

Please read through this information sheet and follow the instructions. Please remember that we are interested in assessing the materials rather than your personal abilities.

1. The paragraphs below give details of a setting for a usability evaluation. Read the evaluation-setting description carefully.

   CityMusic Website

   You work for a team of usability consultants that have been employed to evaluate the usability of the CityMusic website. CityMusic is a small music store that wants to develop a new website to sell CDs and vinyl. The staff at CityMusic have developed some software-based prototypes. These prototypes have limited content and functionality. Instead, they focus on site navigation and the overall 'look' of the website. Staff at CityMusic want to get feedback about the usability of these prototypes.

   There is a large budget for this usability evaluation. CityMusic are keen to have a highly usable website in order to make their customer's online experience pleasurable and without problems.

   CityMusic have allocated 3 months for the evaluation of their prototypes and they would like feedback on any usability problems and redesign suggestions within this timescale. Any findings from the usability evaluations will be taken into account and fed back into the design.

   There are three others in your team of usability consultants that you could use to help you in this usability evaluation. However, they all have extremely busy schedules and it would be difficult to involve them. Alternatively, potential users of the website are readily available and your consultancy has its own usability lab.

2. You are presented with electronic text materials on usability and usability evaluation techniques. Please read through the electronic text materials and use the information to **select a usability evaluation technique, or combination of techniques, that would be appropriate for use in the above setting**.

3. You have 45 minutes to read and browse through the electronic text materials. As you do this please think aloud. This means saying any thoughts or reactions that come to mind as you work. If you remain silent for a while, you may occasionally be prompted to start talking again.

4. When you have finished using the electronic text you will be asked to give your decision and say which usability evaluation technique(s) you think should be employed. Please explain your decision and give details of why or why not each of the techniques presented in the materials is or is not appropriate for the above setting.

If you have any questions please ask the researcher before you start.

Your start and stop times will be shown below (to be completed by the researcher):
Start time _____
Stop time_____

EXPERIMENT 2 – FOR THE CREATING MAP/ CREATING A-Z/ CREATING CONTENTS LIST CONDITIONS

Please read through this information sheet and follow the instructions. Please remember that we are interested in assessing the materials rather than your personal abilities.

1. The paragraphs below give details of a setting for a usability evaluation. Read the evaluation-setting description carefully.

   CityMusic Website

   You work for a team of usability consultants that have been employed to evaluate the usability of the CityMusic website. CityMusic is a small music store that wants to develop a new website to sell CDs and vinyl. The staff at CityMusic have developed some software-based prototypes. These prototypes have limited content and functionality. Instead, they focus on site navigation and the overall 'look' of the website. Staff at CityMusic want to get feedback about the usability of these prototypes.

   There is a large budget for this usability evaluation. CityMusic are keen to have a highly usable website in order to make their customer's online experience pleasurable and without problems.

   CityMusic have allocated 3 months for the evaluation of their prototypes and they would like feedback on any usability problems and redesign suggestions within this timescale. Any findings from the usability evaluations will be taken into account and fed back into the design.

   There are three others in your team of usability consultants that you could use to help you in this usability evaluation. However, they all have extremely busy schedules and it would be difficult to involve them. Alternatively, potential users of the website are readily available and your consultancy has its own usability lab.

2. You are presented with electronic text materials on usability and usability evaluation techniques. Please read through the electronic text materials and use the information to **select a usability evaluation technique, or combination of techniques, that would be appropriate for use in the above setting**.

3. You have 45 minutes to read and browse through the electronic text materials and to **create a map |<<A-Z>> or <<contents list>>| of the materials**. As you do this please think aloud. This means saying any thoughts or reactions that come to mind as you work. If you remain silent for a while, you may occasionally be prompted to start talking again.

4. When you have finished using the electronic text you will be asked to give your decision and say which usability evaluation technique(s) you think should be employed. Please explain your decision and give details of why or why not each of the techniques presented in the materials is or is not appropriate for the above setting.

If you have any questions please ask the researcher before you start.

Your start and stop times will be shown below (to be completed by the researcher):

Start time _____

Stop time_____

Appendix 4.6 An example log file (from the embedded links condition in experiment 1).

16:25:04 GUIDE C:\embedded links\Usability.htm|USABILITY
16:33:23 HOTW C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:34:28 HOTW C:\embedded links\Usability problems.htm|USABILITY PROBLEMS
16:34:45 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:34:51 HOTW C:\embedded links\Role of Usability Evaluation.htm|ROLE OF USABILITY EVALUATION
16:35:44 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:36:01 HOTW C:\embedded links\Types of usability evaluation.htm|TYPES OF USABILITY EVALUATION
16:36:26 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:36:28 HOTW C:\embedded links\Types of usability evaluation.htm|TYPES OF USABILITY EVALUATION
16:37:09 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:37:16 HOTW C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
16:37:33 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:37:50 HOTW C:\embedded links\expert reviews\Expert Reviews introduction.htm|EXPERT REVIEWS INTRODUCTION
16:37:52 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:37:57 HOTW C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
16:38:26 HOTW C:\embedded links\observations\Observational Evaluation Method.htm|OBSERVATIONAL EVALUATION METHOD
16:38:36 BACK C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
16:39:08 HOTW C:\embedded links\observations\Observational Evaluation Method.htm|OBSERVATIONAL EVALUATION METHOD
16:40:12 HOTW C:\embedded links\observations\Observational Evaluation Data Analysis.htm|OBSERVATIONAL EVALUATION DATA ANALYSIS
16:41:20 BACK C:\embedded links\observations\Observational Evaluation Method.htm|OBSERVATIONAL EVALUATION METHOD
16:41:28 HOTW C:\embedded links\References.htm|REFERENCES
16:41:38 BACK C:\embedded links\observations\Observational Evaluation Method.htm|OBSERVATIONAL EVALUATION METHOD
16:41:39 BACK C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
16:41:41 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:41:42 BACK C:\embedded links\Usability.htm|USABILITY
16:41:44 BACK C:\Training materials\embedded links\Where is the American Museum.htm|WHERE IS THE AMERICAN MUSEUM
16:41:55 GUIDE C:\embedded links\Usability.htm|USABILITY
16:42:00 HOTW C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:42:25 HOTW C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
16:42:39 HOTW C:\embedded links\observations\Observational Evaluation Advantages.htm|OBSERVATIONAL EVALUATION ADVANTAGES
16:42:55 BACK C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
16:42:57 HOTW C:\embedded links\observations\Observational Evaluation Disadvantages.htm|OBSERVATIONAL EVALUATION DISADVANTAGES
16:43:51 BACK C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
16:43:55 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:44:15 HOTW C:\embedded links\expert reviews\Expert Reviews introduction.htm|EXPERT REVIEWS INTRODUCTION
16:44:25 HOTW C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation Introduction.htm|HEURISTIC EVALUATION INTRODUCTION
16:44:53 HOTW C:\embedded links\expert reviews\Heuristic evaluation\Nielsens heuristics.htm|NIELSENS HEURISTICS
16:46:32 BACK C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation Introduction.htm|HEURISTIC EVALUATION INTRODUCTION
16:46:57 HOTW C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation method.htm|HEURISTIC EVALUATION METHOD
16:47:47 HOTW C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation analysis.htm|HEURISTIC EVALUATION ANALYSIS
16:47:57 BACK C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation method.htm|HEURISTIC EVALUATION METHOD
16:48:02 BACK C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation Introduction.htm|HEURISTIC EVALUATION INTRODUCTION
16:48:08 HOTW C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation advantages.htm|HEURISTIC EVALUATION ADVANTAGES
16:48:16 BACK C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation Introduction.htm|HEURISTIC EVALUATION INTRODUCTION
16:48:19 HOTW C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation disadvantages.htm|HEURISTIC EVALUATION DISADVANTAGES
16:48:23 BACK C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation Introduction.htm|HEURISTIC EVALUATION INTRODUCTION
16:48:24 HOTW C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation advantages.htm|HEURISTIC EVALUATION ADVANTAGES
16:48:59 HOTW C:\embedded links\References.htm|REFERENCES
16:49:00 BACK C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation advantages.htm|HEURISTIC EVALUATION ADVANTAGES
16:49:13 BACK C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation Introduction.htm|HEURISTIC EVALUATION INTRODUCTION
16:49:15 BACK C:\embedded links\expert reviews\Expert Reviews introduction.htm|EXPERT REVIEWS INTRODUCTION
16:49:21 HOTW C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough Introduction.htm|COGNITIVE WALKTHROUGH INTRODUCTION
16:50:12 HOTW C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough advantages.htm|COGNITIVE WALKTHROUGH ADVANTAGES
16:50:27 BACK C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough Introduction.htm|COGNITIVE WALKTHROUGH INTRODUCTION
16:50:30 HOTW C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough disadvantages.htm|COGNITIVE WALKTHROUGH DISADVANTAGES
16:51:22 BACK C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough Introduction.htm|COGNITIVE WALKTHROUGH INTRODUCTION
16:51:47 HOTW C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough method.htm|COGNITIVE WALKTHROUGH METHOD
16:52:41 HOTW C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough analysis.htm|COGNITIVE WALKTHROUGH ANALYSIS
16:52:48 HOTW C:\embedded links\Usability problems.htm|USABILITY PROBLEMS
16:52:50 BACK C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough analysis.htm|COGNITIVE WALKTHROUGH ANALYSIS
16:52:54 BACK C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough method.htm|COGNITIVE WALKTHROUGH METHOD
16:52:56 BACK C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough Introduction.htm|COGNITIVE WALKTHROUGH INTRODUCTION
16:53:09 BACK C:\embedded links\expert reviews\Expert Reviews introduction.htm|EXPERT REVIEWS INTRODUCTION
16:53:10 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:53:12 BACK C:\embedded links\Usability.htm|USABILITY
16:53:17 BACK C:\Training materials\embedded links\Where is the American Museum.htm|WHERE IS THE AMERICAN MUSEUM
16:53:45 GUIDE C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation analysis.htm|HEURISTIC EVALUATION ANALYSIS
16:54:40 GUIDE C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:54:47 HOTW C:\embedded links\Usability.htm|USABILITY
16:54:57 HOTW C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:55:14 HOTW C:\embedded links\Types of usability evaluation.htm|TYPES OF USABILITY EVALUATION
16:55:17 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:55:19 HOTW C:\embedded links\Types of usability evaluation.htm|TYPES OF USABILITY EVALUATION
16:55:21 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:55:24 BACK C:\embedded links\Usability.htm|USABILITY
16:55:25 HOTW C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:55:31 HOTW C:\embedded links\expert reviews\Expert Reviews introduction.htm|EXPERT REVIEWS INTRODUCTION
16:55:36 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:56:01 BACK C:\embedded links\Usability.htm|USABILITY
16:56:02 HOTW C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:57:41 HOTW C:\embedded links\Types of usability evaluation.htm|TYPES OF USABILITY EVALUATION
16:57:57 HOTW C:\embedded links\Usability problems.htm|USABILITY PROBLEMS
16:57:59 BACK C:\embedded links\Types of usability evaluation.htm|TYPES OF USABILITY EVALUATION
16:58:00 HOTW C:\embedded links\Usability.htm|USABILITY
16:58:02 HOTW C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:58:05 HOTW C:\embedded links\Types of usability evaluation.htm|TYPES OF USABILITY EVALUATION
16:58:10 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:58:12 HOTW C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
16:58:40 HOTW C:\embedded links\observations\Observational Evaluation Method.htm|OBSERVATIONAL EVALUATION METHOD
16:58:43 BACK C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
16:58:44 HOTW C:\embedded links\Usability problems.htm|USABILITY PROBLEMS
16:58:46 BACK C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
16:58:52 HOTW C:\embedded links\observations\Observational Evaluation Advantages.htm|OBSERVATIONAL EVALUATION ADVANTAGES
16:58:56 BACK C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
16:59:10 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
16:59:39 HOTW C:\embedded links\expert reviews\Expert Reviews introduction.htm|EXPERT REVIEWS INTRODUCTION
16:59:54 HOTW C:\embedded links\Usability problems.htm|USABILITY PROBLEMS
16:59:56 BACK C:\embedded links\expert reviews\Expert Reviews introduction.htm|EXPERT REVIEWS INTRODUCTION

17:00:03 HOTW C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough Introduction.htm|COGNITIVE WALKTHROUGH INTRODUCTION
17:00:10 HOTW C:\embedded links\expert reviews\Expert Reviews introduction.htm|EXPERT REVIEWS INTRODUCTION
17:00:37 BACK C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough Introduction.htm|COGNITIVE WALKTHROUGH INTRODUCTION
17:00:44 HOTW C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
17:00:53 BACK C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough Introduction.htm|COGNITIVE WALKTHROUGH INTRODUCTION
17:00:54 BACK C:\embedded links\expert reviews\Expert Reviews introduction.htm|EXPERT REVIEWS INTRODUCTION
17:00:58 HOTW C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough Introduction.htm|COGNITIVE WALKTHROUGH INTRODUCTION
17:01:00 HOTW C:\embedded links\expert reviews\Expert Reviews introduction.htm|EXPERT REVIEWS INTRODUCTION
17:01:35 BACK C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough Introduction.htm|COGNITIVE WALKTHROUGH INTRODUCTION
17:01:43 HOTW C:\embedded links\Types of usability evaluation.htm|TYPES OF USABILITY EVALUATION
17:01:58 BACK C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough Introduction.htm|COGNITIVE WALKTHROUGH INTRODUCTION
17:02:04 BACK C:\embedded links\expert reviews\Expert Reviews introduction.htm|EXPERT REVIEWS INTRODUCTION
17:02:06 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
17:02:09 HOTW C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
17:03:11 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
17:06:25 BACK C:\embedded links\Usability.htm|USABILITY
17:06:27 BACK C:\embedded links\Types of usability evaluation.htm|TYPES OF USABILITY EVALUATION
17:06:29 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
17:06:32 HOTW C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
17:06:40 HOTW C:\embedded links\observations\Observational Evaluation Method.htm|OBSERVATIONAL EVALUATION METHOD
17:06:54 HOTW C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
17:06:56 HOTW C:\embedded links\observations\Observational Evaluation Method.htm|OBSERVATIONAL EVALUATION METHOD
17:07:22 HOTW C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
17:07:24 HOTW C:\embedded links\Usability problems.htm|USABILITY PROBLEMS
17:07:26 BACK C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
17:07:27 HOTW C:\embedded links\Types of usability evaluation.htm|TYPES OF USABILITY EVALUATION
17:07:49 BACK C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
17:08:03 HOTW C:\embedded links\observations\Observational Evaluation Data Analysis.htm|OBSERVATIONAL EVALUATION DATA ANALYSIS
17:08:27 BACK C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
17:08:30 HOTW C:\embedded links\observations\Observational Evaluation Advantages.htm|OBSERVATIONAL EVALUATION ADVANTAGES
17:09:03 BACK C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
17:09:05 HOTW C:\embedded links\observations\Observational Evaluation Disadvantages.htm|OBSERVATIONAL EVALUATION DISADVANTAGES
17:09:30 BACK C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
17:09:34 BACK C:\embedded links\observations\Observational Evaluation Method.htm|OBSERVATIONAL EVALUATION METHOD
17:09:35 BACK C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
17:09:44 BACK C:\embedded links\observations\Observational Evaluation Method.htm|OBSERVATIONAL EVALUATION METHOD
17:09:45 BACK C:\embedded links\observations\Observational Evaluation Introduction.htm|OBSERVATIONAL EVALUATION INTRODUCTION
17:09:48 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
17:09:53 HOTW C:\embedded links\expert reviews\Expert Reviews introduction.htm|EXPERT REVIEWS INTRODUCTION
17:10:10 BACK C:\embedded links\Usability Evaluation Introduction.htm|USABILITY EVALUATION INTRODUCTION
17:11:57 HOTW C:\embedded links\expert reviews\Expert Reviews introduction.htm|EXPERT REVIEWS INTRODUCTION
17:12:12 HOTW C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation Introduction.htm|HEURISTIC EVALUATION INTRODUCTION
17:12:27 BACK C:\embedded links\expert reviews\Expert Reviews introduction.htm|EXPERT REVIEWS INTRODUCTION
17:12:29 HOTW C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough Introduction.htm|COGNITIVE WALKTHROUGH INTRODUCTION
17:13:11 HOTW C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation Introduction.htm|HEURISTIC EVALUATION INTRODUCTION
17:13:13 BACK C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough Introduction.htm|COGNITIVE WALKTHROUGH INTRODUCTION
17:13:42 HOTW C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation Introduction.htm|HEURISTIC EVALUATION INTRODUCTION
17:13:46 BACK C:\embedded links\expert reviews\Cognitive walkthrough\Cognitive Walkthrough Introduction.htm|COGNITIVE WALKTHROUGH INTRODUCTION
17:14:39 BACK C:\embedded links\expert reviews\Expert Reviews introduction.htm|EXPERT REVIEWS INTRODUCTION
17:14:42 HOTW C:\embedded links\expert reviews\Heuristic evaluation\Heuristic Evaluation Introduction.htm|HEURISTIC EVALUATION INTRODUCTION

Key:

"GUIDE" indicates that the Nestor Navigator window was used
"BACK" indicates that the back button was used.
"HOTW" indicates that an embedded link (hotword) was used

Appendix 4.7 The ownership questionnaire given to participants in experiments 1 and 2.

Please read the instructions below and complete the following questionnaire on your feelings about using the electronic text materials on usability evaluation.

Adapted from a questionnaire developed by Marina Milner-Bolotin (Milner-Bolotin, 2001).

Participant no.:_____

The first 16 statements on this questionnaire may or may not describe your feelings and beliefs about using these electronic text materials. Please rate each statement by circling a number between 1 and 5 according to the following scale:

1: Strongly Disagree; **2**: Disagree; **3**: Neutral; **4**: Agree; **5**: Strongly Agree

These statements should be taken as straightforward and simple descriptions of your attitudes. If you think the statement is very true of you, circle 5; if a statement is not at all true of you, circle 1. If the statement is more or less true of you, find the number between 1 and 5 that best describes you.

	Strongly Disagree				**Strongly Agree**
1. I found personal value in the use of the electronic text.	1	2	3	4	5
2. I felt I had control over the use of the electronic text.	1	2	3	4	5
3. I feel responsible for the usability evaluation decisions I made when using the electronic text.	1	2	3	4	5
4. I felt that my progression through the electronic text materials was guided.	1	2	3	4	5
5. I think I will be able to use what I have learned from the electronic text materials in other courses, and/or in everyday life.	1	2	3	4	5
6. I had a sense of ownership for my use of the electronic text materials to choose a usability evaluation technique(s).	1	2	3	4	5
7. I felt responsible for my final choice of evaluation technique(s).	1	2	3	4	5
8. I think I had control over my progression through the electronic text materials.	1	2	3	4	5
9. I felt responsible for the exploration of the materials on usability evaluation.	1	2	3	4	5
10. I think that the skill I have learned when using these materials will help me to succeed in the future.	1	2	3	4	5
11. I do not feel a personal responsibility for the decisions I made when using the electronic texts to choose a usability evaluation technique.	1	2	3	4	5
12. I felt ownership for my final choice of usability evaluation technique(s).	1	2	3	4	5
	Strongly Disagree				**Strongly Agree**
13. I felt I was free to choose the way I progressed through	1	2	3	4	5

the electronic text materials.

14. I think freedom to decide the way you use electronic text materials is very important to learning with these materials.	1	2	3	4	5
15. I found no personal value in the information in the electronic texts.	1	2	3	4	5
16. I felt I could not access the pages I wanted to in the electronic texts.	1	2	3	4	5

Appendix 4.8 Task sheet for the written transfer task in experiments 1 and 2.

Please read through this information sheet and follow the instructions.

1. Below you are given another setting for a usability evaluation. Read the evaluation-setting description carefully.

   Usability evaluation context:

   A large telecoms company is creating software for writing short memos on mobile phones. You work for a team of usability consultants that have been employed to evaluate this software.

   The telecoms company are in the early stages of their designs and have developed some paper prototypes. The paper prototypes are in the form of a cardboard model of the mobile phone to give the impression of the size of the screen that users will be working on. Additionally, they have created actual size screen shots of each of the screens that users traverse when undertaking typical tasks with the memo software, such as adding a new memo. These screen shots can be stuck on to the screen of the cardboard model.

   Your team is made up of five usability consultants, three of which are also experts in mobile computing. Access to users is also good. However, you don't have access to a formal usability lab.

   The usability budget for this iteration of the project is relatively low. Also, as the telecoms company want to keep the iterations short they have requested that you give them feedback on the usability of their prototypes within just two weeks. Any findings from the usability evaluations will be taken into account and fed back into the next design iteration.

2. Please select a usability evaluation technique, or combination of techniques, that would be appropriate for this setting. Please consider the information you read in the electronic text materials when making this decision.

3. Please write a report about how you came to your decision including details of:
   - what usability evaluation is
   - brief details of each of the techniques presented in the materials
   - an explanation of why or why not each technique is/is not suitable for the given context
   - conclude with your selected technique(s) and give a brief description of how they will be employed

   You are given **30 minutes** to write this report. Your start and stop times will be shown below (to be completed by the experimenter):

   Start time _____

   Stop time_____

Appendix 4.9 Task sheet for the concept mapping task in experiments 1, 2 and 3.

A concept map, or mind map, is a graphical representation of information showing key points in the information and the links between them. An example of a concept map for **eating** is shown below. Concepts are represented in ellipses, and lines between the ellipses indicate relationships between the concepts. Descriptions of the relationships are shown by text on the lines linking the two concepts.

Please create a concept map about the usability evaluation techniques that were presented in the electronic text materials. When you create your own concept maps, note that you don't always have to label relationships between the concepts, as sometimes this is not necessary or appropriate.

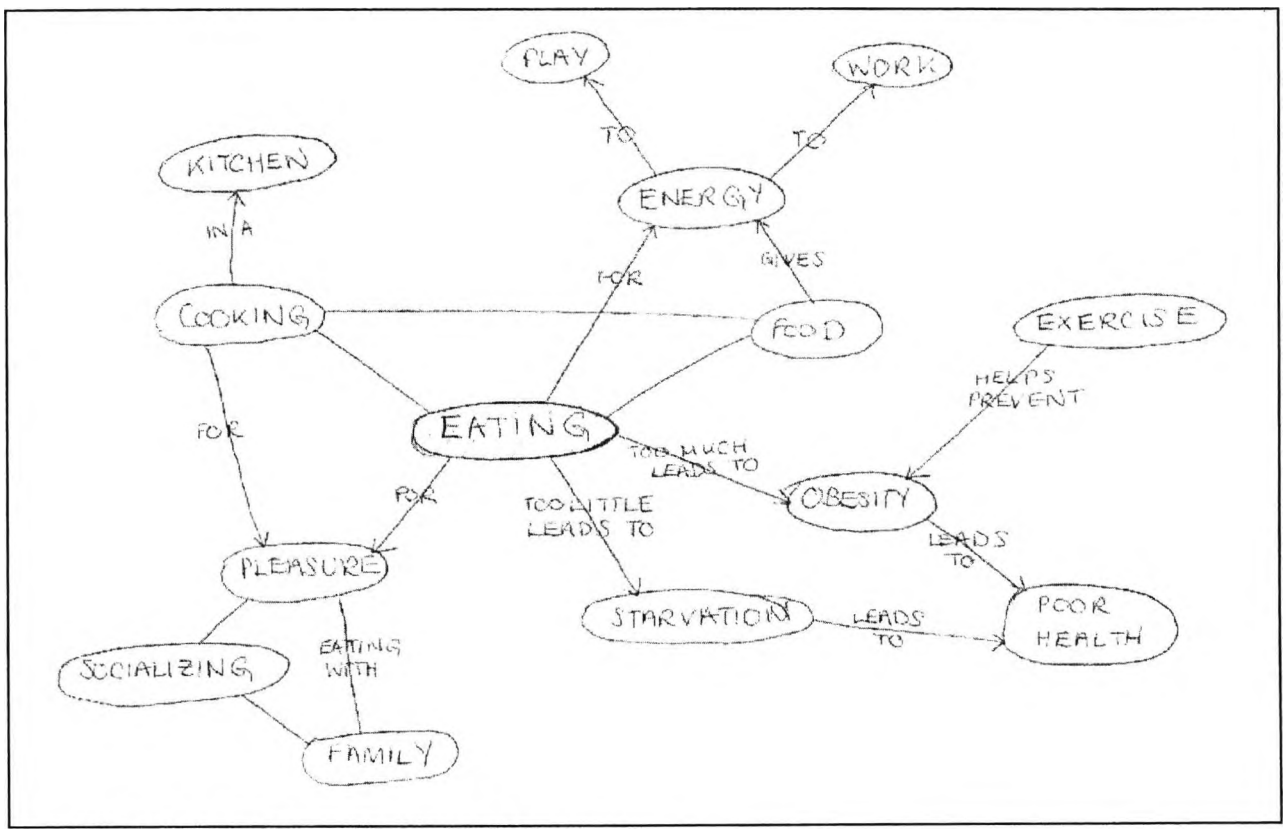


Figure 4. Example concept map for 'eating'.

You have **<<10 for experiments 1 and 2, or 5 for experiment 3>>** minutes to create your concept map.

Your start and stop times are shown below (to be completed by the researcher).

Start time_____

Stop time_____

Appendix 4.10 The marking scheme for the pre-test in experiments 1, 2 and 3.

Mark Scheme for Pre-test – Knowledge of Usability Evaluations

3.8. What is usability? [5 marks]

1 – slight grasp e.g. 'easy to use' only

3 – basic ideas covers 2/3 of below points (e.g. answer includes something like 'How easy something is to learn and use'):
How easy something is to learn (learnability)
How easy something is to use
Utility
Memorability
Safety
Efficiency
Effectiveness
User friendliness

5 – Detailed answer, covers 3+ of the above points.

3.9. What is a usability problem? [5 marks]

Specific example of a usability problem = 1 mark

1 – slight grasp of basic concepts e.g. bad designs

3 – covers basic concepts e.g. user difficulties, poor usability, preventing good usability

5 – clear understanding of concepts e.g. problem with an interface/system that causes a decrease/breakdown in usability, identified aspect of a system where usability is poor

3.10. What is the purpose of usability evaluation? [5 marks]

1 – slight grasp e.g. assessment

3 – basic ideas e.g. one of test/assess/measure usability **or** identify problems

5 – includes both test/assess/measure usability and identify usability problems and feedback into design

3.11. What is formative usability evaluation? [5 marks]

1 – very vague description showing some relation to the key points

3 – evaluation during design **or** evaluation that feeds-back into design

5 – evaluation early lifecycle, feedback into/during design

3.12. What is summative usability evaluation? [5 marks]

1 – very vague description showing some relation to the key points (assessment of usability of a final design/product, usability evaluation at the end of the lifecycle)

3 – either assessment of usability of a final design/product **or** usability evaluation at the end of the lifecycle

5 – includes both of the above aspects

3.13. List as many usability evaluation techniques as you can. [10 marks]

2 marks for each of:
Questionnaires
Interviews

Contextual evaluations
Observations (usability testing)
Cognitive walkthrough
Heuristic evaluation
Analytic approaches (KLM, GOMs)
Experimental evaluations
[Wizard of Oz, Field studies, Lab-based evaluations]

Specific measures (e.g. task completion times)1 mark only

3.14. Give brief details of the techniques you have listed and how they might be used in formative usability evaluations. [10 marks].

Each technique rated on the following:

- Mention of using the particular technique early in the lifecycle to feedback into design [5marks across both techniques]

- Details of performing the technique- evidence that they know what the technique involves (see below) [5marks across both techniques]

Questionnaires- administer questionnaire rating aspects of usability (utility, learnability, effectiveness, efficiency etc) of a device and asking questions about usability problems that arise. Any problems identified may be prioritised and rectified in the next design iteration.

Interviews- interview about aspects of usability of a system (utility, learnability, effectiveness, efficiency etc) and any usability problems with a system. Any problems identified may be prioritised and rectified in the next design iteration.

Contextual evaluations- evaluation of a system within the setting that the technology is normally used, can involve evaluator participation. Data is analysed for usability problems and any problems identified may be prioritised and rectified in the next design iteration.

Observations (usability testing)- evaluator observes a user using a system, data is analysed for usability problems. Any problems identified may be prioritised and rectified in the next design iteration.

Cognitive walkthrough- an expert evaluator walks through a system simulating a typical user's mental processes (goals etc), and asks questions about whether the user will understand the system and whether they will be able to see how to achieve their goals. Any time there is a 'no' answer, this indicates a usability problem. Any problems identified may be prioritised and rectified in the next design iteration.

Heuristic evaluation- expert evaluators go through a series of tasks with a system and at each point in the task check whether the interface complies with a set of heuristics. Each time that a heuristic is broken indicates that there is a usability problem with that part of the interface. Any problems identified may be prioritised and rectified in the next design iteration.

Analytic approaches (KLM, GOMs)- detailed assessment of tasks e.g. KLM predicts performance times. When predicted performance times are high, this may indicate a usability problem. Any problems identified may be prioritised and rectified in the next design iteration.

Experimental evaluations- controlled experiments to test specific hypotheses e.g. one interface is faster than another. Can look at specific usability measures e.g. task performance times. Usability problems may be identified for example when there is a high task performance time. Any problems identified may be prioritised and rectified in the next design iteration.

[Wizard of Oz- informal evaluator acts as a computer with a paper prototype and user gives comments, Field studies- usability evaluations based on observing users in the field, Lab-based evaluations- observing users using technology in a controlled lab based environment. All of these are used to identify usability problems and feedback the results into the next design iteration.]

Appendix 4.11 SPSS output for the reliability and validity checking for the pre-test (correlation) for data from experiment 1 and parts A and B of experiment 2.

Correlations

			Second Marking	Author's Marking
Spearman's rho	Second Marking	Correlation Coefficient	1.000	.834(**)
		Sig. (1-tailed)	.	.000
		N	105	105
	Author's Marking	Correlation Coefficient	.834(**)	1.000
		Sig. (1-tailed)	.000	.
		N	105	105

** Correlation is significant at the 0.01 level (1-tailed).

NB. N = 105 because the correlation was performed using the marks for each of the 7 questions, so there were 7 x 15 data points in the analysis.

Appendix 4.12 Detailed coding scheme for cognitive engagement used in experiments 1 and 2.

Coded by single comments where single comment = part of a sentence or about 1-2 sentences in succession, related to the same theme/concept.

All of the transcribed text should be considered, including any summary comments given by participants at the end of the task.

Any sections of the transcript where the participant is simply reading aloud from the electronic text should not be coded (check against task materials).

Higher Order Activities

Drawing on Corno and Mandinach's (1983) components of self-regulated learning and higher order activities in Stoney and Oliver (1999).

Alertness [A]

Definition: Comments regarding the tracking/gathering/noticing of important information in the electronic texts and recognising what information in the electronic texts is about. Discriminating among information presented in the electronic texts, distinguishing relevant from irrelevant information. Note that this is not simply stating the name of the page they are on.
Examples:

- So here's the information on formative evaluations.
- So this is the observational evaluation method.
- So this text gives information on observational evaluations and expert reviews.
- So references are not relevant to the task
- So observational evaluation would be very relevant here.
- This looks important.
- I'll think about that one.

Planning/Strategy [P]

Definition: Comments related to considering strategies for exploring the electronic texts and planning the sequence that they will visit pages in the text. Considering strategies for using the electronic texts in the task.

Note: this relates to groups of pages, not just single pages i.e. I'm going to heuristic evaluation advantages is not planning.

Examples:

- First I'm going to read all the introduction pages.
- I'm going to go to cognitive walkthrough's first and then go to heuristic evaluation.
- First I'm going to read all the pages in the text, then I'm going to look back on it in terms of the task setting.

Connecting Experiences [CE]

Definition: Comments related to making connections between concepts within the text, or to real world knowledge/experience and prior knowledge, including comments about the task as a real world problem. Involves going beyond the text content.
Examples:

- So a usability problem might be when I can't find something on a website.
- In the real world 3 months is ages.
- Observational evaluation, that sounds like what I'm doing now.
- Yes, that sounds like things I've heard before
- That fits in with what I already know

- I didn't know it happened like that... I thought xxx...
- We were taught this in class.
- Now I see that heuristic evaluation and cognitive walkthrough are both parts of expert reviews.
- Ah, so heuristic evaluation and cognitive walkthrough use experts, where as observational evaluation uses real users.

Connecting to the task setting [CT]

Definition: Any comments where text content is considered in terms of factors in the task setting (considering information about a given technique and how this relates to the factors in the task setting). Includes relating the text content to factors in the task setting while selecting a final usability evaluation technique.
Examples:

- HE requires experts and the task setting says that I have plenty of them.
- Observational evaluation needs real users and the task setting says that I have lots of them.
- [It says that Nielsen's heuristics are not very good for websites], and in the task we are dealing with the City Music website.

Notes: this is not just checking the task sheet. It must include relating statements about the task to information in the electronic text, or vice versa. Also, it is not just saying whether one technique or another is good for the task (this is ST), it goes beyond this and considers specific factors in the task setting.

Monitoring Understanding [MU]

Definition: Comments related to continuous tracking and self-checking understanding of the text content and comments confirming that they understand the text content. Can apply to the entire task.
Example:

- I'm not really sure what heuristic evaluation is about.
- I want to remind myself what cognitive walkthrough is about (check difference with planning)
- I'm going to try and remember this.
- Ok, I understand that.

Note: simple checking statements such as 'Right, ok' are not enough.

Monitoring Navigation [MN]

Definition: Any comments of tracking/checking of navigation, summaries of where they have been in the electronic texts. Refers to tracking a group of pages, rather than single pages, and involves checking if they have missed anything. Can include comments related to creating/rearranging navigation aids.
Examples:

- Now I've been to x,x, and x. Have I missed anything?
- Looking at this, I can see I have been to x, x and x, but I haven't been to y.
- Where have I been?

Note: careful about differences with just stating what they have done, where they might just say e.g. I have been to UE intro. This only involves a single page so is not monitoring.

Predicting [PR]

Definition: Comments that relate to stating expectations and working out what might come next in the text.
Example:

- I expect it will tell me more about formative and summative evaluations later.

Note: this is not simply where a navigation aid will take them.

Critiquing Text Content [CTC]

Definition: Any comments related to the quality of the text content including how informative it is and quality of explanations and definitions. Comments about whether they agree/disagree with ideas in the text, or making judgements about ideas in the text.

Examples:

- This explanation isn't very good.
- There's too much jargon.
- This definition is clear.
- This is interesting.
- I don't think heuristic evaluation is necessarily cheap, it depends how much you pay the experts.
- 'Because usability is so important to whether a system is accepted and ultimately used by people, it is helpful to have some way of evaluating...' – yes I agree with that.

Notes: this is not just saying 'yes' in response to the text since it is difficult to interpret the meaning of this single word. Should be something along the lines of, 'yes I agree with that' etc.

Restating Understanding [RU]

Definition: restating information in the text and showing understanding i.e. putting text content into their own words. Not simply reading aloud.
Example:

- So heuristic evaluation follows a set of heuristics or rules.

Selecting Technique [ST]

Definition: Any comments related to the selection of a usability evaluation technique, or combination of techniques, with or without explanation (including saying whether they think a technique is good or bad, or discussing the advantages/disadvantages).

Notes: this may co-occur with CE and CT.

Examples:

- I think observational evaluation is best because it uses real users.
- I think that heuristic evaluation is best because it is cheap (and it say's here that the budget is low [CT])
- Heuristic evaluation sounds good.
- I choose cognitive walkthrough and heuristic evaluation.

Employing Selected Technique [EST]

Definitions: Comments related to how a technique will be employed in the task setting. Includes comments about the ordering of the techniques, choosing users and tasks, and adapting heuristics. These comments can include those made during the use of the electronic texts or at the end of the task in the decision summary.
Examples:

- I'll do heuristics first then observations.
- I'll use novice and expert users to do the observational evaluation.
- I'll get them to try out buying a CD as one of the tasks.

Appendix 4.13 Example transcript coded for cognitive engagement activities from experiments 1 and 2.

From the paging buttons condition in experiment 1.

Counter	Page	Protocol
5500	Usability	[I recognise this definition from my course so I know that this is the proper definition of usability **A, CE]** [This definition doesn't really stress the importance of... that it should be implemented in the earlier stages of testing... the material. **CTC]** [It is a bit vague, "it is helpful to have some way of evaluating the level to which a system is usable" **CTC]**
53:47	UE intro	[I wasn't sure what... how to... there is the summative evaluation and formative evaluation and what they are... yet! **MU]**
52:30	Role of usability evaluation	[The assess of usability should occur at any and all stages... so I will agree with this... **CTC]** [it is the first time I really hear about it in this course, I never heard about usability before I came to this. **CE]**
50:20	Types of usability evaluation	[OK I now understand that formative evaluation is about **MU]**, [it's when it happens while the product is designed and summative is just on the final stages, on the final design solutions. **RU]** [I didn't know this before when you asked me this question. **CE]**
48:18	Observational evaluation introduction	I find it difficult to concentrate when I have information on the screen, and reading definitions from the screen. I would prefer to see it on paper personally, but I don't know... Also because English is not my first language so like I have to concentrate really well and it's more difficult when you see it on the screen.
46:23	Observational evaluation method	[This observational evaluation really tells me about what I am doing at the moment. I am being recorded and I am thinking aloud. **CE]**
4257	Observational evaluation data analysis	[I don't really understand **MU]** [... ah ha... observational evaluation ... this data is part of observational **A].** [flicks previous to OE method and next again] it's good I can go backwards and forwards.
4241	OE advantages	I think it's a lot to read on the screen and my eyesight is getting tired ... my eyesight isn't good anyway.
4204	Observational evaluation disadvantages	It would be nice to be sitting higher. [checking sheet]
3946	HE Intro.	UA - what are you thinking now? I'm thinking that it's just a lot of information to absorb from the screen. I just I don't concentrate very well when I'm looking at the screen. [I have a very clear idea of what I've read so far... **MU]** but it's because of the

		headings [I know OK this is another kind of evaluation now **A]** [and before it was about evaluation which wasn't anyone can test and here it's about experts **CE]** so it's like it's nice that I'm clicking every now and then coz it just sort of organises the thoughts. But it would still be nice to see it on a piece of paper because it's a lot of text to read. Am I supposed to, just one question, am supposed to say something about what I'm reading and what I think about it the conditions as well or how I feel reading it from the screen, what is the best thing really? UA - What you think about the information that you are reading on the screen ... you don't need to give me comments... if you think this bit fits together. There's so much reference to all those previously said like I'm like I've already forgotten the name of the other evaluation so it said unlike the other evaluation this one like, there really is not much contrast with the other it just says what it is may be ... so I think I think of... May be it would be nice to have other evaluations listed to see other evaluations you know here, to have the names of other evaluations other evaluations just to, because now when I click previous I have to click it several times so it would be nice to have this navigation, extra links.
3504	HE - Nielsen's Heuristics	[It's very interesting that minimalist design is mentioned here **CTC]**. [Many websites aren't really this. **CE]** [Aesthetics is in the same line as minimalism, it's quite interesting... **CTC]** [mumbling.] [It also quite funny the idea of control and freedom that people like taking control and it's actually quite stressful when we don't have control over things.**CE]** [Never really thought of control and freedom together. **CE]**
3240	HE Method	[This method is really vague. I would not know how to apply it. **CTC]** [Creating a prototype... selecting...it's just, it's nothing new really... it's something I have no knowledge of it **CE],** [but I think it's what I would do... **ST]** [I would like to hear more about the method. Just more about the method really **CTC]**.
3053	HE Analysis	[Well no... I think I don't like this approach very much. **ST]** [Just creating a prototype, it's not very in the real world. Just experts trying to testing and saying that this will result in the identification of 75% of usability problems is I don't know, I don't think it can be that clear cut really.... **RU, CE]** It's just my intuition but may be I'm wrong.
2948	HE Advantages	[Here, it says here that there have been claims that it is not very successful **A]** [, so my intuition was right **CE]**. [May be experts, experts test everything and it's not very successful. **CE]**
2854	HE Disadvantages	[Here it stresses the importance of user testing and I would agree with this **CTC]**. [The real user. If someone

		like my parents or my grandparents if they can use it then that is the real test **CE]**.
2730	CW Intro.	**[**I'm looking at cognitive walkthrough. **A]**
2543	CW Method	**[**I still think that any of this cognitive walkthrough method... I still think creating someone who's not the real user, trying to trying to identify them, the characteristics of typical users **RU] [**. I just don't understand why not just give it to a typical user to test. It would be just easier in a way. **CE] [**Just always have someone who is not an expert in the field and always change this person so they never become an expert. Just make them test the product and it'll be more efficient which is someone who knows nothing about the system. **EST,CE] [**Rather than invent a person which is just I don't see why, why this is done really. I don't see. **CTC]** [If a person gets stuck it means that something is wrong, it's just easier to test **CE]**.
2325	CW Analysis	**[**I like this 'analysis'... this word appears all the time , the feedback is so important analysing **CTC]**... going backwards going to a previous page is always really important.
2234.	CW advantages	**[**I don't like this idea of eliminating real users **CTC]**. **[**I can't imagine a situation where access to real users is difficult, just um, may be there are situations like that **CE]**. **[**I don't like this testing outside of the real world situation, I understand it's in the early stages but it's just um. My feeling is just that the real user should always be there. **CTC,CE]**
2113	References	UA - if you look at the task again. OK I have to make a decision now. [Reads sheet] My decision is to err… UA - you are able to look back through [flicks back through sequentially]
	Various	UA - what are you looking for now? **[**I'm looking for something more in the real world, you know. We have a lot of time, 3 months is a lot and it's not at the same time as the product... **CT]** [clicks previous as far as types of UE]
1923	types of UE	**[**I would be looking for a formative evaluation for sure, something that is tested all along. But I think I would I think I would use a combination.... **ST]**
1840	OE method	**[**Because here all of these don't really mention the real user and I would definitely implement the real user right from the start so I would use um... **ST]**
1801	OE advantages	**[**I think observational evaluation would be best because it identifies real user problems **ST]** UA - why not the others? **[**Because they don't, they don't, it was mentioned that every, that the advantage of the observational is that they

		concentrate on the real user problems and the other ones don't **RU]** [so that would be my priority cause **ST]** [it's going to be a real store so it's going to involve people's money **CE]**. [So it needs to be well designed as well as secure because it's a store so that would be my priority too. **CE]**
1655	ER intro.	If I have time... do I need to choose just one? UA - you can choose just one or you can choose a combination... [Yeah may be I'll choose a combination **ST]**. [At the early stages just have the expert, just for the prototype **EST],** [but as soon as we have a prototype I would employ the real user. Someone who has no idea about shopping on the website, and then may be someone who has done it a few times **EST]**. UA - which expert one? Ah which expert… [flicks through] [I think the cognitive. **ST]** [It's more expensive but I think it's worth it... because it's also formative and I like this idea of doing things as we go evaluating as we go **CE]** [so may be a combination **ST]**.
1524	CW disadvantages	[Keeping in mind that expert evaluators they may miss user problems. **RU]** UA - Can u summarise your final decision? [So my final decision is to use what's it called ... observational evaluation in with the cognitive walk... the cognitive one... cognitive walkthrough. **ST]**

Appendix 4.14 SPSS output for the internal reliability analysis of the ownership questionnaire for data from experiment 1 and parts A and B of experiment 2.

Iteration 1.

****** Method 2 (covariance matrix) will be used for this analysis ******

N of Cases = 56.0 (note that this is 56, not 58 because there were two outliers in experiment 1 and parts A and B of experiment 2)

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	61.8929	61.0792	7.8153	16

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
Q1	58.0179	52.5997	.4315	.5871	.7463
Q2	58.0179	53.4724	.3834	.4929	.7509
Q3	57.8929	53.5883	.5772	.5499	.7392
Q4	58.6786	56.9130	.1354	.2102	.7762*
Q5	57.7679	54.4724	.4267	.5973	.7482
Q6	58.1429	54.7065	.3565	.2232	.7533
Q7	57.7679	53.3088	.5048	.6482	.7419
Q8	58.1607	53.3373	.4728	.4420	.7438
Q9	58.0357	52.3623	.5888	.6229	.7354
Q10	58.5714	57.7403	.1614	.4902	.7685*
Q11	58.0893	54.9919	.3352	.5529	.7550
Q12	58.0714	56.6857	.3057	.4736	.7574
Q13	58.0893	55.2464	.2372	.4865	.7657
Q14	57.5357	59.4896	.0637	.2918	.7737*
Q15	57.6964	53.3425	.3742	.6675	.7518
Q16	57.8571	50.1247	.5147	.6303	.7372

*These items were removed in this iteration of the reliability analysis due to low item total correlations.

Reliability Coefficients 16 items

Alpha = .7650 Standardized item alpha = .7736

Iteration 2

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

N of Cases = 56.0.

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	51.0000	52.0000	7.2111	13

Item-total Statistics

	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Squared multiple correlation	Alpha if item deleted
Q1	47.1250	44.3659	.4145	.5517	.7791
Q2	47.1250	44.3659	.4228	.4541	.7782
Q3	47.0000	44.9091	.5936	.5202	.7669
Q5	46.8750	46.5477	.3692	.4039	.7827
Q6	47.2500	46.4091	.3305	.1947	.7862
Q7	46.8750	44.7295	.5111	.6280	.7710
Q8	47.2679	44.9269	.4644	.3626	.7746
Q9	47.1964	45.9425	.3646	.4907	.7832
Q11	47.1786	47.9312	.3035	.4193	.7875
Q12	47.1964	45.3971	.3082	.3753	.7909
Q13	46.8036	44.9971	.3605	.6132	.7847
Q15	46.9643	41.6351	.5290	.6013	.7672
Q16	47.1429	43.8338	.5985	.5688	.7639

Reliability Coefficients 13 items

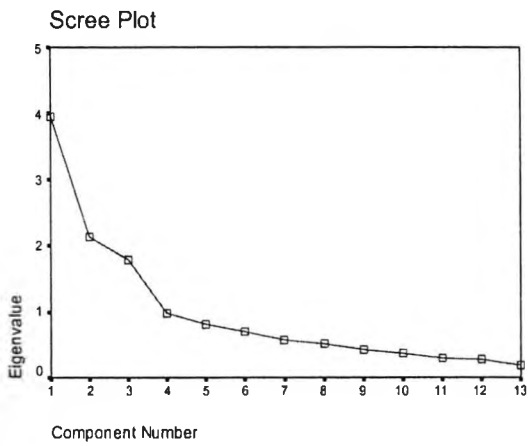
Alpha = .7919 **Standardized item alpha =** .7997 **(final alpha)**

Appendix 4.15 SPSS output for the factor analysis of the ownership questionnaire for data from experiment 1 and parts A and B of experiment 2.

Communalities

	Initial	Extraction
Q1	1.000	.734
Q2	1.000	.606
Q3	1.000	.650
Q5	1.000	.638
Q6	1.000	.192
Q7	1.000	.770
Q8	1.000	.463
Q9	1.000	.555
Q11	1.000	.573
Q12	1.000	.589
Q13	1.000	.577
Q15	1.000	.800
Q16	1.000	.728

Extraction Method: Principal Component Analysis.



Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.953	30.404	30.404	3.953	30.404	30.404	2.823	21.712	21.712
2	2.134	16.415	46.818	2.134	16.415	46.818	2.797	21.517	43.229
3	1.788	13.753	60.572	1.788	13.753	60.572	2.255	17.342	60.572
4	.966	7.430	68.002						
5	.804	6.181	74.183						
6	.708	5.443	79.626						
7	.576	4.429	84.055						
8	.520	3.999	88.054						
9	.427	3.284	91.338						
10	.375	2.884	94.222						
11	.291	2.241	96.463						
12	.268	2.061	98.525						
13	.192	1.475	100.000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

	Component		
	1 (Control)	2 (Responsibility)	3 (Value)
Q1	.177	.039	.837
Q2	.760	-.060	.155
Q3	.377	.707	.084
Q5	.053	.132	.786
Q6	.215	.358	.134
Q7	.206	.853	-.023
Q8	.642	.169	.151
Q9	.531	.495	.169
Q11	-.105	.718	.214
Q12	-.128	.756	.036
Q13	.749	-.007	-.123
Q15	-.039	.163	.879
Q16	.834	.178	-.007

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
[a] Rotation converged in 5 iterations.

Component Transformation Matrix

Component	1 (Control)	2 (Responsibility)	3 (Value)
1 (Control)	.626	.670	.399
2 (Resp.)	-.733	.331	.594
3 (Value)	.266	-.664	.699

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Appendix 4.16 Marking scheme for the written transfer task in experiments 1 and 2.

Written Transfer Task Marking Scheme

Each report is **rated out of 30**.

What the participant was asked to do:

Please write a report about how you came to your decision including details of:

- what usability evaluation is
- brief details of each of the techniques presented in the materials
- an explanation of why or why not each technique is/is not suitable for the given context
- conclude with your selected technique(s) and give a brief description of how they will be employed

A. Description of what usability evaluation is and it's purpose [5]

- description/purpose of usability evaluation
  - evaluating/testing/assessment/measurement of usability (investigating how easy a product is to use) [2]
  - identifying usability problems [2]
- bonus mark for description of usability or usability factors that might be looked for in a usability evaluation [1]
  - any two from: ease of use, easy to remember, easy to learn, utility, efficiency, effectiveness

Something that is along the right lines, but does not quite fit with the above (e.g. seeing how effective an interface is for end users) => 1 mark

B. Details of 3 evaluation techniques presented in the materials [5]

- observation involves real users [1]...
- being observed while using/interacting/completing set tasks with a system [1]
- expert reviews
  - expert reviews involve experts using a system and identifying usability problems [1] **or**
    - heuristic evaluation involves experts using a system and checking for conformity to a set of heuristics/rules/guidelines/principles [1]
    - cognitive walkthrough involves experts walking through set tasks (i.e. is task focussed) [1] **or**
      - simulating the behaviour/mental processes of a typical user[1] **or**
      - and checking to see if users can achieve their task goals [1] **or**
      - focus is on learning through exploration [1]
- + [1] bonus mark for level/quality of explanation (or details of formative/summative evaluations).
- N.B. just naming the techniques does not get any marks, they have to give some description. However, when they don't name a technique, a reasonable description that obviously relates to a particular technique can get marks, depending on the quality of the description as above.
- Also, specific data collection techniques (e.g. audio recording, video recording) if explained in detail can get 1 mark.

C. Understanding of how the usability evaluation techniques relate to each other (i.e. that CW and HE are both Expert Reviews and they are distinct from OE which uses real users) [5]

- 0 marks – e.g. mentions ERs, but does not mention each individual technique, or only mentions one technique.
- 1 mark– it is obvious that they know that CW and HE are both expert reviews but have not said this anywhere explicitly e.g. says 'HE is done by experts...' 'CW is done by experts'.
- 3 marks – this is implied but there is no explicit mention e.g. 'heuristics evaluations use experts...Cognitive walkthrough is *another* form of expert review...'
- 5 marks – explicit reference e.g. 'CW and HE are *both* forms of expert review'

D. Explanation of how each technique relates to the usability evaluation setting [maximum of 5 marks]

- e.g. advantages and disadvantages of each technique in relation to the setting:

- observational evaluation [At least 2 points for 2 marks, max 2 marks]
  - good because it uses real users therefore identify real problems
  - access to users is good
  - but, no access to a usability lab, so one might need to be set up (time consuming/costly)
  - can be costly and the budget is low
  - can be time consuming and the timescale is short
  - observing can change user behaviour
  - N.B. unsuitability of the paper prototype for evaluation with users is not valid and does not get marks.
- cognitive walkthrough [At least 2 points for 2 marks, max 2 marks]
  - access to experts good (experts in HCI and mobile computing)
  - goes through tasks in detail
  - experts can suggest solutions to problems
  - experts are able to give more technical feedback
  - but more expensive/time consuming than heuristics
  - expert bias (missing/creating problems)
- heuristic evaluation [At least 2 points for 2 marks, max 2 marks]
  - access to experts is good (experts in HCI and mobile computing)
  - cheap and quick to perform so good for the short timescale and low budget
  - experts can suggest solutions to problems
  - expert bias problems (missing/creating problems)

Notes:

If several advantages and disadvantages are given for a particular technique, but are not related to the task setting, 1 mark should be awarded for that technique (i.e. if the advantages and disadvantages of each technique are discussed without reference to the task setting then a max of 3 marks can be awarded).

If only expert reviews are talked about, rather than each individual technique, then a maximum of 2 marks can be given for the advantages/disadvantages of expert reviews.

No marks for the discussion of the appropriateness of formative/summative approaches.

No extra marks for just stating the factors in the task setting without relation to a particular technique.

E. Details of how the chosen technique will be employed [5]

- 1 mark – vague details of a particular element of the evaluation e.g. who does it, if a combination of techniques are recommended then which ones.
- 2/3 marks – good suggestions of how to use the techniques e.g. choosing tasks, choosing prototypes, ordering of chosen techniques, variations on the technique, choosing participants, how data will be gathered, testing environments
- 4 – including steps of the chosen technique or something including several of the above points
- 5 marks – e.g. adapting the heuristics for mobile phones/using adapted heuristics (if heuristic evaluation is chosen).

Notes:

Even if some facts are incorrect, e.g. they have said that HE uses users, then some credit can be given if they have describe details of a user based evaluation.

F. Argument quality [5]

- 0 marks – no argument – just presents techniques with no selection, or presents a conclusion with no argument.
- 1 mark – confused and including factual errors. Techniques are explained and *some* advantages and disadvantages are discussed. However, the conclusion does not clearly follow on from this discussion. For example if a combination of techniques is presented as the solution and this is not clearly justified and appears to be because the participant is not able to make a decision. If only one technique is discussed then 1 mark can be given if they justify the reasons for choosing that technique.
- 3 marks – reasonable (even if some points are incorrect). Each technique is explained and advantages and disadvantages are given in relation to the task setting. It is apparent that conclusions relate to the discussion of these advantages and disadvantages.

- 5 marks - clear logical sequence showing. Each technique is explained and discussed in terms of advantages and disadvantages in relation to the task setting. Conclusions are clearly justified and follow from this discussion.

Example solution

Usability is about how easy a system or product is to learn and use. This may be in terms of how well user tasks are supported and how easily and efficiently tasks can be completed. Usability evaluation is the assessment of usability and has the purpose of either identifying usability problems or giving some measure of usability of a system.

The electronic text materials presented three techniques for usability evaluation: observational evaluations, and two forms of expert review, heuristic evaluations and cognitive walkthroughs. The focus of these techniques was on their use in a formative approach to usability evaluation where the results of the evaluation are fed back into design. This approach is in contrast to summative evaluations where the usability of a final product is assessed. The appropriateness of each of these usability evaluation techniques in the given setting will be given consideration.

Observational evaluations involve observing users as they complete typical tasks and recording their interactions with a system either by audio, video, interaction logging or pen and paper. Users are commonly asked to give verbal protocols as they complete the tasks where they say any thoughts or reactions that come to mind. The data about the users' interactions is then analysed for usability problems.

In this setting access to real users is good- a factor that is essential to observational evaluations. This use of real users is an advantage of observational evaluations as it elicits relatively realistic feedback. But, there is no access to a usability lab. Also, the budget for this usability evaluation is low, and observational evaluations are potentially costly, so in this particular setting observations may not be as appropriate as other methods. In addition, the time scale is short, and observations can be time consuming, so it is probably better to consider a technique that is also quick to perform.

Heuristic evaluations involve expert evaluators assessing how well a system complies with a set of heuristics, or rules/guidelines. Experts walkthrough a set of typical user tasks with the system and at each stage of the task check conformity to the heuristics. Any time that a heuristic is broken details of the location of the problem are recorded on a coding sheet. At the end of the evaluation the problems are then grouped and often ordered in terms of the most significant problems.

Heuristic evaluations are quick and cheap to perform, making it appropriate for this setting since there is a low budget and a short timescale. Also, there is good access to expert evaluators, including experts in mobile computing as well as usability experts. This approach is particularly good at suggesting solutions to problems as it uses expert evaluators.

Cognitive walkthroughs are another form of expert reviews. It involves experts walking through a set of typical user tasks trying to predict user's thoughts and behaviours. At each stage of the task the expert asks themselves questions related to user's goals- whether they will form the correct goal and whether they can achieve it.

Any time that there is a negative answer to these questions the location of the problem is recorded. At the end of the evaluation the problems are grouped and ordered for importance.

Because of the good access to experts in this setting cognitive walkthrough at first seems appropriate here. Also it is cheaper than observational evaluations, which is beneficial since the usability budget for this design iteration is low. However, as compared to heuristic evaluations, cognitive walkthrough is more expensive and can be time consuming to perform. Time is important in this setting as the telecoms company want feedback in just two weeks.

In conclusion, due to the good access to experts, the short timescale and the low budget heuristic evaluation is the recommended technique for this setting since it is cheap and quick to perform. Since the focus is on the evaluation of a mobile phone a set of heuristics, adapted from Nielsen's to be specific to mobile phones, will be used. The experts can walkthrough the task of creating a memo and at each stage of the task check whether the interface conforms to the heuristics.

Appendix 4.17 SPSS output for the reliability and validity checking for the transfer task (correlation) for data from experiment 1 and parts A and B of experiment 2.

Correlations

			Author's Marking	Second Marking
Spearman's rho	Author's Marking	Correlation Coefficient	1.000	.853(**)
		Sig. (1-tailed)	.	.000
		N	15	15
	Second Marking	Correlation Coefficient	.853(**)	1.000
		Sig. (1-tailed)	.000	.
		N	15	15

** Correlation is significant at the 0.01 level (1-tailed).

Appendix 4.18 Marking scheme for the qualitative concept map marks in experiments 1, 2 and 3.

Concept Maps Marking Scheme

Rated out of 40.

1. Representations of key concepts (nodes) [20]

This part of the rating scheme concerns the representations of key ideas from the task text materials in the concept map.

Maps may include representations of the following ideas or similar:

- Usability evaluation/evaluation/evaluation techniques/testing*
- Usability
- Usability problems
- Formative evaluation*
- Summative evaluation*
- Observational evaluations/user testing*
- Users
- Experts/[Expert reviews*- only counts as a key point if CW and HE not included]
- Typical tasks
- Heuristic evaluation*
- Heuristics/guidelines/Nielsen's/principles
- Cognitive walkthroughs*
- Simulating user behaviour
- Cheap
- Quick
- Expensive
- Time consuming
- Rich data
- System being evaluated/Prototypes

* Key concepts (all other points are other related ideas that might appear as valid nodes on the concept maps)

Additional relevant point related to the content of the task materials are still valid.

Rating breakdown:

0 marks
- completely irrelevant i.e. none of the key points are represented, and the relation to the content of the task materials is scarce

5 marks
- several key points missing
- nodes are additional to the materials (e.g. general iterative design/usability information not included in the task materials)

10 marks
- all key points represented with little detail (e.g. no details of who does each technique, what they involve, or advantages/disadvantages)
- **OR** some key points represented in reasonable detail. May be sporadic for each technique e.g. might say who performs one technique but doesn't say who performs another.

15 marks
- all key points + good representations of understanding elements/features of these points (includes advantages/disadvantages **OR** features of a technique e.g. uses experts or users).

- Also, if most key points are shown, but e.g. formative and summative evaluation are omitted, and detail is very good (both advs/disadvs and details of the technique) then 15 marks can be given.

20 marks

- detailed/elaborate representations of understanding including all key points + additional detail (includes features of a technique, e.g. who does it, **AND** advantages/disadvantages e.g. cost, time etc.).

Notes:

- All in between ratings (i.e. 2-4, 6-9,11-14 etc) can be given when the criteria of the lower rating band has been met, but the map does not quite fulfil the upper band's criteria.
- Marks can still be awarded even if a full exact name is not given, but it is clear what is being referred to e.g. a node labelled 'evaluation at the end of design' can still be counted as representing summative evaluation.
- Any errors in the structure of the map (e.g. a nodes labelled 'heuristic evaluation' is linked to a node labelled 'users') should be accounted for in the appropriateness of links section (section 2).
- General errors (e.g. incorrect advantages/disadvantages linked to a particular evaluation technique) should also be accounted for only in the appropriateness of links section (section 2).

2. Appropriateness of links (and labelling) [20]

This part of the rating scheme concerns the quality of links, and encompasses the quality of the structure of the map.

Rating breakdown:

0 marks

- all links are irrelevant/random/inappropriate/confusing e.g. links have no apparent meaning especially in terms of the content of the task materials

5 marks

- mostly random/inappropriate links (e.g. links have no apparent meaning)
- missing key links (obvious links are missing e.g. a node labelled 'expert reviews' is linked to a node labelled 'cognitive walkthrough', but not to a node labelled 'heuristic evaluation')
- due to a low number of concepts represented linking cannot be given a higher rating
- linking does not appear to relate to the content of the task materials

10 marks

- some appropriate linking of key points (not all obvious links are shown on the map i.e. it appears that further links could have been added, although their omission is not critical to the quality of the map)
- if linking is good, but there are a low number of concepts on the map (i.e. some key points and not many detail-nodes) then this rating might be more appropriate than a higher rating
- lack of labelling makes the meaning of some links unclear

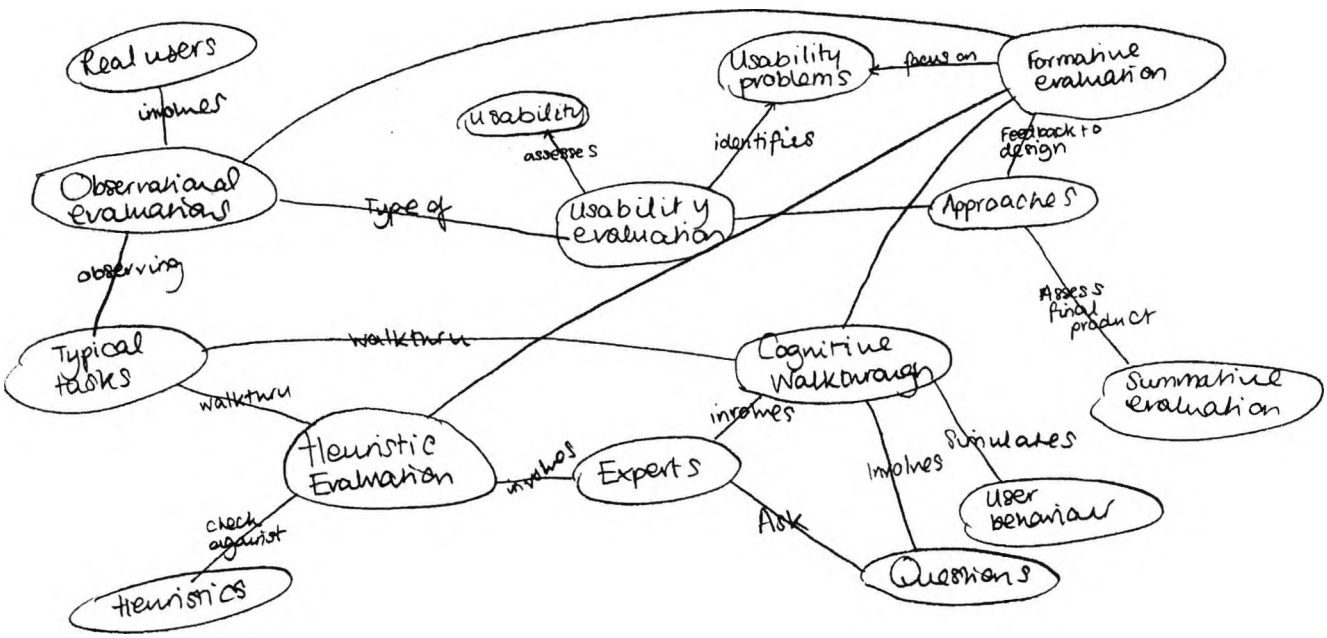
15 marks

- good clear linking of key points e.g. links give a structure and flow to the map
- if links aren't labelled, arrows are also acceptable since they indicate the flow of the map

20 marks

- clear logical flow and detailed linking of key points to additional points e.g. most points are labelled, and where not labelled the meaning of the link is obvious and logical
- may use arrows (directional arrows are particularly good to show the direction of the relationship between linked nodes)

Example:



Rating of the above concept map:

Representations of key concepts – 15 marks. This map represents all of the key concepts in the text as well as additional points showing understanding. However, some points could also have been included such as those concerning the relative merits of each of the evaluation techniques, such as cost.

Appropriateness of links – 10 marks. They key points are linked and are clearly labelled. However, some obvious links are not present on the concept map, for example there is a link labelled 'Type of' between the 'Usability evaluation' node and the 'Observational evaluations' node, but there is no link from 'Observational evaluations' to the 'Heuristic Evaluation' or 'Cognitive Walkthrough' nodes.

Appendix 4.19 SPSS output for the reliability and validity checking for the concept-mapping task (correlations) for data from experiment 1 and parts A and B of experiment 2.

Correlations

			Author's marking for node quality	Second marking for node quality
Spearman's rho	Author's marking for node quality	Correlation Coefficient	1.000	.600(**)
		Sig. (1-tailed)	.	.009
		N	15	15
	Second marking for node quality	Correlation Coefficient	.600(**)	1.000
		Sig. (1-tailed)	.009	.
		N	15	15

** Correlation is significant at the 0.01 level (1-tailed).

Correlations

			Author's marking for link quality	Second marking for link quality
Spearman's rho	Author's marking for link quality	Correlation Coefficient	1.000	.496(*)
		Sig. (1-tailed)	.	.030
		N	15	15
	Second marking for link quality	Correlation Coefficient	.496(*)	1.000
		Sig. (1-tailed)	.030	.
		N	15	15

* Correlation is significant at the 0.05 level (1-tailed).

Appendix 4.20 Example transcript coded for usability problems from experiments 1 and 2.

From the paging buttons condition in experiment 1.

Counter	Page	Protocol
5500	Usability	I recognise this definition from my course so I know that this is the proper definition of usability. [This definition doesn't really stress the importance of... that it should be implemented in the earlier stages of testing... the material. It is a bit vague, "it is helpful to have some way of evaluating the level to which a system is usable". **UP 2.1]**
53:47	UE intro	I wasn't sure what... how to... there is the summative evaluation and formative evaluation and what they are... yet!
52:30	Role of usability evaluation	The assess of usability should occur at any and all stages... so I will agree with this... it is the first time I really hear about it in this course, I never heard about usability before I came to this.
50:20	Types of usability evaluation	OK I now understand that formative evaluation is about, it's when it happens while the product is designed and summative is just on the final stages, on the final design solutions. I didn't know this before when you asked me this question.
48:18	Observational evaluation introduction	[I find it difficult to concentrate when I have information on the screen, and reading definitions from the screen. I would prefer to see it on paper personally, but I don't know... Also because English is not my first language so like I have to concentrate really well and it's more difficult when you see it on the screen. **UP 1.1]**
46:23	Observational evaluation method	This observational evaluation really tells me about what I am doing at the moment. I am being recorded and I am thinking aloud.
4257	Observational evaluation data analysis	[I don't really understand... **UP 2.2]** ah ha... observational evaluation ... this data is part of observational. [flicks previous to OE method and next again] it's good I can go backwards and forwards.
4241	OE advantages	[I think it's a lot to read on the screen and my eyesight is getting tired ... my eyesight isn't good anyway **UP 1.5]**
4204	Observational evaluation disadvantages	[It would be nice to be sitting higher **UP 1.4]** [checking sheet]
3946	HE Intro.	UA - what are you thinking now? [I'm thinking that it's just a lot of information to absorb from the screen. **UP 1.1][** I just I don't concentrate very well when I'm looking at the screen **UP 1.1]**. I have a very clear idea of what I've read so far... [but it's because of the headings **UP 1.1]** I know OK this is another kind of evaluation now and before it was about evaluation which wasn't anyone can test and here it's about experts so it's like it's nice that I'm clicking every now and then coz it just sort of organises the thoughts. [But it would still be nice to see it on a piece of paper **UP 1.10]** [because it's a lot of text to read **UP 1.1]**. Am I supposed to, just one question, am supposed to say something about what I'm reading and what I think about it the conditions as well or how I feel reading it from the screen, what is the best thing really? UA - What you think about the information that you are reading on the screen ... you don't need to give me comments... if you think this bit fits together. [There's so much reference to all those previously said **UP2.1]** [like I'm like I've already forgotten the name of the other evaluation so it said unlike the other evaluation this one like, there really is not much contrast with the other it just says what it is may be ... so I think I think of... **UP 2.2]** [May be it would be nice to have other evaluations listed to see other evaluations you know here, to have the names of other evaluations other evaluations **UP 1.10]** just to, [because now when I click previous I have to click it several times **UP 1.1, 1.7]** [so it would be nice to have this navigation, extra links **UP 1.10]**.
3504	HE - Nielsen's Heuristics	It's very interesting that minimalist design is mentioned here. Many websites aren't really this. Aesthetics is in the same line as minimalism, it's quite interesting... [mumbling.] It also quite funny the idea of control and freedom that people like taking control and it's actually quite stressful when we don't have control over things. Never really thought of control and freedom together.
3240	HE Method	[This method is really vague **UP 2.2]**. I would not know how to apply it. Creating a prototype... selecting...it's just, it's nothing new really... it's something I have no knowledge of it, but I think it's what I would do... [I would like to hear more about the method. Just more about the method really **UP 2.4]**.
3053	HE Analysis	Well no... I think I don't like this approach very much. Just creating a prototype, it's not very in the real world. Just experts trying to testing and saying that this will result in the identification of 75% of usability problems is I don't know, I don't think it can be that clear cut really.... It's just my intuition but may be I'm wrong.
2948	HE Advantages	Here, it says here that there have been claims that it is not very successful, so my intuition was right. May be experts, experts test everything and it's not very

		successful.
2854	HE Disadvantages	Here it stresses the importance of user testing and I would agree with this. The real user. If someone like my parents or my grandparents if they can use it then that is the real test.
2730	CW Intro.	I'm looking at cognitive walkthrough.
2543	CW Method	I still think that any of this cognitive walkthrough method... I still think creating someone who's not the real user, trying to trying to identify them, the characteristics of typical users. I just don't understand why not just give it to a typical user to test. It would be just easier in a way. Just always have someone who is not an expert in the field and always change this person so they never become an expert. Just make them test the product and it'll be more efficient which is someone who knows nothing about the system. [Rather than invent a person which is just I don't see why, why this is done really. I don't see. **UP 2.2]** If a person gets stuck it means that something is wrong, it's just easier to test.
2325	CW Analysis	I like this analysis... this word appears all the time , the feedback is so important analysing... going backwards going to a previous page is always really important.
2234.	CW advantages	I don't like this idea of eliminating real users. [I can't imagine a situation where access to real users is difficult, just um, may be there are situations like that **UP2.2]**. I don't like this testing outside of the real world situation, I understand it's in the early stages but it's just um. My feeling is just that the real user should always be there.
2113	References	UA - if you look at the task again. OK I have to make a decision now. [Reads sheet] My decision is to err… UA - you are able to look back through [flicks back through sequentially]
	Various	UA - what are you looking for now? **[**I'm looking for something more in the real world **UP 1.7],** you know. We have a lot of time, 3 months is a lot and it's not at the same time as the product... [clicks previous as far as types of UE]
1923	types of UE	I would be looking for a formative evaluation for sure, something that is tested all along. But I think I would I think I would use a combination....
1840	OE method	Because here all of these don't really mention the real user and I would definitely implement the real user right from the start so I would use um...
1801	OE advantages	I think observational evaluation would be best because it identifies real user problems UA - why not the others? Because they don't, they don't, it was mentioned that every, that the advantage of the observational is that they concentrate on the real user problems and the other ones don't so that would be my priority cause it's going to be a real store so it's going to involve people's money. So it needs to be well designed as well as secure because it's a store so that would be my priority too.
1655	ER intro.	If I have time... do I need to choose just one? UA - you can choose just one or you can choose a combination... Yeah may be I'll choose a combination. At the early stages just have the expert, just for the prototype, but as soon as we have a prototype I would employ the real user. Someone who has no idea about shopping on the website, and then may be someone who has done it a few times. UA - which expert one? Ah which expert… [flicks through] I think the cognitive. It's more expensive but I think it's worth it... because it's also formative and I like this idea of doing things as we go evaluating as we go so may be a combination.
1524	CW disadvantages	Keeping in mind that expert evaluators they may miss user problems. UA - Can you summarise your final decision? So my final decision is to use what's it called ... observational evaluation in with the cognitive walk... the cognitive one... cognitive walkthrough.

Appendix 4.21 SPSS output for analyses of cognitive engagement in experiment 1.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
TOTAL	Paging Buttons	7	76.1429	38.65846	14.61152	40.3897	111.8960	29.00	128.00
	Embedded links	7	77.4286	52.24576	19.74704	29.1093	125.7478	14.00	160.00
	A-Z	7	65.7143	23.22150	8.77690	44.2380	87.1906	35.00	111.00
	Map	7	68.4286	27.24492	10.29761	43.2312	93.6259	21.00	106.00
	Total	28	71.9286	35.34269	6.67914	58.2241	85.6330	14.00	160.00
Planning/ Strategy (P)	Paging Buttons	7	.8571	1.46385	.55328	-.4967	2.2110	.00	3.00
	Embedded links	7	1.7143	1.97605	.74688	-.1133	3.5418	.00	5.00
	A-Z	7	3.4286	3.20713	1.21218	.4625	6.3947	.00	9.00
	Map	7	1.7143	1.70434	.64418	.1380	3.2905	.00	5.00
	Total	28	1.9286	2.27594	.43011	1.0461	2.8111	.00	9.00
Connecting to the Task Setting (CT)	Paging Buttons	7	5.1429	6.14894	2.32408	-.5440	10.8297	.00	17.00
	Embedded links	7	2.4286	2.69921	1.02020	-.0678	4.9249	.00	6.00
	A-Z	7	2.1429	3.23669	1.22336	-.8506	5.1363	.00	9.00
	Map	7	5.0000	4.54606	1.71825	.7956	9.2044	.00	11.00
	Total	28	3.6786	4.35510	.82304	1.9898	5.3673	.00	17.00
Connecting Experiences (CE)	Paging Buttons	7	12.1429	10.46309	3.95468	2.4661	21.8196	4.00	31.00
	Embedded links	7	11.1429	9.63377	3.64122	2.2331	20.0526	.00	28.00
	A-Z	7	8.5714	4.64963	1.75739	4.2712	12.8716	2.00	15.00
	Map	7	8.5714	4.61364	1.74379	4.3045	12.8383	1.00	14.00
	Total	28	10.1071	7.55395	1.42756	7.1780	13.0363	.00	31.00
Critiquing Text Content (CTC)	Paging Buttons	7	1.7143	3.30224	1.24813	-1.3398	4.7683	.00	9.00
	Embedded links	7	2.7143	4.71573	1.78238	-1.6470	7.0756	.00	11.00
	A-Z	7	1.7143	2.62769	.99317	-.7159	4.1445	.00	6.00
	Map	7	1.4286	1.90238	.71903	-.3308	3.1880	.00	5.00
	Total	28	1.8929	3.15453	.59615	.6697	3.1161	.00	11.00
Monitoring Understanding (MU)	Paging Buttons	7	5.4286	3.64496	1.37766	2.0575	8.7996	1.00	10.00
	Embedded links	7	5.1429	6.81734	2.57671	-1.1621	11.4478	.00	20.00
	A-Z	7	2.7143	.95119	.35952	1.8346	3.5940	1.00	4.00
	Map	7	3.8571	2.41030	.91101	1.6280	6.0863	.00	7.00
	Total	28	4.2857	3.99868	.75568	2.7352	5.8362	.00	20.00
Employing Selected Technique (EST)	Paging Buttons	7	3.4286	6.10620	2.30793	-2.2187	9.0759	.00	17.00
	Embedded links	7	3.2857	4.07080	1.53862	-.4791	7.0506	.00	11.00
	A-Z	7	4.4286	5.09435	1.92548	-.2829	9.1401	1.00	15.00
	Map	7	3.2857	4.02965	1.52307	-.4411	7.0125	.00	12.00
	Total	28	3.6071	4.64550	.87792	1.8058	5.4085	.00	17.00
Restating Understanding (RU)	Paging Buttons	7	8.7143	11.85628	4.48125	-2.2509	19.6795	.00	32.00
	Embedded links	7	11.4286	11.73111	4.43394	.5791	22.2780	.00	33.00
	A-Z	7	8.5714	10.86059	4.10492	-1.4729	18.6158	2.00	32.00

	Map	7	10.0000	9.96661	3.76702	.7824	19.2176	1.00	24.00
	Total	28	9.6786	10.55867	1.99540	5.5843	13.7728	.00	33.00
Alertness (A)	Paging Buttons	7	5.0000	2.30940	.87287	2.8642	7.1358	1.00	8.00
	Embedded links	7	2.7143	2.75162	1.04002	.1695	5.2591	.00	7.00
	A-Z	7	6.4286	5.34968	2.02199	1.4809	11.3762	.00	15.00
	Map	7	3.2857	4.15188	1.56926	-.5541	7.1256	.00	12.00
	Total	28	4.3571	3.90834	.73861	2.8416	5.8726	.00	15.00
Selecting Technique (ST)	Paging Buttons	7	6.5714	4.82553	1.82388	2.1086	11.0343	1.00	15.00
	Embedded links	7	7.2857	6.62607	2.50442	1.1576	13.4138	1.00	19.00
	A-Z	7	5.7143	2.81154	1.06266	3.1140	8.3145	4.00	12.00
	Map	7	7.7143	4.46148	1.68628	3.5881	11.8405	1.00	15.00
	Total	28	6.8214	4.65915	.88050	5.0148	8.6281	1.00	19.00
Monitoring Navigation (MN)	Paging Buttons	7	1.8571	2.54484	.96186	-.4964	4.2107	.00	6.00
	Embedded links	7	6.4286	10.58076	3.99915	-3.3570	16.2141	.00	30.00
	A-Z	7	3.4286	2.50713	.94761	1.1099	5.7473	1.00	7.00
	Map	7	3.0000	2.30940	.87287	.8642	5.1358	1.00	7.00
	Total	28	3.6786	5.64410	1.06663	1.4900	5.8671	.00	30.00

Table 1. Descriptive statistics for cognitive engagement.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
TOTAL	Paging Buttons	7	15.64
	Embedded links	7	15.21
	A-Z	7	12.71
	Map	7	14.43
	Total	28	
Planning/Strategy (P)	Paging Buttons	7	9.93
	Embedded links	7	14.36
	A-Z	7	18.86
	Map	7	14.86
	Total	28	
Connecting to the Task Setting (CT)	Paging Buttons	7	16.79
	Embedded links	7	12.57
	A-Z	7	11.29
	Map	7	17.36
	Total	28	
Connecting Experiences (CE)	Paging Buttons	7	15.21
	Embedded links	7	15.50
	A-Z	7	13.57
	Map	7	13.71
	Total	28	
Critiquing Text Content (CTC)	Paging Buttons	7	14.36
	Embedded links	7	13.79
	A-Z	7	14.43
	Map	7	15.43
	Total	28	
Monitoring Understanding (MU)	Paging Buttons	7	17.50
	Embedded links	7	13.21
	A-Z	7	11.86
	Map	7	15.43
	Total	28	
Employing Selected Technique (EST)	Paging Buttons	7	12.71
	Embedded links	7	13.71
	A-Z	7	16.64
	Map	7	14.93
	Total	28	
Restating Understanding (RU)	Paging Buttons	7	12.71
	Embedded links	7	16.50
	A-Z	7	13.64

	Map	7	15.14
	Total	28	
Alertness (A)	Paging Buttons	7	17.93
	Embedded links	7	10.93
	A-Z	7	17.71
	Map	7	11.43
	Total	28	
Selecting Technique (ST)	Paging Buttons	7	14.00
	Embedded links	7	13.57
	A-Z	7	13.50
	Map	7	16.93
	Total	28	
Monitoring Navigation (MN)	Paging Buttons	7	10.64
	Embedded links	7	15.29
	A-Z	7	16.64
	Map	7	15.43
	Total	28	

Table 2. Total number of data points and mean rank for each condition in experiment 1.

Test Statistics(a,b)

	TOTAL	P	CT	CE	CTC	MU	EST	RU	A	ST	MN
Chi-Square	.519	4.394	2.935	.311	.178	1.960	.919	.867	4.639	.840	2.241
df	3	3	3	3	3	3	3	3	3	3	3
Asymp. Sig.	.915	.222	.402	.958	.981	.581	.821	.833	.200	.840	.524

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for aspects of cognitive engagement and significance.

Appendix 4.22 SPSS output for analyses of ownership in experiment 1.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Paging buttons	7	3.8242	.49398	.18671	3.3673	4.2810	3.31	4.54
Embedded links	7	3.7802	.42697	.16138	3.3853	4.1751	3.23	4.23
A-Z	7	4.0659	.47508	.17956	3.6266	4.5053	3.31	4.62
Map	7	3.8901	.41864	.15823	3.5029	4.2773	3.08	4.46
Total	28	3.8901	.44284	.08369	3.7184	4.0618	3.08	4.62

Table 1. Descriptive statistics for total ownership.

Kruskal-Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Total Ownership	Paging buttons	7	13.57
	Embedded links	7	12.43
	A-Z	7	17.79
	Map	7	14.21
	Total	28	

Table 2. Total number of data points and mean rank for each condition for total ownership.

Test Statistics(a,b)

	Total Ownership
Chi-Square	1.667
df	3
Asymp. Sig.	.644

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for total ownership.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Paging Buttons	35	3.3714	1.30802	.22110	2.9221	3.8208	1.00	5.00
Embedded links	35	3.5429	.98048	.16573	3.2060	3.8797	2.00	5.00
A-Z	35	4.4000	.81168	.13720	4.1212	4.6788	2.00	5.00
Map	35	4.1714	.92309	.15603	3.8543	4.4885	2.00	5.00
Total	140	3.8714	1.09835	.09283	3.6879	4.0550	1.00	5.00

Table 4. Descriptive statistics for the control factor.

Kruskal-Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
CONTROL	Paging Buttons	35	55.33
	Embedded links	35	56.50
	A-Z	35	89.61
	Map	35	80.56
	Total	140	

Table 5. Total number of data points and mean rank for each condition for the control factor.

Test Statistics(a,b)

	CONTROL FACTOR
Chi-Square	20.770
df	3
Asymp. Sig.	.000

a Kruskal Wallis Test
b Grouping Variable: IV

Table 6. Chi-squared (or H) value for each condition and significance for the control factor.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Paging Buttons	35	3.9143	.78108	.13203	3.6460	4.1826	2.00	5.00
Embedded links	35	3.9714	.92309	.15603	3.6543	4.2885	2.00	5.00
A-Z	35	3.5714	.97877	.16544	3.2352	3.9076	2.00	5.00
Map	35	3.5429	1.09391	.18490	3.1671	3.9186	1.00	5.00
Total	140	3.7500	.96055	.08118	3.5895	3.9105	1.00	5.00

Table 7. Descriptive statistics for the responsibility factor.

Kruskal-Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
RESPONSIBILITY FACTOR	Paging Buttons	35	76.50
	Embedded links	35	78.94
	A-Z	35	63.17
	Map	35	63.39
	Total	140	

Table 8. Total number of data points and mean rank for each condition for the responsibility factor.

Test Statistics(a,b)

	RESPONSIBILITY FACTOR
Chi-Square	4.999
df	3
Asymp. Sig.	.172

a Kruskal Wallis Test
b Grouping Variable: IV2

Table 9. Chi-squared (or H) value for each condition and significance for the responsibility factor.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Paging Buttons	21	4.4286	.81064	.17690	4.0596	4.7976	3.00	5.00
Embedded Links	21	3.8571	1.27615	.27848	3.2762	4.4380	1.00	5.00
A-Z	21	4.3333	.73030	.15936	4.0009	4.6658	2.00	5.00
Map	21	4.0000	1.00000	.21822	3.5448	4.4552	2.00	5.00
Total	84	4.1548	.98781	.10778	3.9404	4.3691	1.00	5.00

Table 10. Descriptive statistics for the value factor.

	IV	N	Mean Rank
VALUE FACTOR	Paging buttons	21	48.81
	Embedded links	21	38.02
	A-Z	21	44.83
	Map	21	38.33
	Total	84	

Table 11. Total number of data points and mean rank for each condition for the value factor.

Test Statistics(a,b)

	VALUEF2
Chi-Square	3.375
df	3
Asymp. Sig.	.337

a Kruskal Wallis Test
b Grouping Variable: IV2

Table 12. Chi-squared (or H) value for each condition and significance for the value factor.

Appendix 4.23 SPSS output for analyses of the written transfer task in experiment 1.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Total transfer task (%)	Paging Buttons	7	48.0952	22.01491	8.32085	27.7348	68.4556	13.33	86.67
	Embedded links	7	28.5714	9.39999	3.55286	19.8779	37.2650	10.00	40.00
	A-Z	7	35.7143	16.06864	6.07337	20.8533	50.5753	10.00	60.00
	Map	7	42.3810	14.36486	5.42941	29.0957	55.6662	20.00	60.00
	Total	28	38.6905	16.90787	3.19529	32.1343	45.2467	10.00	86.67
A (%)	Paging Buttons	7	37.1429	26.90371	10.16865	12.2611	62.0246	.00	60.00
	Embedded links	7	42.8571	24.29972	9.18443	20.3837	65.3306	.00	60.00
	A-Z	7	42.8571	29.27700	11.06567	15.7804	69.9339	.00	80.00
	Map	7	54.2857	29.92053	11.30890	26.6138	81.9576	.00	80.00
	Total	28	44.2857	26.86435	5.07688	33.8688	54.7026	.00	80.00
B(%)	Paging Buttons	7	62.8571	21.38090	8.08122	43.0831	82.6312	40.00	100.00
	Embedded links	7	45.7143	9.75900	3.68856	36.6887	54.7399	40.00	60.00
	A-Z	7	42.8571	24.29972	9.18443	20.3837	65.3306	20.00	80.00
	Map	7	60.0000	20.00000	7.55929	41.5031	78.4969	20.00	80.00
	Total	28	52.8571	20.52228	3.87835	44.8994	60.8149	20.00	100.00
C(%)	Paging Buttons	7	37.1429	37.28909	14.09395	2.6562	71.6295	.00	100.00
	Embedded links	7	28.5714	48.79500	18.44278	-16.5564	73.6993	.00	100.00
	A-Z	7	17.1429	37.28909	14.09395	-17.3438	51.6295	.00	100.00
	Map	7	62.8571	40.70802	15.38619	25.2085	100.5058	.00	100.00
	Total	28	36.4286	42.53228	8.03785	19.9363	52.9209	.00	100.00
D(%)	Paging Buttons	7	62.8571	35.45621	13.40119	30.0656	95.6487	.00	100.00
	Embedded links	7	34.2857	22.25395	8.41120	13.7042	54.8672	.00	60.00
	A-Z	7	54.2857	39.52094	14.93751	17.7349	90.8365	.00	100.00
	Map	7	42.8571	40.70802	15.38619	5.2085	80.5058	.00	80.00
	Total	28	48.5714	35.03588	6.62116	34.9859	62.1569	.00	100.00
E(%)	Paging Buttons	7	40.0000	30.55050	11.54701	11.7455	68.2545	.00	80.00
	Embedded links	7	8.5714	10.69045	4.04061	-1.3156	18.4584	.00	20.00
	A-Z	7	31.4286	25.44836	9.61858	7.8928	54.9644	.00	60.00
	Map	7	8.5714	15.73592	5.94762	-5.9819	23.1247	.00	40.00
	Total	28	22.1429	25.14508	4.75197	12.3926	31.8931	.00	80.00
F(%)	Paging Buttons	7	48.5714	30.23716	11.42857	20.6067	76.5361	.00	100.00
	Embedded links	7	11.4286	15.73592	5.94762	-3.1247	25.9819	.00	40.00
	A-Z	7	25.7143	27.60262	10.43281	.1861	51.2425	.00	80.00
	Map	7	25.7143	15.11858	5.71429	11.7319	39.6966	.00	40.00
	Total	28	27.8571	25.72751	4.86204	17.8811	37.8332	.00	100.00

Table 1. Descriptive statistics for the written transfer task.

Kruskal-Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Total written transfer task	Paging Buttons	7	18.79
	Embedded links	7	9.00
	A-Z	7	13.21
	Map	7	17.00
	Total	28	
A	Paging Buttons	7	12.50
	Embedded links	7	14.14
	A-Z	7	13.71
	Map	7	17.64
	Total	28	
B	Paging Buttons	7	17.79
	Embedded links	7	11.21
	A-Z	7	11.07
	Map	7	17.93
	Total	28	
C	Paging Buttons	7	15.57
	Embedded links	7	12.14
	A-Z	7	10.79
	Map	7	19.50
	Total	28	
D	Paging Buttons	7	17.64
	Embedded links	7	10.71
	A-Z	7	16.00
	Map	7	13.64
	Total	28	
E	Paging Buttons	7	19.29
	Embedded links	7	10.86
	A-Z	7	17.57
	Map	7	10.29
	Total	28	
F	Paging Buttons	7	20.71
	Embedded links	7	9.07
	A-Z	7	13.43
	Map	7	14.79
	Total	28	

Table 2. Total number of data points and mean rank for each condition for each aspect that the written transfer task was marked on.

Test Statistics(a,b)

	Total written transfer task	A	B	C	D	E	F
Chi-Square	5.926	1.604	5.120	5.351	2.939	7.393	7.704
df	3	3	3	3	3	3	3
Asymp. Sig.	.115	.658	.163	.148	.401	.060	.053

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for each aspect that the written transfer task was marked on.

Appendix 4.24 SPSS output for analyses of the concept-mapping task in experiment 1.

Quantitative Concept Map Marks

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Paging Buttons	7	36.5714	7.56873	2.86071	29.5715	43.5713	24.00	47.00
Embedded links	7	21.4286	10.56499	3.99319	11.6576	31.1996	5.00	38.00
A-Z	7	29.7143	3.94606	1.49147	26.0648	33.3638	23.00	35.00
Map	7	33.4286	10.69045	4.04061	23.5416	43.3156	22.00	55.00
Total	28	30.2857	9.98093	1.88622	26.4155	34.1559	5.00	55.00

Table 1. Descriptive statistics for the parametric ANOVA for the quantitative concept map marks.

Levene Statistic	df1	df2	Sig.
1.063	3	24	.383

Table 2. Levene test for homogeneity of variances for the quantitative concept map marks.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	897.143	3	299.048	4.004	.019
Within Groups	1792.571	24	74.690		
Total	2689.714	27			

Table 3. Parametric Analysis of Variance for the quantitative concept map marks.

(I) IV	(J) IV	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Paging Buttons	Embedded links	15.1429(*)	4.61954	.016	2.3994	27.8864
	A-Z	6.8571	4.61954	.462	-5.8864	19.6006
	Map	3.1429	4.61954	.904	-9.6006	15.8864
Embedded links	Paging Buttons	-15.1429(*)	4.61954	.016	-27.8864	-2.3994
	A-Z	-8.2857	4.61954	.301	-21.0292	4.4578
	Map	-12.0000	4.61954	.070	-24.7435	.7435
A-Z	Paging Buttons	-6.8571	4.61954	.462	-19.6006	5.8864
	Embedded links	8.2857	4.61954	.301	-4.4578	21.0292
	Map	-3.7143	4.61954	.852	-16.4578	9.0292
Map	Paging Buttons	-3.1429	4.61954	.904	-15.8864	9.6006
	Embedded links	12.0000	4.61954	.070	-.7435	24.7435
	A-Z	3.7143	4.61954	.852	-9.0292	16.4578

* The mean difference is significant at the .05 level.

Table 4. Tukey HSD multiple comparison tests for the quantitative concept map marks.

Qualitative Concept Map Marks

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Paging Buttons	7	60.3571	18.84302	7.12199	42.9303	77.7840	37.50	90.00
Embedded links	7	39.6429	14.46465	5.46713	26.2653	53.0204	25.00	67.50
A-Z	7	40.0000	23.45208	8.86405	18.3104	61.6896	17.50	87.50
Map	7	52.8571	17.40621	6.57893	36.7591	68.9552	15.00	67.50
Total	28	48.2143	19.88226	3.75739	40.5048	55.9238	15.00	90.00

Table 5. Descriptive statistics for the qualitative concept map marks.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Qualitative Concept Map Mark	Paging Buttons	7	19.86
	Embedded links	7	10.71
	A-Z	7	10.36
	Map	7	17.07
	Total	28	

Table 6. Total number of data points and mean rank for each condition for the qualitative concept map marks.

Test Statistics(a,b)

	Qualitative Concept Map Mark
Chi-Square	6.947
df	3
Asymp. Sig.	.074

a Kruskal Wallis Test
b Grouping Variable: IV

Table 7. Chi-squared (or H) value for each condition and significance for the qualitative concept map marks.

Appendix 4.25 SPSS output for analyses of navigation behaviour in experiment 1.

Number of Operations

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Paging Buttons	7	108.0000	59.97222	22.66737	52.5350	163.4650	39.00	217.00
Embedded links	7	117.4286	67.59156	25.54721	54.9168	179.9403	35.00	239.00
A-Z	7	50.4286	29.69207	11.22255	22.9680	77.8892	27.00	115.00
Map	7	61.0000	21.64871	8.18244	40.9783	81.0217	34.00	88.00
Total	28	84.2143	54.61607	10.32147	63.0364	105.3922	27.00	239.00

Table 1. Descriptive statistics for the parametric ANOVA for the number of operations.

Levene Statistic	df1	df2	Sig.
2.212	3	24	.113

Table 2. Levene test for homogeneity of variances for the number of operations.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	23445.286	3	7815.095	3.285	.038
Within Groups	57093.429	24	2378.893		
Total	80538.714	27			

Table 3. Parametric analysis of variance for the number of operations.

(I) IV	(J) IV	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Paging Buttons	Embedded links	-9.4286	26.07074	.983	-81.3476	62.4904
	A-Z	57.5714	26.07074	.150	-14.3476	129.4904
	Map	47.0000	26.07074	.297	-24.9190	118.9190
Embedded links	Paging Buttons	9.4286	26.07074	.983	-62.4904	81.3476
	A-Z	67.0000	26.07074	.074	-4.9190	138.9190
	Map	56.4286	26.07074	.162	-15.4904	128.3476
A-Z	Paging Buttons	-57.5714	26.07074	.150	-129.4904	14.3476
	Embedded links	-67.0000	26.07074	.074	-138.9190	4.9190
	Map	-10.5714	26.07074	.977	-82.4904	61.3476
Map	Paging Buttons	-47.0000	26.07074	.297	-118.9190	24.9190
	Embedded links	-56.4286	26.07074	.162	-128.3476	15.4904
	A-Z	10.5714	26.07074	.977	-61.3476	82.4904

Table 4. Tukey HSD tests for the number of operations.

Number of Different Pages Visited

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Paging buttons	7	23.0000	.00000	.00000	23.0000	23.0000	23.00	23.00
Embedded links	7	20.4286	2.37045	.89595	18.2363	22.6209	17.00	23.00
A-Z	7	21.1429	2.54484	.96186	18.7893	23.4964	16.00	23.00
Map	7	22.7143	.75593	.28571	22.0152	23.4134	21.00	23.00
Total	28	21.8214	2.00099	.37815	21.0455	22.5973	16.00	23.00

Table 5. Descriptive statistics for the parametric ANOVA for the number of different pages visited.

Levene Statistic	df1	df2	Sig.
6.261	3	24	.003

Table 6. Levene test for homogeneity of variances for the number of different pages visited.

	IV	N	Mean Rank
No. of different pages visited	Paging buttons	7	19.50
	Embedded links	7	9.07
	A-Z	7	11.64
	Map	7	17.79
	Total	28	

Table 7. Total number of data points and mean rank for each condition for the number of different pages visited.

Test Statistics(a,b)

	No. of different pages visited
Chi-Square	10.361
df	3
Asymp. Sig.	.016

a Kruskal Wallis Test
b Grouping Variable: IV

Table 8. Chi-squared (or H) value for each condition and significance for the number of different pages visited.

Appendix 4.26 SPSS output for analyses of usability problems in experiment 1.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Problem instance	Paging Buttons	7	13.1429	11.68230	4.41550	2.3385	23.9472	1.00	35.00
	Embedded links	7	10.2857	6.87300	2.59775	3.9293	16.6422	3.00	20.00
	A-Z	7	16.2857	7.20450	2.72304	9.6227	22.9488	5.00	27.00
	Map	7	10.7143	9.94509	3.75889	1.5166	19.9120	2.00	30.00
	Total	28	12.6071	8.95809	1.69292	9.1336	16.0807	1.00	35.00
Unique problems	Paging Buttons	7	10.2857	7.91021	2.98978	2.9700	17.6014	1.00	24.00
	Embedded links	7	9.1429	5.58058	2.10926	3.9817	14.3040	3.00	18.00
	A-Z	7	14.0000	5.94418	2.24669	8.5025	19.4975	5.00	23.00
	Map	7	9.1429	8.55236	3.23249	1.2332	17.0525	2.00	26.00
	Total	28	10.6429	7.00378	1.32359	7.9271	13.3586	1.00	26.00
Total problem severity	Paging Buttons	7	23.5714	18.18293	6.87250	6.7550	40.3878	2.00	57.00
	Embedded links	7	20.4286	15.78878	5.96760	5.8264	35.0308	5.00	52.00
	A-Z	7	30.1429	11.86632	4.48505	19.1683	41.1174	11.00	46.00
	Map	7	19.4286	17.00840	6.42857	3.6984	35.1587	6.00	52.00
	Total	28	23.3929	15.57619	2.94362	17.3530	29.4327	2.00	57.00

Table 1. Descriptive statistics for usability problems.

Kruskal-Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Problem instances	Paging Buttons	7	14.29
	Embedded links	7	12.93
	A-Z	7	18.71
	Map	7	12.07
	Total	28	
Unique Problems	Paging Buttons	7	14.00
	Embedded links	7	13.29
	A-Z	7	18.93
	Map	7	11.79
	Total	28	
Total Severity	Paging Buttons	7	14.14
	Embedded links	7	12.86
	A-Z	7	19.29
	Map	7	11.71
	Total	28	

Table 2. Total number of data points and mean rank for each condition for usability problems.

Test Statistics(a,b)

	Problem instances	Unique Problems	Total Severity
Chi-Square	2.714	2.978	3.473
df	3	3	3
Asymp. Sig.	.438	.395	.324

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for usability problems.

Appendix 4.27 The full set of "unique" usability problems that fell into each category for each condition in experiment 1.

PAGING BUTTONS CONDITION

Hardware Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
2	The user comments that they are having difficulties concentrating/reading off the screen.	1.1	OE intro, HE intro	3	1
4	The user comments that their eyes are getting tired.	1.5	OE advs	2	1
6	The user is having problems with their seat/discomfort.	1.4	OE dis	1	1
8	The user comments that they would prefer to read the text on paper.	1.10	HE intro	2	1
20	The user is surprised when the right click mouse menu pops up.	1.3	OE advs	2	25
25	The user comments that they keep looking for the mouse scroller, but there isn't one.	1.2	Nielsen's Heuristics	1	25
51	The user comments that they are finding it more difficult to read the text now (has read pages pretty much sequentially up to this point).	1.5	HE dis	2	49

Text Content Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Number
63	The user is surprised that the last page is just a list of references.	1.3	Refs	2	58

Text Presentation Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
24	The user comments that Nielsen's heuristics are presented better than OE with the points in bold.	1.1	Nielsen's Heuristics	2	25
34	The user wonders why the presentation is slightly different for the OE method compared to the HE method (is getting Nielsen's heuristics confused with HE method).	1.2	OE meth	3	25
35	The user comments that the presentation of HE (Nielsen's heuristics) is better than OE method.	1.1	OE meth	2	25
37	The user comments that they thought that this page was HE method, they now realise. They say they didn't pay attention to this part. They say this happened because Nielsen's heuristics was presented differently.	1.2	Nielsen's Heuristics, HE meth	3	25
52	The user comments that the text on HE is a lot easier to read, implying that the rest of the text is less easy.	1.1	Nielsen's Heuristics	2	49

Text Presentation Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
5	The user comments that there is a lot (of information) to read off the screen.	1.1, 2.1	OE advs, HE intro, OE data, UE intro	3	1, 49, 41

7	The user comments that they only know what they have read so far because of the headings in the text.	1.1	HE intro	2	1
19	The user is surprised that there is more text on OE, they expected the text to go on to the next technique.	1.1/2.2	OE data	2	25
22	The user comments that there is very little information on ER and they would expect more and they don't know much about it (therefore don't notice that HE and CW are part of ER). This confuses them.	1.2, 2.2	ER intro, HE dis	3	25, 58
26	The user comments that HE is too long compared to ER. (implying that they don't understand HE and ER are related).	1.2	HE dis	2	25
38	The user comments that they didn't expect/are confused about the Nielsen's heuristics page because it wasn't in the usual sequence of pages. They thought it was the HE analysis page when checking against the normal sequence and are confused that it comes after the introduction.	1.2	Nielsen's Heuristics, OE dis, OE data	3	25
39	The user comments that each technique should be consistent in it's page sequence.	1.10	Nielsen's Heuristics	3	25
40	The user suggests that Nielsen's heuristics could be combined with the HE intro.	1.10	Nielsen's Heuristics	3	25
43	The user is unsure of whether this page is an introduction or the start of something.	1.2	Types of UE	2	9
45	The user was unsure of whether ER was the start of a new section - they had to check back to the previous page to be sure.	1.2	ER intro	2	9
47	The user is unsure about whether HE is a part of ER.	1.2	HE intro	2	9
49	The user comments that they want to read through OE, but they're not sure where it starts.	1.2/1.7	OE dis	2	9

Navigation Efficiency Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
11	The user suggests that the evaluation methods should be listed as navigation links.	1.10	HE intro, HE dis	2	1
12	The user has to click several times to get from one page to another for example if they want to go back to the beginning. They may indirectly or directly comment on this.	1.1/1.7, 1.7, 1.1/1.7	HE intro, CW Dis	3	1, 25, 9
17	User is looking for OE, but has forgotten the name, they appear to be flicking through pages looking for it.	1.7	Various pages	2	1
18	The user comments that they haven't found any techniques yet. They are having problems recognising which text refers to the techniques.	1.2	OE intro	2	25
28	The user suggests that there should be a link back from the last page to the first page so they don't have to click through every page.	1.10	CW dis, Refs	2	25
29	The user noticed that they were clicking through pages in the wrong direction.	1.8	CW dis	2	25
30	The user suggests that it would be better to have the previous and next buttons in a fixed position. (currently they appear at the end of the text on each page rather than in a fixed place).	1.10	HE An	2	25

32	The user comments that it would be good to be able to click straight to OE with out having to click all the way back (using previous).	1.10/1.7, 1.1	HE advs, Refs	2	25, 58
33	User comments that every time they come to this page the previous button doesn't seem to work and they have to click on it several times.	1.2	HE meth	2	25
36	The user wants to go back to HE method (Nielsen's heuristics) but the next button isn't working (clicks on it several times).	1.8	OE meth	2	25
42	The user is confused about how many pages are in the electronic text.	1.2	Types of UE	2	9
48	The user has to check back to OE to remember the name of that technique.	1.2	HE dis	2	9

Understanding Text Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
1	The user comments that the definition of usability in the text is unclear.	2.1	Usability	1	1
3	The user is having problems seeing that OE data is part of OE.	1.2	OE data	2	1
9	The text content frequently refers to information on previous pages in the electronic text.	2.1	HE intro	2	1
10	The user has forgotten the name of an evaluation they have seen previously. (in two cases it is OE, in another HE)	2.2, 1.2	HE intro, HE dis, OE dis, Refs	3	1, 9, 58
13	The user comments that the description of HE method is vague and they wouldn't know how to apply it.	2.1, 2.2	HE meth	2	1
14	The user comments that they would like to hear more about HE method.	2.2	HE meth	2	1
15	Uncertainty about the advantages in CW of simulating users, rather than using real users.	2.2	CW meth	2	1
16	Difficulties imagining a situation where access to real users is difficult.	2.2	CW advs	2	1
21	The user comments that it doesn't say if costs are an issue for OE. (They have either failed to notice that costs are mentioned on this page, or they could be referring to the task sheet).	2.3	OE dis	2	25
23	The user comments that HE is similar to ER and they are only going to choose one of them (and they don't need to read it again), implying that they don't recognise that HE is part of ER.	1.2	HE intro	3	25
27	The user comments that they wouldn't choose CW because it is an 'alternative' to HE. This indicates that the word 'alternative' biases the users view about CW compared to HE.	2.3	CW dis	3	25
31	The user comments that they don't think ER intro combines well with the other techniques implying that they don't understand that it is related to HE and CW.	1.2/2.2	ER intro	3	25
41	The user is unsure what formative and summative evaluations are. (they haven't read this information yet).	2.2	UE intro	1	9

44	The user is unsure of whether they only have to choose between formative and summative for the task (problems recognising whether these are UE techniques).	1.2	Types of UE	2	9
46	The user is unsure of the meaning of heuristic evaluation.	2.2	ER intro	1	9
50	The user's understanding of HE is not very good- they think because it is 'based on tasks' it is not very good for evaluating the City Music website.	2.3	HE An.	2	17
53	The user is confused about CW - they seem to think that it focuses on navigation (they may be getting confused with 'exploration' used in the text.	2.2, 2.3	CW intro	3	49
54	The user is unsure of whether OE is another form of UE (in addition to formative/summative).	2.2	OE intro	2	41
55	The user thinks/is unsure whether OE is on designs only (has just read that HE can be used for designs as well as fully working systems, the whole text is on formative generally).	2.3, 2.2	Nielsen's Heuristics	3	41
56	The user is unsure of whether HE evaluators have to be experts.	2.2	HE intro	3	41
57	The user is unsure about whether UE and Types of UE (formative and summative) are separate from Oes and ERs.	2.2	UE intro	3	41
58	The user thinks that HE uses users. (text on HE advs says it can but this is unsuccessful).	2.3	HE advs	3	41
59	The user thinks that because it is ideal to have two or more evaluators to check the data from OE they shouldn't choose this for the task (only one evaluator readily available, may be confusing this with HE and CW).	2.2	HE meth	3	41
60	The user has noticed that HE can be performed by users, but seems to be giving this undue attention - doesn't seem to have picked up the text that says that this is unsuccessful.	2.3	HE meth	2	41
61	The user thinks that summative evaluations are 'more observational' (user hasn't read OE yet).	2.3	Types of UE	2	58
62	The user has read 'pretest' as 'pretask' and interpreted this as performing a set of predetermined tasks.	2.3	OE meth	2	58
64	The user is confused about OE - thinks that users become distracted after too many tasks in OE. This seems to be because they are misinterpreting the text about OE being time consuming.	2.3	OE data	2	58

EMBEDDED LINKS CONDITION

General Confusion Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
36	The user comments that it's never consistent. (unclear exactly what they are referring to).	2.1	CE dis	2	42
57	The user comments that they are confused.(Cause unclear, may be about HE pages in general).	1.2	HE meth	2	50

Text Content Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
18	The user suggests that the HE method should be on the same page as HE intro.	1.10	HE intro	2	26
26	The user comments that the text is repeating what it says on the first page (Usability).	2.1	UE intro	2	34
29	The user comments that the references page is not very useful.	1.1	Refs	2	34
52	The user is surprised that the references page only contains references.	1.3	Refs	2	50

Navigation Predicting Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers s
3	User pressed back on the first page taking them out of the electronic texts. User suggests that there should be a warning to say don't press back on this page.	1.10	Usability	3	2
15	The user is suprised that the 'evaluating' embedded link in Usability takes you back to UE intro and the 'usability' embedded link in UE intro takes you to Usability.	1.3	UE intro, Usability	2	26, 34
16	The user is uncertain and cautious about clicking back on the Usability page in case it takes them out of the electronic text. [the embedded links between UE intro and Usability seem to have added to this].	1.2	Usability	2	26
56	The user is surprised that they haven't been to this page before.	1.3	HE intro	2	50

Navigation Disorientation Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Part No.s
7	The user comments that the electronic text is not set out (overall?) as they would expect.	1.2	OE intro	2	2
19	The user comments that they are getting lost in the embedded links and they are unsure what each page was a part of (i.e. how the pages linked to one another).	1.2	HE meth	2	26
20	The user comments that they can't get an overall picture of where each page is relation to the other pages (how the pages are linked), and how each method is related to each type of evaluation.	1.2	HE meth	2	26
22	The user comments that seeing the 'overall picture' especially in an electronic form would help them make a final decision for the task.	1.10	HE intro	2	26
28	The user comments that they will read a whole page rather than going straight to the embedded links. [This implies that the embedded links interrupt their understanding?]	1.7	ER intro	2	34
30	The user is confused about where they are in the electronic texts. They comment that they are trying to go to CW but have to go back once more.	1.2	HE intro	2	34

Navigation Efficiency Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
1	User comments that they would prefer to see everything (all pages) at once so they can jump backwards and forwards between pages.	1.10	OE meth	2	2

2	The user comments that short pages are inefficient because links have to be followed and the user has to work out how the linked page fits in with the original page.	1.1/1.7	OE meth	2	2
4	The user's comments imply that there are too many steps (in general).	1.7	HE intro	2	2
5	The user's comments imply there are too many links (in general).	1.1/1.2	HE meth	2	2
6	The user is having problems remembering the names of/finding OE and CW information.	1.7	OE intro	2	2
8	The user suggests that it would be useful to have different screens to be able to compare and contrast the different techniques.	1.10	ER intro	2	2
12	The user comments that there is a lot of/ too much information (and they can't remember it all).	1.1/2.1	OE intro	2	18, 50
17	The user comments that there are too many links on this page e.g. the embedded link to the HE method.	1.1	HE intro	2	26
23	The user is fustrated that they have to remember definitions of different concepts (e.g. formative) and at having to refer back.	1.1	Types of UE	2	26
31	The user is unsure of what to do next. (where to go? They have been to most/all of the pages already).	1.2	UE intro, OE data, OE intro, HE meth	3	34, 50
42	The user suggests that a home button would be useful.	1.10	UPs	2	42
50	The user comments that they have already read this page.	1.3	Usability	2	50
51	The user comments that they have gone to the wrong page.	1.8	OE intro, UPs	2	50
53	The user doesn't notice that they keep visiting the same page. [they have been checking pages and have followed the formative embedded link from UE intro, then the summative embedded link, both to Types of UE, then follows the formative embedded link again].	1.2	Types of UE	2	50
54	The user can't find ERs.	1.2	Types of UE	2	50
60	The user can't find CW method ('the stages of cognitive'). [they have to click through several pages before finding it, when looking the second time checks a few pages then gives up].	1.7	CW intro, HE meth	3	50

Understanding Text Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
9	The user has misunderstood the heuristic of 'Match between system and real world'. They thought it meant that terms (in the interface) need to be explained.	2.3	Nielsen's Heuristics	2	10
10	The user has misunderstood the meaning of expert biases - seems to think this can be overcome by choosing experts with a good reputation so they are fair like a judge.	2.3	HE dis	2	10
11	The user has mixed up summative evaluation with OE.	1.8	HE dis	1	10

13	The user comments that there are many words they don't know the meaning of so it's difficult to read and remember the text. (English is not their first language).	2.1	OE intro	2	18
14	The user cannot differentiate between CW and HE, so cannot choose between them for the task.	2.2	UE intro	3	18
25	The user doesn't understand ERs (CW and HE).	2.2	ER intro	3	26
27	The user comments that they can't remember (doesn't know?) what formative evaluation is. They haven't been to the Types of UE page before.	1.2/2.2	UE intro	1	34
32	The user talks about UE as usability - they are merging the two concepts.	2.3	UE intro	2	42
33	The user states that "usability is a user interface".	2.3	UE intro	2	42
34	The user is unsure whether to choose formative (or summative) for the task. (Has just read Types of UE).	2.2	UE intro	2	42
35	The user misunderstands what qualitative data would be for the task. Seems to think it would be evaluation of CDs or products on the City Music website.	2.3	OE data	2	42
37	The user thinks that formative evaluation does not require standards (they comment that this is because they are biased).	2.3	Types of UE	3	42
38	The user comments that there may be no advantages or problems for the website in the task.	2.2	CW dis	2	42
39	The user thinks that HE is more time consuming that CW (and gives this as a reason for not choosing HE).	2.3	HE intro	3	42
40	The user is confused about the relation between OE and ER. They think that they are both "information methods".	2.2	UE intro	2	42
41	The user thinks that CW is about identifying what the end user thinks about difficulties of using the website.	2.3	CW meth	3	42
43	The user is confused about formative and summative. They think that summative evaluation may be inappropriate for a website, but more appropriate for software, and formative is more general.	2.3	Types of UE	3	42
44	The user thinks that OE is only conducted at the end of testing a prototype.	2.3	OE intro	2	42
45	The user comments that they would put formative at the beginning for the task. (Implies that they haven't gathered that it is throughout the design process).	2.3	Types of UE	1	42
46	The user thinks that summative evaluation is mostly observation.	2.3	OE dis	2	42
47	The user thinks that after one cycle of evaluations if the prototype needs to be redesigned then do summative evaluation. (Implies that the haven't understood that summative evaluation happens after design).	2.3	CW intro	1	42
48	The user thinks that formative evaluation is about forming a set of standards (may be getting confused with HE).	2.2	Types of UE	2	42
49	The user comments that they would put summative evaluation at the beginning of the design process.	2.3	Types of UE	2	42
55	The user is unsure of what 'experts' means.	2.2	ER intro	2	50
58	The user comments that they haven't taken in heuristics even though they have read it five or six times.	2.2	HE intro	2	50
59	The users comments that they don't think they understand CW and what it involves (HE involves rules so what is CW) properly.	2.2	CW intro	2	50

61	The user thinks that CW involves "3 rules". (getting confused with HE?)	2.3	CW intro	2	50

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
21	The user comments that they would normally make notes about how and why the pages relate to each other.	1.10	HE dis	2	26
24	The user comments that there are too many things to do (in the task) - they are being introduced to new subjects, have to learn what they are and have to choose one.	1.2	OE intro	2	26

A-Z INDEX

General Confusion

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
12	The user comments that they are confused ("don't understand all of this") (cause unclear).	2.2	Nielsen's Heuristics	OE advs	11, 19

Hardware Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
35	The user is rubbing their neck as if it hurts. The experimenter suggests that they can adjust the seat if necessary.	1.4	CW meth	1	27

Text Content Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
6	The user comments that it would be easier to have the text from Usability first then Types of UE, rather than having everything mentioned in the introduction.	1.2	UE intro	2	11
9	The user comments that the text repeats information.	1.1/2.1	CW intro/OE intro	2	11, 43
30	The user comments that the reference page is not very interesting/useful.	1.1/2.1	Refs	2	27, 35
69	The user expresses surprise at the content of ER intro.	1.3	ER intro	2	51
75	The user comments that OE data analysis is better because there is more information than in HE and CW analysis (implies HE and CW analysis are not as good).	2.1	OE data	2	57
76	The user comments that there is a language problem. [The user's first language is not English.] (Implies that the text doesn't account for users whos first language is not English).	2.1	Nielsen's Heuristics	2	57
83	The user suggests that there could be a separate section that has technical or other descriptions.	2.4/1.10	ER intro	2	57

Text Presentation Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
1	The user comments that they are having problems comparing the different pieces of text (pages) because they are all very similar.	1.1/2.1	Various pages.	2	11
2	The user suggests that they would like the name of the author in bold (or a different type of text) so you can see where it is.	1.10	Refs	1	11
47	The user thinks the CW analysis page is CW method.	1.8	CW analysis	2	43
59	The user comments that there should be a carriage return after the paragraph on critical incidents. [This is a problem with the way that the page is displayed in Nestor, the carriage return *should* be there].	1.10/2.4	OE data	1	43

Using Aggregate Navigation Aid Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
19	The user is unsure if there is an HE intro page on the A-Z.	1.6/1.2	CW analysis	2	27
26	The user has difficulties seeing the Types of UE page on the A-Z and identifying (reading title) what it is.	1.6	UE intro	2	27
51	The user is confused because they think that there are two HE advs pages [they had been on HE advs then clicked on HE Analysis on A-Z, but the page didn't change, they then clicked on HE advs again].	1.2	HE advs	2	43
57	The user is confused because when they clicked on OE advs on the A-Z the page didn't change. They say they thought they clicked too hard.	1.2	OE advs	2	43
58	The user suggests that OE pages should start in the right hand column on the A-Z so they are grouped together. [Currently OE advs is at the end of the left column and the rest of the OE pages are at the top of the right hand column.]	1.10	OE advs	2	43
60	The user suggests that the Role of UE and Types of UE pages should be at the top of the A-Z, then the different evaluation techniques.	1.10	UPs, Usability	2	43
61	The user comments that the (page titles on the) A-Z are really small.	1.6	Start - no page.	2	51
67	The user comments that the A-Z index is not very good.	1.1	OE intro	2	51
68	The user comments that it would be better if the A-Z index was like a table of contents because they don't know the order (of pages).	1.10	OE intro	2	51
71	The user is surprised that they accidentally slid the A-Z window divider across the text window with the mouse.	1.3	CW meth	1	51
77	The user comments that they would expect pages on the A-Z that have been visited to be in different colours so you know you have read it.	1.10	Nielsen's Heuristics	2	57
79	The user comments that the A-Z index appears to be upside down because the UE intro is at the end - they would expect it at the beginning.	1.2	UE intro	2	57
80	The user comments that they would expect to have UE intro first on the A-Z, then evaluation methods, the references at the end.	1.10	UE intro	2	57

81	The user comments that they A-Z index is a bit "hectic" (confusing?).	1.2	UE intro	2	57
87	The user comments that they don't understand why Nielsen's heuristics (which they call "heuristic analysis") follows OE.	1.2	HE analysis	2	57

Navigation Text Structure Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
3	The user comments that there is a lot to read/a lot of information.	1.1, 2.1	Nielsen's Heuristics, OE data	3	11, 19, 43
7	The user suggests moving Nielsen's heuristics to the end of HE as a summary.	1.10	Nielsen's Heuristics	1	11
8	The user suggests that (for each technique) the index should be ordered with introductions first, then definitions, then advantages, then disadvantages.	1.10	CW intro	2	11
16	The user comments that the order of the A-Z means that they read the CW advs before they have read the (CW) introduction.	1.1	CW advs	2	27
18	The user comments that it would have been better to read the analysis page before the advantages and disadvantages because it ties in with the introduction and method.	1.2	CW analysis	2	27
20	The user comments that at the bottom of this page it mentions advantages and disadvantages, but they are unsure of whether this is supposed to lead you to read them (next).	1.2	HE intro	2	27
21	The user comments that they would prefer to read the method first so you fully understand what it is first and then it is easier to understand the advantages and disadvantages.	1.1	HE meth	2	27
22	The user comments that they think it would be better to read HE before CW because in CW it referred to HE.	1.1	HE analysis	2	27
25	The user comments that UE intro should probably have been the first page to look at out of all the pages on the A-Z (has read CW, HE and OE already).	29	UE intro	2	27
27	The user comments that it would be better if the Usability page was at the top of the A-Z and pages were then listed in order. The text gives clues that it should be read in a certain order.	32	Usability	2	27
28	The user comments that ER intro should be read before CW and HE.	33	ER intro	2	27
29	The user comments that it would be good to read Nielsen's heuristics (first) so you know what the heuristics are.	34	Nielsen's Heuristics	2	27
52	The user comments that it is slightly confusing, and they are not totally "digesting" all of the information. They say this is because either the text is contradicting itself or because of the sequence they are reading it in (straight down A-Z). [See problem 56]	66	HE dis	2	43
62	The user comments that the index is an A-Z not the (natural) order of pages.	81	Start - no page.	2	51
64	The user comments that they would find it easier to have a "next" button and a linear page sequence.	83	Usability	2	51
66	The user comments that they have realised that there is an introduction to OE (that they should have read before OE meth).	86	OE meth	2	51

Navigation Efficiency Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
14	The user is unsure is there is any more text that they should read (or whether they should read the text that they have read again)	1.2	ER intro	2	19
17	The user is unsure where to go next.	1.2	CW intro, HE analysis, UE intro, Refs	3	21, 27, 51
23	The user is unsure where HE analysis is on the A-Z.	1.2/1.6	HE meth	2	27
24	The user is unsure where OE analysis is on the A-Z.	1.2/1.6	OE meth	2	27
32	The user is unsure which page will tell them the difference between HE and CW.	1.2	Refs	2	27
34	The user is unsure where HE disadvantages is on the A-Z.	1.2/1.6	HE advs	2	27
38	The user comments that they are trying to find techniques for the task, but they are only finding "theoretical" information. (Implies that they are having problems identifying the techniques).	1.2	UE intro	2	35
43	The user can't find Types of UE on the A-Z. [clicks through 3 pages before finding it].	1.2/1.8	Usability	2	35
65	The user comments that all they have (to navigate) is the A-Z (nothing to tell them where to go next).	1.1/1.2	Usability	2	51
78	The user comments that they are reading pages at random because they don't know which pages they have read and which they haven't.	1.2	Nielsen's Heuristics	57	2
85	The user comments that they are having problems finding "the list of ten something" (clicking through HE and OE pages on the A-Z).	1.2	HE intro	57	2
86	The user suggests that the HE page should be have something in the title about "no. ten" so it's easier to find (to go back to).	1.10	Nielsen's Heuristics	57	2

Understanding Text Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
4	The user describes that CW is a study about the people that use the computer. (Implies that they think that CW involves users?/general misunderstanding).	2.3	CW meth	2	11
5	The user is confused/unsure about HE (heuristics).	2.2	HE intro, HE meth, Nielsen's Heuristics, HE advs	3	11, 51, 57
10	The user comments that they don't understand how the techniques "link" to each other.	2.2	CW dis	2	11
11	The user is confusing 'usability' with another technique (ERs?). They say 'usability' is more focused on professionals making websites.	2.3	Types of UE	3	11
13	The user comments that they don't know the meaning of HE (the text is making comparisons between CW and HE) but they haven't read it yet (in problem instance 13 they are unsure of this).	1.2/2.2	CW dis	2	19, 27

15	The user thinks there are two different user evaluations (quantitative and qualitative data?).	2.3	CW advs	2	19
31	The user is unsure of the difference between HE and CW (has forgotten).	2.2	Refs, HE analysis	2	27
33	The user is unsure why CW would be more expensive than HE.	2.2	CW dis, CW meth	2	27
36	The user thinks that CW doesn't involve user testing but HE does.	2.3	CW intro	3	27
37	The user thinks that HE is more expensive (than CW).	2.3	CW intro	3	27
39	The user seems to think that 'Usability' (the information on the usability page) is a UE technique.	2.3	Usability, Nielsen's Heuristics, ER intro	3	35
40	The user misunderstands the 'Recognition versus Recall' heuristic. They seem to think that it is about learnability of an interface.	2.3	Nielsen's Heuristics	2	35
41	The user is confused about formative and summative evaluations. They think they are "context specific" (as in the time in the design process) but they don't really seem to understand this, they seem to think that this literally means the context, e.g. as in the environment.	2.2/2.3	Types of UE	3	35
42	The user seems to think that formative and summative are part of the same thing. They talk about them as one thing that can be used in the same way.	2.3	Types of UE	3	35
44	The user doesn't realise HE is part of ERs.	2.3	ER intro	3	35
45	The user notes that they have forgotten about OE in their choice of techniques for the task.	1.8	Types of UE	2	35
46	The user is talking about HE as a design tool (e.g. talks about ways of helping the user should they encounter any errors).	2.3, 2.4, 2.5	Nielsen's Heuristics	3	35
48	The user thinks that it says that ERs can be used instead of usability evaluations, although the user thought these were the same thing.	2.2	ER intro	2	43
49	The user thinks that HE is used when there's access to real users (has misread the text).	2.3	HE advs	2	43
50	The user thinks that you can get feedback from real users in HE, but has missed the point that this has been claimed to be unsuccessful.	2.3	HE advs	2	43
53	The user is confused about who performs HE. Thinks that the "users" (evaluators) that perform HE are not real users.	2.2	HE dis	2	43
54	The user comments that they have just realised that HE (is useful) when access to users is difficult. They thought it was (useful) when access to users is easy.	2.2	HE advs	3	43
55	The user reads CW and HE as saying that "access to real users is difficult" rather than CW/HE is useful when access to users is difficult. [also see problems 54 and 56].	2.2	CW advs, OE data, HE advs	3	43
56	The user comments that they missed that CW can be performed when access to users is difficult, rather than when access to users is easy. They say this is why they thought it was contradicting earlier. [See problems 52 and 55]	2.2	CW advs	43	3
63	The user is doesn't know the meaning of 'ISO'.	2.2	Usability	51	2

72	The user comments that it would be useful if the text explained the meaning of 'heuristics'.	2.4	HE intro	57	2
73	The user comments that they would expect examples of the top-ten UPs identified (by heuristics) to be listed (so they can compare them for different evaluation techniques).	2.2	HE analysis	57	2
74	The user comments that just seeing that a top-ten list (a number) can be created doesn't give much information.	2.1	HE analysis	57	2
82	The user suggests that it would be good to have a glossary (especially for non-computing people).	2.4/1.10	ER intro	57	2
84	The user thinks that HE is concerned with how to create specific applications, such as websites.	2.3	HE intro	57	3
88	The user thinks that Nielsen's heuristics (or "heuristic analysis" as they call it) comes after OE on the A-Z because you can use the heuristics to analyse the problems from OE. [They suggest this for their task decision]	2.3/1.2	HE analysis	57	3

MAP CONDITION

General Confusion Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
27	The user comments that they are confused. (appears to be about the content of the page since they say this whilst reading).	2.2	CW intro	2	28
61	The user comments that they have stopped concentrating.	1.5	CW intro	2	52

Text Content Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
13	The user comments that the references are not very useful (during the task).	2.1	Refs	2	12

Text Presentation Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
3	The user comments that all pages/map nodes start to look similar after a while.	1.1	Nielsen's Heuristics	2	4
9	The user comments that it is disorientating that the text makes references to other pages in the text, but there are no actual embedded links, the only place you can see the other pages is on the map.	1.2	UE intro	2	12
49	The user comments that there are a few pages where you have to scroll down. The short pages are annoying because they involve extra work (in order to read more of the text you have to click on the map and decide which page to visit).	1.1	CW An	2	36

59	The user comments that CW method is the longest. [Does this imply it is too long?]	2.1	CW meth	1	52

Using Aggregate Navigation Aid Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
2	The user comments that they would like to know where they had been on the map.	1.10	Nielsen's Heuristics	2	4
4	The user suggests that there may be a way of showing the user's route through the map. (Doesn't give any more details on this).	1.10	Nielsen's Heuristics	2	4
8	The user comments that the map titles are small.	1.6	OE meth	2	12
12	The user comments that the map doesn't give as much information as they would like seeing that it is the only way to navigate.	1.1	OE meth	2	12
17	The user comments that the page titles look like they could simply have been listed rather than shown on a map since they seem to be in some kind of order.	1.10	Nielsen's Heuristics	2	12
21	The user is having problems reading the HE nodes on the map.	1.6	ER intro	2	20
22	The user is unsure of what HE is from looking at the map.	1.2	ER intro	2	20
25	The user is comments that they are looking for page titles saying 'techniques' on the map. They are confused about whether all the pages refer to the techniques.	1.2	OE intro	2	28
34	The user comments that they don't know where the reference page comes from/is linked to on the map (from intro pages or from OE or entire document?).	1.2	Refs	3	36
36	The user suggests that if all the pages are linked then there should be some (explicit) link between them (shown on the map) rather than just a common starting point.	1.10	OE intro	2	36
37	The user comments that the advantages and disadvantages are very closely linked, and this link is closer that with the UE intro page. Implies that this should be shown on the map.	1.1	OE dis	2	36
38	The user suggests that the map could show main parts and secondary parts which show the links through the different documents.	1.10	OE advs	2	36
39	The user suggests that the map could show different suggested routes through the documents.	1.10	OE advs	2	36

40	The user comments that the text is very similar to book or web pages but the map forces a logical organisation on top of the text. A book is more familiar. They comment for example that with the advantages and disadvantages you don't want to go back to a central start point (UE intro) in between reading them - implying that the map leads the user to do this.	1.1	OE advs	2	36
41	The user comments that the map is inappropriate if the user is going through information for the first time because it doesn't make sense because the user doesn't know what they are about to read. The map may be good for finding information quickly.	1.1	OE advs	2	36
42	The user comments that there is no history list.	1.1	OE data	2	36
43	The user suggests that it would be useful to be able to leave notes on pages (to keep the notes all in the same place).	1.10	OE data	2	36
44	The user comments that the observational evaluation pages on the map seem to go anticlockwise. They are reading it clockwise. (Note all page titles on the map read from left to right).	1.2	OE meth	2	36
45	The user is surprised to see the OE disadvantages higher than the advantages and the method as anticlockwise on the map. (Note all page titles on the map read from left to right).	1.2	OE meth	2	36
46	The user comments that they wondered if there was any link between the type of content and the line. (Note all lines on the map are dotted).	1.2	OE meth	2	36
47	The user suggests that the map could have different thicknesses and different types of lines (dotted etc.) (to represent different things.)	1.10	OE meth	1	36
48	The user comments that HE seems to be anticlockwise on the map, but they think that CW is clockwise (quickly realises their mistake).	1.2	Nielsen's Heuristics	1	36
51	The user comments that other pages on the map are like chapter headings, where as references is "stuck out" on its own.	1.2	Refs	2	36
52	The user suggests that they would expect a link on the map from references to the rest of the text, currently it is too separate from ERs.	1.10	Refs	2	36
53	The user comments that it is not completely clear that UE intro is the introduction (start point).	1.1	UE intro	2	36
54	The user suggests that it would be useful to have the different "chapter headings" on the map in different colours (e.g. red instead of blue).	1.10	UE intro	2	36
55	The user suggests that UE intro should be flashing on the map until the user has clicked on that page.	1.10	UE intro	2	36

Navigation Text Structure Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
5	The user comments that they should have clicked on ER before the HE pages.	1.8	ER intro	2	4
6	The user comments that there is a lot of information (needs a lot of concentration, too much to read).	1.1/2.1	UE intro, OE data	3	12, 52
16	The user comments that the text looks like it should be read in some kind of order.	1.1	HE intro	2	12
18	The user comments that the (whole text) is long, and that even breaking it into pages doesn't make any difference.	1.1	HE meth	2	12
33	The user comments that it seems funny to split the text up into twenty separate "areas" when in fact they're all linked.	1.2	Types of UE	2	36
35	The user suggests that it would make more sense to have step 1, step 2, step 3 etc. - a "more hierarchical" structure.	1.10	OE intro	2	36

Navigation Efficiency Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
1	The user is unsure about where to find more information on formative evaluations (they have understood that all of the text is focused on formative evaluations).	1.2	Types of UE	2	4
7	The user is unsure about where (which page) to start on. (randomly clicked on Nielsen's initially).	1.2	Nielsen's Heuristics	2	12
10	The user is unsure about where to go next.	1.2	UE intro, OE data, ER intro, Types of UE, Usability	3	12, 36
11	The user is unsure about where to find out the difference between formative and summative evaluations (says they 'guess it might be Types of Usability Evaluation').	1.2	UE intro	2	12
14	The user comments that they have already been to this page.	1.8	Types of UE	2	12
24	The user comments that they went to the wrong page.	1.8	Refs	2	28
26	The user wants to go back to UE intro, but doesn't seem to remember its name or where it was. Checks on UPs and Types of UE and Usability on the map before finding it. (no back button in this condition).	1.7	OE dis	3	28
30	The user cannot find HE analysis.	1.2	Nielsen's Heuristics	2	28
31	The user suggests that it would be useful to have links to formative and summative evaluations.	1.10	UE intro	2	36

32	The user suggests it would be useful to have next and previous buttons in the text (if there's a natural progression to the text).	1.10	Types of UE	2	36
50	The user comments that they would rather have everything on one page so that they they can scan the information and don't have to click on different pages to find out if there's any useful information.	1.10	CW An	2	36

Understanding Text Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
15	The user reads that cognitive is an alternative to heuristic, then decides to read HE first. Implies that there is some confusion about what order the pages should be read in.	1.2	CW intro	2	12
19	The user thinks that OE is part of HE (i.e. you have to do OE as part of HE).	2.3	HE meth	3	12
20	The user comments they are confused over who performs HE if it's not real users.	2.2	HE advs	2	12
23	The user appears to think that CW involves users.	2.3	CW intro, CW meth	3	20
28	The user comments that they don't understand CW (and its advantages).	2.2	HE intro, CW meth, OE dis	3	28
29	The user comments that they are finding it hard to understand how CW works.	2.2	CW meth	2	28
56	The user thinks that the results of HE don't feedback into design.	2.3	HE intro	3	44
57	The user thinks that CW is focuses on navigation. [They may be getting confused by the use of 'exploration' in the text].	2.3	CW intro	3	44
58	The user comments that they have never heard of HE or Nielsen ("any of these things").	2.2	CW intro	2	52
60	The user is unsure of the meaning of 'heuristic'. [they know it means 'rule of thumb' but they check the ten heuristics].	2.2	Nielsen's Heuristics	2	52
62	The user wonders why CW is called 'walkthrough' and the other techniques are called 'evaluation'.	2.2	CW intro	2	52

Appendix 5.1. SPSS output for analyses of cognitive engagement in experiment 2 part A.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Total	Using Map	7	99.1429	76.07546	28.75382	28.7848	169.5009	11.00	207.00
	Creating Map	6	34.1667	23.72692	9.68647	9.2668	59.0665	10.00	70.00
	Embedded links	7	77.4286	52.24576	19.74704	29.1093	125.7478	14.00	160.00
	Total	20	72.0500	59.76663	13.36422	44.0784	100.0216	10.00	207.00
Planning/ Strategy (P)	Using Map	7	4.5714	3.59894	1.36027	1.2430	7.8999	.00	10.00
	Creating Map	6	1.1667	2.40139	.98036	-1.3534	3.6868	.00	6.00
	Embedded links	7	1.7143	1.97605	.74688	-.1133	3.5418	.00	5.00
	Total	20	2.5500	3.03445	.67852	1.1298	3.9702	.00	10.00
Connecting to the Task Setting (CT)	Using Map	7	5.7143	4.27061	1.61414	1.7646	9.6639	.00	10.00
	Creating Map	6	2.3333	2.87518	1.17379	-.6840	5.3507	.00	6.00
	Embedded links	7	2.4286	2.69921	1.02020	-.0678	4.9249	.00	6.00
	Total	20	3.5500	3.59056	.80287	1.8696	5.2304	.00	10.00
Connecting Experiences (CE)	Using Map	7	15.7143	16.61038	6.27813	.3522	31.0763	2.00	47.00
	Creating Map	6	5.0000	1.89737	.77460	3.0088	6.9912	2.00	7.00
	Embedded links	7	11.1429	9.63377	3.64122	2.2331	20.0526	.00	28.00
	Total	20	10.9000	11.70200	2.61665	5.4233	16.3767	.00	47.00
Critiquing Text Content (CTC)	Using Map	7	4.2857	4.53557	1.71429	.0910	8.4804	.00	11.00
	Creating Map	6	.5000	1.22474	.50000	-.7853	1.7853	.00	3.00
	Embedded links	7	2.7143	4.71573	1.78238	-1.6470	7.0756	.00	11.00
	Total	20	2.6000	4.04449	.90438	.7071	4.4929	.00	11.00
Monitoring Understanding (MU)	Using Map	7	5.4286	5.82687	2.20235	.0396	10.8175	.00	17.00
	Creating Map	6	.6667	.81650	.33333	-.1902	1.5235	.00	2.00
	Embedded links	7	5.1429	6.81734	2.57671	-1.1621	11.4478	.00	20.00
	Total	20	3.9000	5.50502	1.23096	1.3236	6.4764	.00	20.00
Employing Selected Technique (EST)	Using Map	7	5.0000	5.16398	1.95180	.2241	9.7759	.00	16.00
	Creating Map	6	1.6667	1.36626	.55777	.2329	3.1005	.00	4.00
	Embedded links	7	3.2857	4.07080	1.53862	-.4791	7.0506	.00	11.00
	Total	20	3.4000	4.00526	.89560	1.5255	5.2745	.00	16.00
Restating Understanding (RU)	Using Map	7	8.2857	7.18132	2.71429	1.6441	14.9273	.00	22.00
	Creating Map	6	1.8333	2.22860	.90982	-.5054	4.1721	.00	6.00
	Embedded links	7	11.4286	11.73111	4.43394	.5791	22.2780	.00	33.00
	Total	2	7.4500	8.78081	1.96345	3.3405	11.5595	.00	33.00

		0							
Alertness (A)	Using Map	7	6.2857	5.79409	2.18996	.9271	11.6443	.00	13.00
	Creating Map	6	1.3333	2.80476	1.14504	-1.6101	4.2767	.00	7.00
	Embedded links	7	2.7143	2.75162	1.04002	.1695	5.2591	.00	7.00
	Total	20	3.5500	4.43046	.99068	1.4765	5.6235	.00	13.00
Selecting Technique (ST)	Using Map	7	3.5714	2.37045	.89595	1.3791	5.7637	.00	6.00
	Creating Map	6	2.5000	1.87083	.76376	.5367	4.4633	.00	5.00
	Embedded links	7	7.2857	6.62607	2.50442	1.1576	13.4138	1.00	19.00
	Total	20	4.5500	4.58229	1.02463	2.4054	6.6946	.00	19.00
Monitoring Navigation (MN)	Using Map	7	4.5714	3.25869	1.23167	1.5576	7.5852	1.00	10.00
	Creating Map	6	7.5000	14.52928	5.93155	-7.7475	22.7475	.00	37.00
	Embedded links	7	6.4286	10.58076	3.99915	-3.3570	16.2141	.00	30.00
	Total	20	6.1000	9.78667	2.18837	1.5197	10.6803	.00	37.00

Table 1. Descriptive statistics for cognitive engagement.

Kruskal-Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
TOTAL	Using Map	7	12.71
	Creating Map	6	6.67
	Embedded links	7	11.57
	Total	20	
Planning/ Strategy (P)	Using Map	7	14.29
	Creating Map	6	7.17
	Embedded links	7	9.57
	Total	20	
Connecting to the Task Setting (CT)	Using Map	7	13.43
	Creating Map	6	9.00
	Embedded links	7	8.86
	Total	20	
Connecting Experiences (CE)	Using Map	7	11.86
	Creating Map	6	8.17
	Embedded links	7	11.14
	Total	20	
Critiquing Text Content (CTC)	Using Map	7	12.79
	Creating Map	6	8.17
	Embedded links	7	10.21
	Total	20	
Monitoring Understanding (MU)	Using Map	7	12.71
	Creating Map	6	5.67
	Embedded links	7	12.43
	Total	20	
Employing Selected Technique (EST)	Using Map	7	13.07
	Creating Map	6	8.08
	Embedded links	7	10.00
	Total	20	
Restating Understanding (RU)	Using Map	7	12.14
	Creating Map	6	6.00
	Embedded links	7	12.71

	Total	20	
Alertness (A)	Using Map	7	13.57
	Creating Map	6	6.83
	Embedded links	7	10.57
	Total	20	
Selecting Technique (ST)	Using Map	7	10.57
	Creating Map	6	7.92
	Embedded links	7	12.64
	Total	20	
Monitoring Navigation (MN)	Using Map	7	12.07
	Creating Map	6	8.92
	Embedded links	7	10.29
	Total	20	

Table 2. Total number of data points and mean rank for each condition for cognitive engagement.

Test Statistics(a,b)

	TOTAL	P	CT	CE	CTC	MU	EST	RU	A	ST	MN
Chi-Square	3.729	5.214	2.783	1.395	2.752	5.935	2.430	5.056	4.422	2.089	.962
df	2	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.155	.074	.249	.498	.253	.051	.297	.080	.110	.352	.618

a Kruskal Wallis Test

b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for cognitive engagement.

Appendix 5.2. SPSS output for analyses of ownership in experiment 2 part A.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Map	7	4.5604	.47980	.18135	4.1167	5.0042	3.62	4.92
Creating Map	6	3.5641	.91233	.37246	2.6067	4.5215	1.85	4.38
Embedded links	7	3.7802	.42697	.16138	3.3853	4.1751	3.23	4.23
Total	20	3.9885	.73667	.16472	3.6437	4.3332	1.85	4.92

Table 1. Descriptive statistics for total ownership.

Kruskal-Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Total ownership	Using Map	7	15.64
	Creating Map	6	7.33
	Embedded links	7	8.07
	Total	20	

Table 2. Total number of data points and mean rank for each condition for total ownership.

Test Statistics(a,b)

	TOTALOWN
Chi-Square	8.226
df	2
Asymp. Sig.	.016

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for total ownership.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Map	35	4.6857	.67612	.11429	4.4535	4.9180	2.00	5.00
Creating Map	30	3.7000	1.26355	.23069	3.2282	4.1718	1.00	5.00
Embedded links	35	3.5429	.98048	.16573	3.2060	3.8797	2.00	5.00
Total	100	3.9900	1.10550	.11055	3.7706	4.2094	1.00	5.00

Table 4. Descriptive statistics for the control factor.

Kruskal-Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
CONTROL	Using Map	35	69.24
	Creating Map	30	44.13
	Embedded links	35	37.21
	Total	100	

Table 5. Total number of data points and mean rank for each condition for the control factor.

Test Statistics(a,b)

	CONTROL
Chi-Square	26.190
df	2
Asymp. Sig.	.000

a Kruskal Wallis Test
b Grouping Variable: IV

Table 6. Chi-squared (or H) value for each condition and significance for the control factor.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Map	35	4.5143	.74247	.12550	4.2592	4.7693	2.00	5.00
Creating Map	30	3.6333	.92786	.16940	3.2869	3.9798	2.00	5.00
Embedded links	35	3.9714	.92309	.15603	3.6543	4.2885	2.00	5.00
Total	100	4.0600	.93008	.09301	3.8755	4.2445	2.00	5.00

Table 7. Descriptive statistics for the responsibility factor.

Kruskal-Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
RESPONSIBILITY	Using Map	35	64.73
	Creating Map	30	37.57
	Embedded links	35	47.36
	Total	100	

Table 8. Total number of data points and mean rank for each condition for the responsibility factor.

Test Statistics(a,b)

	RESPONSIBILITY
Chi-Square	16.700
df	2
Asymp. Sig.	.000

a Kruskal Wallis Test
b Grouping Variable: IV

Table 9. Chi-squared (or H) value for each condition and significance for the responsibility factor.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Map	21	4.4286	.97834	.21349	3.9832	4.8739	2.00	5.00
Creating Map	18	3.2222	1.39560	.32895	2.5282	3.9162	1.00	5.00
Embedded links	21	3.8571	1.27615	.27848	3.2762	4.4380	1.00	5.00
Total	60	3.8667	1.29493	.16717	3.5322	4.2012	1.00	5.00

Table 10. Descriptive statistics for the value factor.

	IV	N	Mean Rank
VALUE	Using Map	21	38.26
	Creating Map	18	21.78
	Embedded links	21	30.21
	Total	60	

Table 11. Total number of data points and mean rank for each condition for the value factor.

Test Statistics(a,b)

	VALUE
Chi-Square	9.644
df	2
Asymp. Sig.	.008

a Kruskal Wallis Test
b Grouping Variable: VALQS

Table 12. Chi-squared (or H) value for each condition and significance for the value factor.

Appendix 5.3. SPSS output for analyses of the transfer task in experiment 2 part A.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Total written transfer task	Using Map	7	48.0952	20.71474	7.82944	28.9373	67.2532	13.33	63.33
	Creating Map	6	35.5556	20.18434	8.24022	14.3734	56.7377	13.33	63.33
	Embedded links	7	28.5714	9.39999	3.55286	19.8779	37.2650	10.00	40.00
	Total	20	37.5000	18.50794	4.13850	28.8380	46.1620	10.00	63.33
A	Using Map	7	51.4286	25.44836	9.61858	27.8928	74.9644	20.00	100.00
	Creating Map	6	46.6667	30.11091	12.29273	15.0672	78.2661	20.00	100.00
	Embedded links	7	42.8571	24.29972	9.18443	20.3837	65.3306	.00	60.00
	Total	20	47.0000	25.36056	5.67079	35.1309	58.8691	.00	100.00
B	Using Map	7	60.0000	28.28427	10.69045	33.8414	86.1586	20.00	80.00
	Creating Map	6	40.0000	30.98387	12.64911	7.4844	72.5156	20.00	80.00
	Embedded links	7	45.7143	9.75900	3.68856	36.6887	54.7399	40.00	60.00
	Total	20	49.0000	24.68752	5.52030	37.4459	60.5541	20.00	80.00
C	Using Map	7	62.8571	48.20591	18.22012	18.2741	107.4402	.00	100.00
	Creating Map	6	20.0000	40.00000	16.32993	-21.9774	61.9774	.00	100.00
	Embedded links	7	28.5714	48.79500	18.44278	-16.5564	73.6993	.00	100.00
	Total	20	38.0000	47.63899	10.65240	15.7043	60.2957	.00	100.00
D	Using Map	7	45.7143	25.07133	9.47607	22.5272	68.9014	.00	80.00
	Creating Map	6	53.3333	30.11091	12.29273	21.7339	84.9328	.00	80.00
	Embedded links	7	34.2857	22.25395	8.41120	13.7042	54.8672	.00	60.00
	Total	20	44.0000	25.62893	5.73080	32.0053	55.9947	.00	80.00
E	Using Map	7	42.8571	21.38090	8.08122	23.0831	62.6312	.00	60.00
	Creating Map	6	30.0000	27.56810	11.25463	1.0691	58.9309	.00	60.00
	Embedded links	7	8.5714	10.69045	4.04061	-1.3156	18.4584	.00	20.00
	Total	20	27.0000	24.51637	5.48203	15.5260	38.4740	.00	60.00
F	Using Map	7	25.7143	15.11858	5.71429	11.7319	39.6966	.00	40.00
	Creating Map	6	23.3333	23.38090	9.54521	-1.2034	47.8701	.00	60.00
	Embedded links	7	11.4286	15.73592	5.94762	-3.1247	25.9819	.00	40.00
	Total	20	20.0000	18.35326	4.10391	11.4104	28.5896	.00	60.00

Table 1. Descriptive statistics for written transfer task marks.

Kruskal-Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Total written transfer task	Using Map	7	13.36
	Creating Map	6	9.83
	Embedded links	7	8.21
	Total	20	
A	Using Map	7	11.21
	Creating Map	6	9.75
	Embedded links	7	10.43
	Total	20	
B	Using Map	7	12.86
	Creating Map	6	8.17
	Embedded links	7	10.14
	Total	20	
C	Using Map	7	13.29
	Creating Map	6	8.83
	Embedded links	7	9.14
	Total	20	
D	Using Map	7	10.79
	Creating Map	6	12.92
	Embedded links	7	8.14
	Total	20	
E	Using Map	7	14.07
	Creating Map	6	11.17
	Embedded links	7	6.36
	Total	20	
F	Using Map	7	12.57
	Creating Map	6	11.17
	Embedded links	7	7.86
	Total	20	

Table 2. Total number of data points and mean rank for each condition for aspects of the written transfer task.

Test Statistics(a,b)

	Total written transfer task	A	B	C	D	E	F
Chi-Square	2.779	.216	2.228	3.024	2.263	6.531	2.588
df	2	2	2	2	2	2	2
Asymp. Sig.	.249	.898	.328	.220	.323	.038	.274

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for aspects of the written transfer task.

Appendix 5.4. SPSS output for analyses of the concept-mapping task in experiment 2 part A.

Quantitative Concept Map Marks

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Map	7	50.8571	7.38080	2.78968	44.0310	57.6832	44.00	61.00
Creating Map	6	32.6667	13.75015	5.61348	18.2368	47.0966	22.00	57.00
Embedded links	7	21.4286	10.56499	3.99319	11.6576	31.1996	5.00	38.00
Total	20	35.1000	16.26070	3.63600	27.4898	42.7102	5.00	61.00

Table 1. Descriptive statistics for the quantitative concept map marks.

Levene Statistic	df1	df2	Sig.
1.146	2	17	.341

Table 2. Levene test for homogeneity of variances for the quantitative concept map marks.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3081.895	2	1540.948	13.490	.000
Within Groups	1941.905	17	114.230		
Total	5023.800	19			

Table 3. Parametric Analysis of Variance for the quantitative concept map marks.

(I) IV	(J) IV	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Using Map	Creating Map	18.1905(*)	5.94616	.018	2.9365	33.4445
	Embedded links	29.4286(*)	5.71288	.000	14.7730	44.0842
Creating Map	Using Map	-18.1905(*)	5.94616	.018	-33.4445	-2.9365
	Embedded links	11.2381	5.94616	.172	-4.0159	26.4921
Embedded links	Using Map	-29.4286(*)	5.71288	.000	-44.0842	-14.7730
	Creating Map	-11.2381	5.94616	.172	-26.4921	4.0159

* The mean difference is significant at the .05 level.

Table 4. Post-hoc Tukey HSD tests for the quantitative concept map marks.

Qualitative Concept Map Marks

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Map	7	58.9286	19.41097	7.33666	40.9764	76.8807	37.50	95.00
Creating Map	6	46.6667	8.61201	3.51584	37.6289	55.7044	40.00	62.50
Embedded links	7	39.6429	14.46465	5.46713	26.2653	53.0204	25.00	67.50
Total	20	48.5000	16.57122	3.70544	40.7444	56.2556	25.00	95.00

Table 5. Descriptive statistics for the qualitative concept map marks.

Kruskal-Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Qualitative concept map marks	Using Map	7	14.14
	Creating Map	6	10.67
	Embedded links	7	6.71
	Total	20	

Table 6. Total number of data points and mean rank for each condition for the qualitative concept map marks.

Test Statistics(a,b)

	QUALMAP
Chi-Square	5.614
df	2
Asymp. Sig.	.060

a Kruskal Wallis Test
b Grouping Variable: IV

Table 7. Chi-squared (or H) value for each condition and significance for the qualitative concept map marks.

Appendix 5.5. SPSS output for analyses of navigation behaviour (no. of operations and no. of different pages visited) in experiment 2 part A.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Map	7	58.7143	18.80350	7.10705	41.3240	76.1046	39.00	85.00
Creating Map	6	85.6667	79.20522	32.33540	2.5459	168.7874	31.00	244.00
Embedded links	7	117.4286	67.59156	25.54721	54.9168	179.9403	35.00	239.00
Total	20	87.3500	61.98071	13.85931	58.3421	116.3579	31.00	244.00

Table 1. Descriptive statistics for the number of operations.

Levene Statistic	df1	df2	Sig.
1.906	2	17	.179

Table 2. Levene test for homogeneity of variances for the number of operations.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	12090.074	2	6045.037	1.687	.215
Within Groups	60900.476	17	3582.381		
Total	72990.550	19			

Table 3. Parametric Analysis of Variance for the number of operations.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Map	7	21.1429	2.11570	.79966	19.1862	23.0996	17.00	23.00
Creating Map	6	19.3333	2.50333	1.02198	16.7062	21.9604	15.00	22.00
Embedded links	7	20.4286	2.37045	.89595	18.2363	22.6209	17.00	23.00
Total	20	20.3500	2.32322	.51949	19.2627	21.4373	15.00	23.00

Table 4. Descriptive statistics for the number of different pages visited.

Levene Statistic	df1	df2	Sig.
.174	2	17	.841

Table 5. Levene test for homogeneity of variances for the number of different pages visited.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10.645	2	5.323	.985	.394
Within Groups	91.905	17	5.406		
Total	102.550	19			

Table 3. Parametric Analysis of Variance for the number of different pages visited.

Appendix 5.6. SPSS output for analyses of navigation (back button, link and map usage) in experiment 2 part A.

	IV	N	Mean	Std. Deviation	Std. Error Mean
BACK	Using Map	7	16.8950	9.86190	3.72745
	Creating Map	6	38.0312	8.60688	3.51374

Table 1. Descriptive statistics for back button usage.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
BACK	Equal variances assumed	.078	.785	-4.080	11	.002	-21.1362	5.18096	-32.53943	-9.73300
	Equal variances not assumed			-4.126	10.989	.002	-21.1362	5.12253	-32.41223	-9.86019

Table 2. Independent samples t-test for back button usage.

	IV	N	Mean	Std. Deviation	Std. Error Mean
LINKS	Using Map	7	30.8991	7.84767	2.96614
	Creating Map	6	43.4027	11.65890	4.75973

Table 3. Descriptive statistics for link usage.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
LINK	Equal variances assumed	1.24	.289	-2.301	11	.042	-12.5036	5.43341	-24.46245	-.54474
	Equal variances not assumed			-2.229	8.562	.054	-12.5036	5.60830	-25.29018	.28299

Table 4. Independent samples t-test for link usage.

	IV	N	Mean	Std. Deviation	Std. Error Mean
MAP	Using Map	7	52.2059	15.30677	5.78542
	Creating Map	6	18.5661	9.92185	4.05058

Table 5. Descriptive statistics for map usage.

		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference

									Lower	Upper
MAP	Equal variances assumed	1.677	.222	4.603	11	.001	33.6398	7.30800	17.55500	49.72462
	Equal variances not assumed			4.763	10.342	.001	33.6398	7.06245	17.97393	49.30569

Table 6. Independent samples t-test for map usage.

Appendix 5.7. SPSS output for analyses of the usability problems in experiment 2 part A.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Problem Instance	Using Map	7	14.8571	6.41427	2.42437	8.9249	20.7894	6.00	24.00
	Creating Map	6	8.1667	7.62671	3.11359	.1629	16.1704	2.00	21.00
	Embedded links	7	10.2857	6.87300	2.59775	3.9293	16.6422	3.00	20.00
	Total	20	11.2500	7.16626	1.60242	7.8961	14.6039	2.00	24.00
Unique Problems	Using Map	7	12.2857	5.12231	1.93605	7.5484	17.0231	5.00	19.00
	Creating Map	6	7.3333	6.34560	2.59058	.6740	13.9926	2.00	17.00
	Embedded links	7	9.1429	5.58058	2.10926	3.9817	14.3040	3.00	18.00
	Total	20	9.7000	5.75006	1.28575	7.0089	12.3911	2.00	19.00
Total Problem Severity	Using Map	7	24.4286	9.50188	3.59137	15.6408	33.2163	12.00	38.00
	Creating Map	6	16.1667	14.93207	6.09599	.4964	31.8369	4.00	41.00
	Embedded links	7	20.4286	15.78878	5.96760	5.8264	35.0308	5.00	52.00
	Total	20	20.5500	13.32380	2.97929	14.3143	26.7857	4.00	52.00

Table 1. Descriptive statistics for usability problems.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Problem Instances	Using Map	7	13.57
	Creating Map	6	7.67
	Embedded links	7	9.86
	Total	20	
Unique Problems	Using Map	7	13.29
	Creating Map	6	7.67
	Embedded links	7	10.14
	Total	20	
Total Problem Severity	Using Map	7	12.86
	Creating Map	6	8.17
	Embedded links	7	10.14
	Total	20	

Table 2. Total number of data points and mean rank for each condition for usability problems.

	Problem Instances	Unique Problems	Total Problem Severity
Chi-Square	3.363	2.974	2.076
df	2	2	2
Asymp. Sig.	.186	.226	.354

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for usability problems.

Appendix 5.8. The full set of "unique" usability problems that fell into each category for each condition in experiment 2 part A.

USING MAP CONDITION

Text Content Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
4	The user comments that there is very little content on this page.	2.1	UPs	1	6
5	The user comments that some words may need more definition (e.g. empirical, verbal protocols by hyperlinks).	2.1	OE intro, OE data	2	6
20	The user comments that there is a typo on this page - the text says 'qualitative' when it should say 'quantitative'.	2.1	HE intro	1	22
21	The user comments that 'heuristic evaluation invovles examining how well a system conforms to set of heuristics' is not a very useful sentence.	2.1	HE intro	2	22
22	The user is unsure of the definitions of 'heuristic'. The sentence 'A heuristic is a rule of thumb of general principle' is not very useful.	2.1, 2.2	HE intro	2	22, 30
33	The user suggests that they would like to see an example of content analysis.	2.4	OE data	2	30
58	The user comments that a whole page on UPs is "a bit silly" (redundant) because all it does is define them.	1.1/2.1	UPs	2	46
59	The user suggests that the UPs definition could be put in brackets in the text of CW analysis.	1.10/2.4	CW analysis	2	46
61	The user suggests putting CW method in with CW intro.	1.10/2.4	CW meth	2	46
66	The user comments that there is a lot to read on OE data.	2.1	OE data	2	54
67	The user suggests that OE data should have a quick summary at the top and then go into details with subheadings. This would be useful for quick reference if you come back to this page so you don't have to read it all again.	2.4	OE data	2	54
68	The user comments that OE data looks like it doesn't have an introduction, it just goes straight into the detail.	2.1	OE data	2	54

Text Presentation Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
23	The user is confused/annoyed that the font has changed at the bottom of the page. One user comments that this looks ugly.	1.2, 1.1	Nielsen's	2	22, 38, 54
43	The user comments that 'Usability testing' and 'user testing' are in italics but they don't really stand out, they just "look a bit funny".	1.1	OE intro	2	38
47	The user comments that the layout is boring.	1.1	UE intro	1	46

48	The user suggests that the title text should be made more "exciting" rather than just plain black.	2.4	UE intro	1	46
51	The user comments that the words that are in italics should be in bold rather than italic so they stand out more.	1.10	OE intro, Types of UE	2	46, 54
72	The user comments that the bullet points (means numbered list) on this page are eye-catching, especially seeing that this is the only place that they're used. (Implies bullets should more).	1.1	CW meth	2	54
76	The user comments that the line between the title and the first paragraph is a line lower than on the Role of UE page - the formatting is not universal.	1.1	Types of UE	1	54

Using Aggregate Navigation Aid Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
1	The user comments that the text (map page titles) is quite 'jargony'.	2.1	Start page	1	6
2	The user comments that it is not clear that UE intro is the best place to start (lucky that they clicked on it; unclear because there are quite a few options at the top).	1.1, 1.2	UE intro, Start page	3	6, 14, 22
3	The user comments that they have just clicked on Types of UE on the map, even though they were already in that page, because they hadn't noticed the page title, they had just gone straight to the text content.	1.3	Types of UE	2	6
14	The user suggests that there should be something highlighted on the map to tell you where to start.	1.10	Start page, Extra - finished	3	22
18	The user is uncertain what Types of UE refers to on the map (what the page content is).	1.2	UE intro	2	22
28	The user comments that the bottom two thirds of the map is more logical. (Implies that the OE and introductory pages are not as good).	1.1	Extra - no page	2	22
29	The user comments that navigation around that top part of the map wasn't logical.	1.1	Extra - no page	2	22
38	The user comments that there a lot of "things"/information on the screen.	1.1	Start - no page, OE data, Nielsen's	2	38
39	The user comments that some of the page titles on the map are in red and some are in black.	1.2	Start - no page	2	38

52	The user suggests that instead of a map there could be a bar with a list of further options, e.g. from an introduction page, that pops up at the top of the screen when the mouse rolls over that part of the screen and it could be clicked.	1.10	UPs	2	46
53	The user comments that it is quite hard (a lot of effort) to go to each page on the map.	1.1	ER intro	2	46
56	The user comments that all the "wording" around the map means that it is quite difficult to "pick out" exactly what you want to see.	1.6/1.1	ER intro	2	46
57	The user suggests that it would be good if the map indicated what page you are on by highlighting the page in red or yellow.	1.10	HE advs	2	46
65	The user comments that they thought they saw "links" (pages) on the map that they didn't see as embedded links (quickly realises they did).	1.2	OE intro	2	54

Navigation Text Structure Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
30	The user comments that in the introductory material they kept thinking that they were doing something wrong because they had too keep going back to the introduction, which made the flow illogical and boring.	1.2/1.1	Extra - no page (after using the electronic text)	2	22
54	The user suggests that a "next button" would be good (if there wasn't a map).	1.10	ER intro	2	46

Navigation Efficiency Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
6	The user had trouble finding OE data on the map (couldn't see it).	1.2/1.7/1.6	OE data	2	6
8	The user comments/is surprised that they had already read/been to this page (but they hadn't realised before they went to it again).	1.8	OE data, ER intro, Types of UE	2	6, 22, 38
15	The user comments that they would have expected the embedded links to take them to the next logical page to visit.	1.2	UE intro	2	22
16	The user suggests that there should be a link to the next logical step in the sequence and for the introductory material there should still be a link back to the introduction so people are guided through it before they read the rest.	1.10, 1.1	Role of UE, Extra - finished	2	22
17	The user went to the wrong page.	1.8	OE intro	2	22
19	The user comments that they are fed up with having to go back to UE intro all the time.	1.1	OE intro	2	22

24	The user is annoyed/surprised that they have gone back to the reference page.	1.3	Refs	2	22
25	The user comments that the embedded links are much better for the HE pages. (Implies that they aren't very good for OE and the introductory pages; they haven't been to CW yet).	1.1	HE analysis.	2	22
31	The user is confused because they have just followed the 'evaluating' embedded link from Usability to UE intro. They commented that they weren't expecting this, one user said the embedded links between Usability and UE intro "go in circles".	1.3, 1.1	UE intro	2	30, 54
40	The user is confused because they have already been to the Usability page but the embedded link hadn't changed colour so they went there again.	1.2	Usability	3	38
44	The user comments that they thought that they had been to this page before, but they just realised they hadn't.	1.8	OE meth	2	38
50	The user suggests that formative and summative could be highlighted as one embedded link rather than two.	1.10	UE intro	2	46
55	The user comments that you have to keep going back.	1.1	ER intro	2	46
60	The user comments that doing the suggestion in UP59 would mean that there wouldn't be so many links (implying that there are currently too many links).	1.1	CW analysis	2	46
69	The user comments that since all the embedded links on this page have been visited from this page (have changed colour) it implies you don't need to read it, especially as the page is quite short, even though they haven't read it before.	1.1	CW advs	2	54
70	The user comments that it is not necessary to have links to CW (intro) when you are already in the CW pages.	1.1	CW dis	2	54
71	The user comments that the embedded links to CW (intro) can make you go around in circles.	1.1	CW dis	2	54
73	The user complains that when they clicked the 'Preece et al' embedded link the Refs page doesn't point out the reference to them so they have to remember the name and they have to go back and check the name again from the embedded link.	1.6, 1.2, 1.7	Refs	2	54
74	The user comments that the back button is too far away from the text window.	1.1	OE meth	2	54
75	The user suggests that it would be better to have the back button above the text window.	1.10	OE intro	2	54

Understanding Text Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
7	The user comments that it is not clear what a pretest is.	2.2, 2.1	OE meth	2	6

9	The user is confused about HE and CW. They think that CW is different from HE because it uses scenarios (i.e. typical tasks), but the text says this method does use typical tasks.	2.3	CW intro	2	6
10	Unsure of the difference between HE and CW.	2.2	CW intro, HE meth	3	14
11	The user is uncertain about HE, they think it is about testing a prototype with users.	2.3	HE meth	3	14
12	The user is not sure whether usability testing is the same as OE. [has followed 'usability testing' embedded link in CW advs to OE intro].	1.2	OE intro	1	14
26	The user thinks that HE involves users.	2.3	HE meth	2	22, 30
27	The user comments that HE is more 'real world' than CW.	2.3.	Nielsen's	1	22
32	The user comments that they are having trouble understanding ("visualising") the text on content analysis.	2.2	OE data	2	30
34	The user is uncertain whether you have to come up with a set of principles before doing an HE for City Music website in the task or whether there are a set of principles for websites already.	2.2	HE intro	2	30
35	The user comments that they are unsure about what evaluators are looking for in HE [then goes to check principles].	2.2	HE analysis.	2	30
36	The user thinks that HE cannot be used in the task because there's limited ("no") content and functionality in the task prototype.	2.3	OE intro	2	30
37	The user thinks that ease of navigation is one of Nielsen's heuristics. (they are probably confused by the text that says Nielsen's are limited by not including navigation).	2.3	OE intro	2	30
41	The user has forgotten what formative evaluation means.	2.2	CW intro	2	38
46	The user says that HE has "an accelerator for expert users". (Implies that they may be misunderstanding heuristics as simply design guidelines rather than as a UE technique).	2.3	OE meth	2	38
62	The user comments that it is difficult to remember information from the electronic text and that you forget what it says on one page by the time you access the next page.	1.1/2.1	Role of UE	2	46
64	The user comments that they thought that there were only two 'approaches' to UE then are surprised/confused to find OE and ER (more). (Implies that they may be confused between approaches and techniques).	1.2	UE intro	2	54

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers

13	The user doesn't think the embedded links are changing colour properly.	1.2	HE advs	2	14

CREATING MAP CONDITION

Hardware Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
8	The user comments that reading from the screen is difficult (they usually print things out).	1.1	OE meth	2	32

Text Content Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
5	The user comments that they don't want the reference page cluttering up their map. (Implies the Refs page is redundant).	1.1	CW intro	2	24
9	The user comments that there is a lot of information (to absorb).	1.1	OE meth	2	32
12	The user comments that they don't think there is enough information on advantages and disadvantages to make a decision over which UE technique to choose for the task.	2.1	HE dis	2	32
15	The user comments that the definition of UPs is circular.	2.1	UPs	2	56
19	The user comments that the first paragraph on this page contradicts itself when it says that HE is useful when access to users is difficult, but that users can be taught it.	2.2	HE advs	2	56
27	The user comments that there are disadvantages mentioned on the advantages page, especially with HE.	2.1/2.2	CW advs	2	56

Creating Aggregate Navigation Aid

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
3	The user suggests that instead of having to click on the page bullet on the map they would prefer to be able to click anywhere on the page title when moving the page.	1.10	ER intro	2	24
4	The user comments that they would like the actions for moving pages on the map to be more "intuitive".	1.1	ER intro	2	24
7	The user is confused when they added a link between OE advs and disadvs. (Cause unclear).	1.2	UPs	2	32
11	The user is having problems moving the CW intro page bullet. It has appeared behind one of the link lines on the map. The user tries four times to move it unsuccessfully. The evaluator intervenes and suggests moving another page out of the way.	1.2/1.9	CW intro	2	32

17	The user comments that they don't want to look at OE analysis yet, but would like to "store it" for later, but can't think how to do that. (Implies that they haven't noticed/fully understood that every page they visit is represented on the map, so they could store this page on their map and just read it later).	1.2	OE meth	2	56
20	The user comments that the page titles on the map overlap (it is hard to read; so they have to move pages).	1.1/1.6	HE advs, Types of UE	2	16, 56
22	The user comments that their map (calls it their "walkthrough"!?) is slightly untidy.	1.1	CW dis	2	56
23	The user is confused/surprised that when they clicked on HE intro on the map the page title came up in text edit mode.	1.3	CW dis	3	56
28	The user is having problems creating a link. They say they are trying to get references linked to OE [but there is already a link]. [The user attempts to move the Refs page but it is stuck under a link line, so the user moves the other pages out of the way].	1.7	Refs	2	16
29	The user is confused about why there is no embedded link in the text of OE data to OE advs when the have added the link themselves. [The embedded links for added links appear in the annotation window fro the page they were added from. However on the page that they are linked to (where the arrow points) there is no embedded link - the links are only one directional].	1.2	OE data	2	16
30	The user has made a link to the wrong page.	1.8	OE intro	2	16
31	The user is generally confused about which pages link to which other pages and creating new links. [They are doing a lot of checking].	1.2	OE intro	3	16
32	The user is surprised when they follow the embedded link from Types of UE to UPs and a link appears on the map pointing down to near the bag and bin. [The UP page is stuck under the bag and bin].	1.2	UPs	3	16
33	The user is unsure about how to recover from the UP page being stuck under the bag and bin [they suggest deleting the link and trying again].	1.2	UPs	3	16
34	The user is dissatisfied/annoyed by the fact that the UP pages is a long way down on the map. [it is stuck under the bag and bin].	1.1	UPs	3	16
36	The user is confused about whether OE data links to CW.	1.2	-	2	16
37	The user is unsure of whether an (unknown) page is represented on the map.	1.2	-	2	16
38	The user is having difficulties (is confused when) creating a link between two pages (unknown). (In instance 43 it appears that they are trying to represent every embedded link as a link on the map).	1.2/1.7	-	3	16
39	The user is confused about why two pages (unknown) aren't already linked [so they delete one of the pages from the map].	1.2	-	2	16
42	The user comments that the number of arrows on the map gets confusing (when there's a lot of pages).	1.2	-	2	16
43	The user comments that the map should show the links you have (just) traveled in red to show your journey, the link lines should stay highlighted. This will make it a lot clearer when the map gets complex.	1.10	-	2	16

Navigation Predicting Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
18	The user is surprised when the 'Brink et al' embedded link takes them to the Refs page. They were expecting it to go to Brink et al's principles.	1.3	HE intro	2	56
26	User is unsure what would happen (on the map) if they follow the embedded link to 'Monk et al' because the embedded link has already changed colour. [Result is that a new link appears on the map].	1.2	Refs	2	56
40	The user is unsure/confused about the link structure (of the embedded links) and this is causing them to be unsure of how to structure their map. [Keeps checking the back button].	1.2/1.7	-	3	16
41	The user is confused about where the back button takes them on the map. [They have been checking this] They don't realise that they back button only takes them to the last page they visited (rather than to the superordinate node on the map). The experimenter intervenes and explains this to them.	1.9/1.2	-	3	16

Navigation Text Structure Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
10	The user comments that the organisation of the text ("data") is not good.	1.1	HE analysis	2	32

Navigation Efficiency Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
6	The user comments that there are too many "links".	1.1	OE advs, HE analysis	2	32
21	The user comments that it would probably would have been quicker to press the back button three times rather than try to use the map to go back.	1.1	HE advs	2	56
24	The user went to the wrong page (because they clicked on the link line rather than the page bullet).	1.8	ER intro	2	56
35	The user can't find the Role of UE page.	1.2	-	2	16

Understanding Text Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
1	The user is confused about formative and summative. Thinks formative relates to ERs and summative relates to Oes.	2.3	OE intro	2	8
2	The user is unsure about how formative and summative relate to the rest of the electronic text.	2.2	OE intro	2	8

13	The user says that HE won't be biased.	2.3	HE advs	2	48
14	The user misunderstands HE. They seem to think heuristics are design guidelines only. They say that if you use HE users won't get "difficult definitions" and the system will "speak the users language"	2.3	HE dis	3	48
16	The user is confused about Usability. They think that usability is not about being easy to use, but is about whether something can be used to "achieve what you are supposed to" with it (effectiveness only).	2.3	UE intro	2	56

General Interface Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
25	The user commented that the scroll bar didn't work as they expected [they were trying to use the arrow key to scroll down].	1.3	OE data	2	56

For unique usability problems in the embedded links condition see appendix 4.27.

Appendix 5.9. SPSS output for analyses of cognitive engagement in experiment 2 part B.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Total	Using A-Z	6	56.0000	20.02998	8.17720	34.9798	77.0202	38.00	84.00
	Creating A-Z	7	38.5714	14.26951	5.39337	25.3743	51.7685	12.00	51.00
	Embedded links	7	77.4286	52.24576	19.74704	29.1093	125.7478	14.00	160.00
	Total	20	57.4000	36.20613	8.09594	40.4550	74.3450	12.00	160.00
Planning/ Strategy (P)	Using A-Z	6	3.0000	2.82843	1.15470	.0317	5.9683	.00	7.00
	Creating A-Z	7	1.0000	1.52753	.57735	-.4127	2.4127	.00	4.00
	Embedded links	7	1.7143	1.97605	.74688	-.1133	3.5418	.00	5.00
	Total	20	1.8500	2.18307	.48815	.8283	2.8717	.00	7.00
Connecting to the Task Setting (CT)	Using A-Z	6	2.5000	2.94958	1.20416	-.5954	5.5954	.00	8.00
	Creating A-Z	7	1.8571	2.47848	.93678	-.4351	4.1494	.00	6.00
	Embedded links	7	2.4286	2.69921	1.02020	-.0678	4.9249	.00	6.00
	Total	20	2.2500	2.57263	.57526	1.0460	3.4540	.00	8.00
Connecting Experiences (CE)	Using A-Z	6	7.3333	4.27395	1.74483	2.8481	11.8186	2.00	13.00
	Creating A-Z	7	5.7143	2.92770	1.10657	3.0066	8.4220	.00	8.00
	Embedded links	7	11.1429	9.63377	3.64122	2.2331	20.0526	.00	28.00
	Total	20	8.1000	6.52041	1.45801	5.0484	11.1516	.00	28.00
Critiquing Text Content (CTC)	Using A-Z	6	1.1667	1.32916	.54263	-.2282	2.5615	.00	3.00
	Creating A-Z	7	.2857	.48795	.18443	-.1656	.7370	.00	1.00
	Embedded links	7	2.7143	4.71573	1.78238	-1.6470	7.0756	.00	11.00
	Total	20	1.4000	2.94511	.65855	.0216	2.7784	.00	11.00
Monitoring Understanding (MU)	Using A-Z	6	4.8333	3.54495	1.44722	1.1131	8.5535	1.00	10.00
	Creating A-Z	7	1.8571	1.95180	.73771	.0520	3.6623	.00	5.00
	Embedded links	7	5.1429	6.81734	2.57671	-1.1621	11.4478	.00	20.00
	Total	20	3.9000	4.64418	1.03847	1.7265	6.0735	.00	20.00
Employing Selected Technique (EST)	Using A-Z	6	2.6667	1.63299	.66667	.9529	4.3804	.00	5.00
	Creating A-Z	7	2.5714	2.22539	.84112	.5133	4.6296	.00	6.00
	Embedded links	7	3.2857	4.07080	1.53862	-.4791	7.0506	.00	11.00
	Total	20	2.8500	2.75824	.61676	1.5591	4.1409	.00	11.00
Restating Understanding (RU)	Using A-Z	6	2.5000	2.88097	1.17615	-.5234	5.5234	.00	7.00
	Creating A-Z	7	4.0000	1.73205	.65465	2.3981	5.6019	2.00	7.00
	Embedded links	7	11.4286	11.73111	4.43394	.5791	22.2780	.00	33.00
	Total	20	6.1500	7.92249	1.77152	2.4422	9.8578	.00	33.00
Alertness (A)	Using A-Z	6	2.3333	1.50555	.61464	.7534	3.9133	1.00	4.00
	Creating A-Z	7	1.4286	1.27242	.48093	.2518	2.6054	.00	4.00
	Embedded links	7	2.7143	2.75162	1.04002	.1695	5.2591	.00	7.00

	Total	20	2.1500	1.95408	.43695	1.2355	3.0645	.00	7.00
Selecting Technique (ST)	Using A-Z	6	5.5000	2.66458	1.08781	2.7037	8.2963	2.00	9.00
	Creating A-Z	7	5.2857	1.49603	.56544	3.9021	6.6693	3.00	7.00
	Embedded links	7	7.2857	6.62607	2.50442	1.1576	13.4138	1.00	19.00
	Total	20	6.0500	4.16091	.93041	4.1026	7.9974	1.00	19.00
Monitoring Navigation (MN)	Using A-Z	6	5.3333	4.96655	2.02759	.1213	10.5454	2.00	15.00
	Creating A-Z	7	3.8571	2.26779	.85714	1.7598	5.9545	2.00	8.00
	Embedded links	7	6.4286	10.58076	3.99915	-3.3570	16.2141	.00	30.00
	Total	20	5.2000	6.68541	1.49490	2.0711	8.3289	.00	30.00

Table 1. Descriptive statistics for cognitive engagement.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
TOTAL	Using A-Z	6	10.67
	Creating A-Z	7	8.14
	Embedded links	7	12.71
	Total	20	
Planning/ Strategy (P)	Using A-Z	6	13.50
	Creating A-Z	7	8.07
	Embedded links	7	10.36
	Total	20	
Connecting to the Task Setting (CT)	Using A-Z	6	11.00
	Creating A-Z	7	9.71
	Embedded links	7	10.86
	Total	20	
Connecting Experiences (CE)	Using A-Z	6	10.08
	Creating A-Z	7	9.07
	Embedded links	7	12.29
	Total	20	
Critiquing Text Content (CTC)	Using A-Z	6	12.00
	Creating A-Z	7	9.14
	Embedded links	7	10.57
	Total	20	
Monitoring Understanding (MU)	Using A-Z	6	13.08
	Creating A-Z	7	7.43
	Embedded links	7	11.36
	Total	20	
Employing Selected Technique (EST)	Using A-Z	6	11.00
	Creating A-Z	7	10.43
	Embedded links	7	10.14
	Total	20	
Restating Understanding (RU)	Using A-Z	6	7.17
	Creating A-Z	7	10.29
	Embedded links	7	13.57
	Total	20	
Alertness (A)	Using A-Z	6	11.67
	Creating A-Z	7	8.50
	Embedded links	7	11.50
	Total	20	
Selecting Technique (ST)	Using A-Z	6	10.50

	Creating A-Z	7	10.64
	Embedded links	7	10.36
	Total	20	
Monitoring Navigation (MN)	Using A-Z	6	11.33
	Creating A-Z	7	10.43
	Embedded links	7	9.86
	Total	20	

Table 2. Total number of data points and mean rank for each condition for cognitive engagement.

	TOTAL	P	CT	CE	CTC	MU	EST	RU	A	ST	MN
Chi-Square	2.103	2.903	.213	1.097	1.042	3.251	.072	3.888	1.306	.008	.208
df	2	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.349	.234	.899	.578	.594	.197	.965	.143	.520	.996	.901

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for cognitive engagement.

Appendix 5.10. SPSS output for analyses of ownership in experiment 2 part B.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using A-Z	6	4.0000	.52172	.21299	3.4525	4.5475	3.54	5.00
Creating A-Z	7	3.8022	.20283	.07666	3.6146	3.9898	3.54	4.15
Embedded Links	7	3.7802	.42697	.16138	3.3853	4.1751	3.23	4.23
Total	20	3.8538	.38976	.08715	3.6714	4.0363	3.23	5.00

Table 1. Descriptive statistics for total ownership.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
TOTAL OWNERSHIP	Using A-Z	6	11.50
	Creating A-Z	7	9.93
	Embedded links	7	10.21
	Total	20	

Table 2. Total number of data points and mean rank for total ownership.

Test Statistics(a,b)

	TOTALOWN
Chi-Square	.256
df	2
Asymp. Sig.	.880

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for total ownership.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using A-Z	30	3.5667	1.19434	.21805	3.1207	4.0126	1.00	5.00
Creating A-Z	34	3.8235	.86936	.14909	3.5202	4.1269	1.00	5.00
Embedded links	35	3.5429	.98048	.16573	3.2060	3.8797	2.00	5.00
Total	99	3.6465	1.01331	.10184	3.4444	3.8486	1.00	5.00

Table 4. Descriptive statistics for the control factor.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
CONTROL	Using A-Z	30	49.32
	Creating A-Z	34	54.35
	Embedded links	35	46.36
	Total	99	

Table 5. Total number of data points and mean rank for each condition for the control factor.

Test Statistics(a,b)

	CONTROL
Chi-Square	1.522
df	2
Asymp. Sig.	.467

a Kruskal Wallis Test
b Grouping Variable: IV

Table 6. Chi-squared (or H) value for each condition and significance for the control factor.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using A-Z	30	4.2000	.84690	.15462	3.8838	4.5162	2.00	5.00
Creating A-Z	35	3.9429	.59125	.09994	3.7398	4.1460	3.00	5.00
Embedded links	35	3.9714	.92309	.15603	3.6543	4.2885	2.00	5.00
Total	100	4.0300	.79715	.07972	3.8718	4.1882	2.00	5.00

Table 7. Descriptive statistics for the responsibility factor.

	IV	N	Mean Rank
RESPONSIBILITY	Using A-Z	30	56.87
	Creating A-Z	35	46.23
	Embedded links	35	49.31
	Total	100	

Table 8. Total number of data points and mean rank for each condition for the responsibility factor.

Test Statistics(a,b)

	RESPONSIBILITY
Chi-Square	2.611
df	2
Asymp. Sig.	.271

a Kruskal Wallis Test
b Grouping Variable: IV

Table 9. Chi-squared (or H) value for each condition and significance for the responsibility factor.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using A-Z	18	4.3889	.84984	.20031	3.9663	4.8115	2.00	5.00
Creating A-Z	21	3.9048	1.04426	.22788	3.4294	4.3801	2.00	5.00
Embedded links	21	3.8571	1.27615	.27848	3.2762	4.4380	1.00	5.00
Total	60	4.0333	1.08872	.14055	3.7521	4.3146	1.00	5.00

Table 10. Descriptive statistics for the value factor.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
VALUE	Using A-Z	18	35.78
	Creating A-Z	21	27.60
	Embedded links	21	28.88
	Total	60	

Table 11. Total number of data points and mean rank for each condition for the value factor.

Test Statistics(a,b)

	VALUE
Chi-Square	2.746
df	2
Asymp. Sig.	.253

a Kruskal Wallis Test
b Grouping Variable: IV

Table 12. Chi-squared (or H) value for each condition and significance for value factor.

Appendix 5.11. SPSS output for analyses of the transfer task in experiment 2 part B.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Written transfer task	Using A-Z	6	54.4444	26.30308	10.73819	26.8411	82.0478	10.00	76.67
	Creating A-Z	7	32.3810	9.94695	3.75959	23.1816	41.5803	13.33	43.33
	Embedded links	7	28.5714	9.39999	3.55286	19.8779	37.2650	10.00	40.00
	Total	20	37.6667	19.25817	4.30626	28.6536	46.6798	10.00	76.67
A	Using A-Z	6	56.6667	26.58320	10.85255	28.7693	84.5640	40.00	100.00
	Creating A-Z	7	42.8571	24.29972	9.18443	20.3837	65.3306	.00	80.00
	Embedded links	7	42.8571	24.29972	9.18443	20.3837	65.3306	.00	60.00
	Total	20	47.0000	24.51637	5.48203	35.5260	58.4740	.00	100.00
B	Using A-Z	6	60.0000	35.77709	14.60593	22.4542	97.5458	.00	100.00
	Creating A-Z	7	31.4286	25.44836	9.61858	7.8928	54.9644	.00	60.00
	Embedded links	7	45.7143	9.75900	3.68856	36.6887	54.7399	40.00	60.00
	Total	20	45.0000	26.65570	5.96040	32.5247	57.4753	.00	100.00
C	Using A-Z	6	53.3333	45.01851	18.37873	6.0893	100.5774	.00	100.00
	Creating A-Z	7	17.1429	37.28909	14.09395	-17.3438	51.6295	.00	100.00
	Embedded links	7	28.5714	48.79500	18.44278	-16.5564	73.6993	.00	100.00
	Total	20	32.0000	44.20050	9.88353	11.3135	52.6865	.00	100.00
D	Using A-Z	6	63.3333	26.58320	10.85255	35.4360	91.2307	20.00	100.00
	Creating A-Z	7	34.2857	22.25395	8.41120	13.7042	54.8672	.00	60.00
	Embedded links	7	34.2857	22.25395	8.41120	13.7042	54.8672	.00	60.00
	Total	20	43.0000	26.17753	5.85347	30.7485	55.2515	.00	100.00
E	Using A-Z	6	53.3333	43.20494	17.63834	7.9925	98.6741	.00	100.00
	Creating A-Z	7	42.8571	29.27700	11.06567	15.7804	69.9339	.00	80.00
	Embedded links	7	8.5714	10.69045	4.04061	-1.3156	18.4584	.00	20.00
	Total	20	34.0000	34.39706	7.69142	17.9017	50.0983	.00	100.00
F	Using A-Z	6	40.0000	28.28427	11.54701	10.3175	69.6825	.00	80.00
	Creating A-Z	7	25.7143	19.02379	7.19032	8.1202	43.3084	.00	60.00
	Embedded links	7	11.4286	15.73592	5.94762	-3.1247	25.9819	.00	40.00
	Total	20	25.0000	23.28315	5.20627	14.1031	35.8969	.00	80.00

Table 1. Descriptive statistics for aspects of the written transfer task.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Written transfer task	Using A-Z	6	14.67
	Creating A-Z	7	10.00
	Embedded links	7	7.43
	Total	20	
A	Using A-Z	6	11.75
	Creating A-Z	7	9.57
	Embedded links	7	10.36
	Total	20	
B	Using A-Z	6	13.75

	Creating A-Z	7	7.86
	Embedded links	7	10.36
	Total	20	
C	Using A-Z	6	13.00
	Creating A-Z	7	9.07
	Embedded links	7	9.79
	Total	20	
D	Using A-Z	6	14.83
	Creating A-Z	7	8.64
	Embedded links	7	8.64
	Total	20	
E	Using A-Z	6	13.08
	Creating A-Z	7	12.21
	Embedded links	7	6.57
	Total	20	
F	Using A-Z	6	13.83
	Creating A-Z	7	11.07
	Embedded links	7	7.07
	Total	20	

Table 2. Total number of data points and mean rank for each condition for aspects of the written transfer task.

Test Statistics(a,b)

	Written transfer task	A	B	C	D	E	F
Chi-Square	4.980	.498	3.498	2.056	4.921	5.168	4.680
df	2	2	2	2	2	2	2
Asymp. Sig.	.083	.780	.174	.358	.085	.075	.096

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for aspects of the written transfer task.

Appendix 5.12. SPSS output for analyses of the concept-mapping task in experiment 2 part B.

Quantitative Concept Map Marks

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using A-Z	6	36.0000	18.83614	7.68982	16.2327	55.7673	8.00	59.00
Creating A-Z	7	20.1429	9.45919	3.57524	11.3946	28.8911	9.00	38.00
Embedded links	7	21.4286	10.56499	3.99319	11.6576	31.1996	5.00	38.00
Total	20	25.3500	14.43415	3.22757	18.5946	32.1054	5.00	59.00

Table 1. Descriptive statistics for the quantitative concept map marks.

Levene Statistic	df1	df2	Sig.
1.649	2	17	.222

Table 2. Levene test for homogeneity of variances for the quantitative concept map marks.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	977.979	2	488.989	2.789	.090
Within Groups	2980.571	17	175.328		
Total	3958.550	19			

Table 3. Parametric Analysis of Variance for quantitative concept map marks.

Qualitative Concept Map Marks

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using A-Z	6	57.0833	35.44068	14.46860	19.8906	94.2760	.00	92.50
Creating A-Z	7	36.0714	9.66708	3.65381	27.1309	45.0120	25.00	50.00
Embedded links	7	39.6429	14.46465	5.46713	26.2653	53.0204	25.00	67.50
Total	20	43.6250	22.58718	5.05065	33.0539	54.1961	.00	92.50

Table 4. Descriptive statistics for the qualitative concept map marks.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Qualitative Concept Map Mark	Using A-Z	6	13.58
	Creating A-Z	7	8.79
	Embedded links	7	9.57
	Total	20	

Table 5. Total number of data points and mean rank for each condition for qualitative concept map marks.

Test Statistics(a,b)

	QUAL MARKS
Chi-Square	2.415
df	2
Asymp. Sig.	.299

a Kruskal Wallis Test
b Grouping Variable: IV

Table 6. Chi-squared (or H) value for each condition and significance for the qualitative concept map marks

Appendix 5.13. SPSS output for analyses of navigation behaviour (no. of operations and no. of different pages visited) in experiment 2 part B.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using A-Z	6	71.6667	33.52412	13.68616	36.4853	106.8481	40.00	135.00
Creating A-Z	7	76.1429	27.22394	10.28968	50.9649	101.3208	42.00	114.00
Embedded links	7	117.4286	67.59156	25.54721	54.9168	179.9403	35.00	239.00
Total	20	89.2500	49.25431	11.01360	66.1983	112.3017	35.00	239.00

Table 1. Descriptive statistics for the number of operations.

Levene Statistic	df1	df2	Sig.
1.899	2	17	.180

Table 2. Levene test for homogeneity of variances for the number of operations.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8615.845	2	4307.923	1.954	.172
Within Groups	37477.905	17	2204.583		
Total	46093.750	19			

Table 3. Parametric Analysis of Variance for the number of operations.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using A-Z	6	21.8333	1.16905	.47726	20.6065	23.0602	20.00	23.00
Creating A-Z	7	19.2857	2.81154	1.06266	16.6855	21.8860	15.00	23.00
Embedded links	7	20.4286	2.37045	.89595	18.2363	22.6209	17.00	23.00
Total	20	20.4500	2.39462	.53545	19.3293	21.5707	15.00	23.00

Table 4. Descriptive statistics for the number of different pages visited.

Levene Statistic	df1	df2	Sig.
3.027	2	17	.075

Table 5. Levene test for homogeneity of variances for the number of different pages visited.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	20.974	2	10.487	2.026	.162
Within Groups	87.976	17	5.175		
Total	108.950	19			

Table 6. Parametric Analysis of Variance for the number of different pages visited.

Appendix 5.14. SPSS output for analyses of navigation behaviour (back, link and A-Z usage) in experiment 2 part B.

	IV	N	Mean	Std. Deviation	Std. Error Mean
BACK	Using A-Z	6	22.2963	9.42364	3.84719
	Creating A-Z	7	36.2076	14.61225	5.52291

Table 1. Descriptive statistics for back button usage.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
BACK	Equal variances assumed	.518	.487	-1.997	11	.071	-13.9113	6.96726	-29.24618	1.42348
	Equal variances not assumed			-2.067	10.320	.065	-13.9113	6.73078	-28.84571	1.02302

Table 2. Independent samples t-test for back button usage.

	IV	N	Mean	Std. Deviation	Std. Error Mean
LINKS	Using A-Z	6	35.9960	14.56980	5.94810
	Creating A-Z	7	43.5439	8.97717	3.39305

Table 3. Descriptive statistics for link usage.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
LINKS	Equal variances assumed	.926	.357	-1.145	11	.277	-7.5479	6.59334	-22.05978	6.96391
	Equal variances not assumed			-1.102	8.071	.302	-7.5479	6.84782	-23.31480	8.21892

Table 4. Independent samples t-test for link usage.

	IV	N	Mean	Std. Deviation	Std. Error Mean
A-Z	Using A-Z	6	41.7077	23.35595	9.53503
	Creating A-Z	7	20.2484	22.61800	8.54880

Table 5. Descriptive statistics for A-Z usage.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
A-Z	Equal variances assumed	.009	.928	1.680	11	.121	21.4593	12.77175	-6.65114	49.56972
	Equal variances not assumed			1.676	10.575	.123	21.4593	12.80620	-6.86582	49.78439

Table 6. Independent samples t-test for A-Z usage.

Appendix 5.15. SPSS output for analyses of the usability problems in experiment 2 part B.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Problem instance	Using A-Z	6	12.5000	9.41807	3.84491	2.6163	22.3837	3.00	29.00
	Creating A-Z	7	10.2857	8.19988	3.09926	2.7021	17.8693	3.00	25.00
	Embedded links	7	10.2857	6.87300	2.59775	3.9293	16.6422	3.00	20.00
	Total	20	10.9500	7.78308	1.74035	7.3074	14.5926	3.00	29.00
Unique problems	Using A-Z	6	10.8333	7.96032	3.24979	2.4795	19.1872	3.00	25.00
	Creating A-Z	7	8.4286	5.96817	2.25576	2.9089	13.9482	3.00	19.00
	Embedded links	7	9.1429	5.58058	2.10926	3.9817	14.3040	3.00	18.00
	Total	20	9.4000	6.22727	1.39246	6.4855	12.3145	3.00	25.00
Total problem severity	Using A-Z	6	24.1667	16.70230	6.81868	6.6387	41.6947	6.00	52.00
	Creating A-Z	7	20.7143	15.87151	5.99887	6.0356	35.3930	5.00	49.00
	Embedded links	7	20.4286	15.78878	5.96760	5.8264	35.0308	5.00	52.00
	Total	20	21.6500	15.31520	3.42458	14.4823	28.8177	5.00	52.00

Table 1. Descriptive statistics for usability problems.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Problem Instances	Using A-Z	6	11.50
	Creating A-Z	7	10.07
	Embedded links	7	10.07
	Total	20	
Unique Problems	Using A-Z	6	11.50
	Creating A-Z	7	9.86
	Embedded links	7	10.29
	Total	20	
Total Problem Severity	Using A-Z	6	11.67
	Creating A-Z	7	9.79
	Embedded links	7	10.21
	Total	20	

Table 2. Total number of data points and mean rank for each condition for usability problems.

Test Statistics(a,b)

	Problem instances	Unique problems	Total problem severity
Chi-Square	.248	.267	.352
df	2	2	2
Asymp. Sig.	.884	.875	.838

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for usability problems.

Appendix 5.16. The full set of "unique" usability problems that fell into each category for each condition in experiment 2 part B.

USING A-Z INDEX

General Confusion Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
44	The user comments that they are getting really confused. [cause unknown]	1.2/2.2	ER intro	2	45

Text Content Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
8	The user comments that there is not much information on this page and they will not click on it again.	2.1	UPs	2	13
34	The user comments that this page is a bit long/there's a lot (too much) to read.	1.1/2.1	OE meth, Types of UE, Nielsen's Heuristics	3	21, 29
52	The user comments that everything is about UPs. They are confused about why text repeats the same information.	2.2	Nielsen's Heuristics	2	53
59	The user suggests changing the text in some places - e.g. change "clarity of the interface" to "visibility" (their own words).	2.4	UPs	2	53

Text Presentation Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
7	The user suggests that they would prefer to have each segment of the method on this page as bullet points.	1.10	HE meth	1	13

Using Aggregate Navigation Aid Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
1	The user comments that they are expecting to find a page called techniques on the A-Z but can't find it.	1.2/1.7	Types of UE	2	5
11	The user comments that they would have thought that advantages and disadvantages would have been grouped next to each other on the A-Z.	1.2	OE advs	2	13
12	The user is having problems seeing/identifying ER intro on the A-Z.	1.6	ER intro, UE intro	2	13
13	The user comments that they font on the A-Z is small and that this doesn't work well with the larger font in the text window.	1.6	ER intro	2	13

17	The user comments that they have to check where they are on the A-Z (rather than having it highlighted).	1.1	HE advs, HE dis	2	13
19	The user comments that when they click on a page on the A-Z a dotted box highlights the page title, then when you click on the text window this disappears (so you don't know what page you have just clicked on the A-Z.	1.1	OE data, OE dis	2	13
21	The user questions why UE intro is at the end of the A-Z, it is not logical. They think it should be at the beginning.	1.1/1.10	OE intro	3	13
22	The user suggests that the OE method should be second to last in the group of pages on OE, not the last.	1.1/1.10	OE meth	2	13
23	The user suggests that they would prefer to see OE method as the first or second in the group on OE so that they know what they are looking at before they see the advantages and disadvantages.	1.10	OE meth	2	13
29	The user comments that they are unsure where to start because the first page on the index is CW advantages and they don't know what CW is.	1.2	Start page of A-Z	2	21
31	Problems deciding on start point. Initially tried CW advs then CW intro, then ER intro, then Types of UE, then UE intro.	1.3, 1.2	CW intro, ER intro, Types of UE, UE intro	3	21
33	The user checks the A-Z to make sure there was not a more obvious start point. Problems deciding on start point.	1.2	UE intro	3	21
37	The user comments that they are going to look at CW again because it will make more sense now that they have read the other (introductory) pages first. (Implies that it is confusing to have this at the start of the A-Z).	1.2	ER intro	2	21

Navigation Predicting Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
3	The user has to check back on the 'user testing' embedded link to see what embedded link they had followed to get to OE intro.	1.2	OE intro	2	5
9	The user has to check which embedded link they used from HE disadvantages then goes back to OE intro.	1.2	OE intro	2	13
10	The user believes that they were previously taken to a reference page with only one reference (they are mistaken).	1.2	Refs	2	13
25	The user clicked on the formative embedded link from OE intro to Types of UE and asks why the page also displays information on summative evaluation.	1.3	Types of UE	2	13

26	The user suggests that there should be a separate page for summative and formative evaluations. If they click on a 'formative' embedded link then they just want information on formative evaluations.	1.1/1.10	Types of UE	2	13
30	The user is uncertain about whether the reference embedded link will take them to the References page.	1.2	Refs	2	21
38	The user is unsure about where the 'Nielsen's heuristics' embedded link will take them.	1.2	HE intro	2	21
43	The user thinks that the 'usability evaluations' embedded link will take them to the Role of UE page.	1.2	Types of UE	2	45
48	The user is surprised when the 'Nielsen, 1994' embedded link takes them to Refs. They thought it was the wrong page. (they were probably expecting the ten heuristics).	1.3	Refs	2	45
54	The user checks whether the A-Z and embedded links go to the same pages. (Implies that they are unsure about this).	1.2	CW intro	2	53
55	The user comments that when they first started using the electronic text they expected that the embedded links would take them to pages that weren't on the A-Z.	1.2	UPs	2	53

Navigation Disorientation

Unique ID	Problem description and context	Criterion ID	Location	Severity	Participants
5	The user is apprehensive about getting lost and will therefore choose pages from the A-Z with no links first.	1.2	Start page of A-Z	2	13
16	The user comments that the back button overwrites some of what has been seen before so they normally open embedded links in new windows to compensate.	1.1	HE intro	2	13
32	The user clicks the 'user testing' embedded link from CW intro to OE intro and clicks back again saying that it's too confusing.	1.2	CW intro	2	21
57	The user comments that the embedded links are confusing (and that the A-Z is better.)	1.2	UPs	2	53
58	The user comments that there should be an A-Z index or embedded links, but not both.	1.10	UPs	2	53

Navigation Text Structure Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
41	The user comments that it not obvious what order the pages should be read in so that they make sense.	1.2	ER intro	2	29

Understanding Text Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
2	The user comments that they are looking for the actual techniques but they're having problems recognising that OE, CW and HE are the techniques.	1.2/1.7	Nielsen's Heuristics	2	5
14	The user comments that it is very difficult to differentiate between HE and CW.	2.2	CW dis	3	13
18	The user thinks that the 'Karak, 1996' embedded link refers to the "users charter" or "ten commandments" (i.e. thinks thinks that they recognise the name).	2.3	HE dis	1	13
39	The user is having problems distinguishing CW from HE.	2.2	HE meth, ER intro	3	21, 45
42	The user comments that they haven't fully understood what HE is.	2.2	Nielsen's Heuristics	2	29
45	The user is confused about which pages are about the techniques and which pages are general information on UE.	1.2	CW advs	2	45
46	The user comments that they think that CW is the technique being used in the study they are participating in.	2.3	CW intro	3	45
49	The user is unsure about how the CW questions should be used and what 'actions' they refer to.	2.2	ER intro, CW meth	2	53
50	The user thinks that if experts identify problems that are not problems for real users the they are not experts.	2.2	HE dis	2	53
51	The user comments that they don't really understand HE - the text says on one hand it's accurate and on the other says that errors detected by experts are not real errors.	2.2	OE advs	3	53
53	The user can't remember the name of 'formative' evaluations.	2.2	Usability	2	53

CREATING A-Z INDEX

Text Content Category

Unique ID	Problem description and context	Criterion ID	Location	Severity	Participants
42	There is a large amount (too much) of text/information.	1.1	OE data, Nielsen's Heuristics, CW intro	3	39, 47
44	The user asks when the text is going to get to the point. (Implies too much text?).	1.1/2.1	OE intro	2	47
45	The user comments that the text should tell them about different usability evaluation techniques, rather than different "ways" (approaches - i.e. formative and summative) of conducting evaluations.	1.1/2.1	UE intro	2	47

Creating Aggregate Navigation Aid Category

Unique ID	Problem description and context	Criterion ID	Location	Severity	Participants
4	The user comments that pages appear in random (e.g. "mish-mashed") places in the A-Z window.	1.1	OE dis, Usability	2	15, 31
5	The user comments that they hadn't noticed the pages appearing in the A-Z window (in random positions).	1.6	OE dis	2	15
9	A page (HE analysis or HE intro in first instance?) got stuck under the bag icon. The user comments that they are unable to move the page. The evaluator intervenes in the first instance and suggests moving other pages then trying to move the stuck page.	1.1, 1.2/1.9	OE data, HE dis	4	15
10	The user comments that they are trying to move a page. But when they try to select the page the title goes into text edit mode rather than moving the page.	1.2	OE data	3	15
11	The user comments that they are clicking on each page to check if they've been through them. (Implies they don't recognise that if the page is in the A-Z window then they have already visited this page. Also implies that the page titles aren't very good at reminding them of the content of the pages).	1.2	Refs	2	15
17	The user comments that there is not enough space for all pages in the A-Z window.	1.1/1.7	HE dis	3	15
20	The user comments that it took a while to put the pages into alphabetical order. (This implies it took too long).	1.1	Types of UE	2	23
21	The user comments that it doesn't seem very logical/it is inappropriate to put pages into alphabetical order.	1.1, 1.2	OE dis, ER intro	3	23, 31
22	The user suggests that it would be better to group pages in subjects rather than in alphabetical order (as a menu with subheadings).	1.10	OE dis, ER intro	3	23, 31
25	The user comments that the pages don't follow on from each other and that there's no order (to the way that they appear in the A-Z window).	1.1	Usability	2	31
26	The user comments that (because of the random way that pages appear in the A-Z window) when they want to go back they are not sure which page they will be taken to.	1.1	Usability	2	31
28	The user complains that their A-Z is not very good (as they are creating it).	1.1	HE intro	2	31
29	The user complains that there is no structure to their A-Z (as they are creating it).	1.1	CW intro	2	31

39	The user comments that an A-Z index would be hard to use; there would be no "consistency" (logical order) to it and you would have to remember the exact title of the page you wanted.	1.1	ER intro	2	31
50	The user comments that the page bullets ("icons") are overlapping in the A-Z window.	1.1	UE intro	2	55
52	The user comments that the multi-selector tool for dragging/moving pages is quite sensitive [it has a clumsy/jerky movement].	1.1	UE intro	2	55

Navigation Predicting Category

Unique ID	Problem description and context	Criterion ID	Location	Severity	Participants
1	The user comments that they expected the 'summative evaluation' embedded link to take them to a different page from the 'formative evaluation' embedded link.	1.3	Types of UE	2	7
2	The user follows the 'Brink et al' embedded link expecting to find an alternative set of web heuristics but instead finds Refs.	1.3/1.1	HE intro	2	7
27	The user comments that there is no guidance ("it doesn't take your hand").	1.2	HE dis	2	31
49	The user is surprised to find several more untravelled embedded links on this page.	1.3	HE intro	2	47

Navigation Disorientation Category

Unique ID	Problem description and context	Criterion ID	Location	Severity	Participants
6	The user clicks back out of the text to the map home page. Having difficulties trying to get back in.	1.7	Map home	3	15
18	The user comments that they are lost. [They have clicked back to Map home, out of the texts, and have gone back in to Usability then UE intro then to OE intro].	1.2	UE intro, OE advs	3	23
19	The user comments that they are putting the pages into alphabetical order to make it easier to find their way around. (They still don't seem to have recovered from going back to Map home in problem 18).	1.2	Types of UE	2	23

Navigation Efficiency Category

Unique ID	Problem description and context	Criterion ID	Location	Severity	Participants
7	The user went to the wrong page.	1.8	OE meth, ER intro	3	15, 23
8	The user comments that they want to get to the beginning of the electronic text, but they can't remember where it is. (This seems to be a result of having clicked back all the way to the map home page in problem 6).	1.7	Map home	3	15
12	The user can't find the (UE) introduction page.	1.2	UE intro	2	15
13	The user can't find the OE data page ("quantitative).	1.7	OE intro, UE intro	2	15
46	The user thinks that the text only has information on OE (i.e. not HE and CW). Can't see any other techniques.	1.2/1.6.	OE intro	3	47
48	The user is unsure of where to go next.	1.2	OE intro	2	47
51	The user is unsure whether they have visited all the pages in the electronic text.	1.2	UE intro	2	55

Understanding Text Category

Unique ID	Problem description and context	Criterion ID	Location	Severity	Participants
3	The user seems to think that HE is used in (only) design rather than evaluation. They think that using HE leads to designing a website free from errors.	2.3	CW intro	1	7
14	The user asks if they are supposed to choose between formative and summative evaluations. (Implies they are having problems recognising the techniques).	2.2	UE intro	2	15
15	The user is unsure if OE and Hes (hasn't been to CW) are techniques that should be selected for the task	2.2	OE data	2	15
16	The user thinks that HE has not been successful (seems to have only be thinking of the text about HE with users not being sucessful.)	2.3	HE advs	2	15
23	The user comments that they don't know what a 'coding sheet' is and it's not explained in the text.	2.2	HE meth	2	23

24	The user thinks that HE is a psychological approach. (Implies they are confusing it with CW).	2.3	CW intro	2	23
30	The user thinks that HE is more appropriate for webpages (that the other techniques??).	2.3	HE intro, Nielsen's Heuristics	3	31
31	The user thinks that HE addresses functionality and speed in Nielsen's heuristics.	2.3	Nielsen's Heuristics, HE advs	2	31
32	The user completely misunderstands CW. They think it involves forcing users to "think what they are doing" and says that users might prefer this approach. (Seems to think it is a way of guiding a user evaluation???).	2.3	CW meth	4	31
33	The user seems to think that HE is a summative approach to evaluation.	2.3	HE intro	2	31
34	The user seems to think that users perform CW. They say that users with disabilities might prefer this approach because they can solve (rectify) problems during development. Seems to be confused with the formative/summative distinction too.	2.3	CW dis	4	31
35	The user is confused about formative vs cognitive and summative vs heuristic. They say that heuristics may miss problems, but this doesn't happen in CW because problems are rectified during development ("as you go along").	2.2/2.3	HE dis	4	31
36	The user is confused about HE and CW. Says that you need a combination for the task decision because you need one to deal with "look and feel" and one to deal with "problems".	2.3	ER intro	3	31
37	The user thinks that HE doesn't allow evaluators to come up with a top-ten list of UPs.	2.3	CW Analysis	2	31
38	The user thinks that HE uses real users.	2.3, 2.2	HE dis, CW advs, HE advs, Usability	4	31, 39
40	The user comments that a problem with HE is that you can't satisfy every user. (Implies they think it involves users??).	2.3	Nielsen's Heuristics	1	31
41	The user is confused whether OE is formative or summative. (They seem to be confused because the text says it can be used for both.)	2.2	OE intro	2	39
43	The user comments that with OE (as opposed to HE) you build a system with no standards. They seem to be misunderstanding OE and HE as design approaches (only) rather than as evaluation techniques.	2.3	Nielsen's Heuristics	3	39
47	The user thinks that formative evaluations involves experienced users. (Is not confused with ERs because they haven't read that bit yet).	2.3	Types of UE	2	47

For usability problems in the embedded links condition see appendix 4.27

Appendix 5.17. SPSS output for the reliability and validity checking for the pretest (correlation) for data from parts C of experiment 2.

Correlations

			Second Marking	Author's Marking
Spearman's rho	Second Marking	Correlation Coefficient	1.000	.929(**)
		Sig. (2-tailed)	.	.003
		N	7	7
	Author's Marking	Correlation Coefficient	.929(**)	1.000
		Sig. (2-tailed)	.003	.
		N	7	7

** Correlation is significant at the 0.01 level (2-tailed).

Appendix 5.18. SPSS output for the internal reliability analysis for the ownership questionnaire for data from experiment 2 part C.

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

N of Cases = 13.0 (note that the data for one participant was removed since they were an outlier)

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	52.4615	27.9359	5.2854	13

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
Q1	48.6923	25.8974	.0983	.	.7199
Q2	48.3077	29.5641	-.2606	.	.7517
Q3	48.4615	22.1026	.8022	.	.6302
Q5	48.0000	23.6667	.5967	.	.6577
Q6	48.6154	20.2564	.8494	.	.6048
Q7	48.0769	23.4103	.6518	.	.6524
Q8	48.5385	22.6026	.4876	.	.6602
Q9	48.6154	21.5897	.7668	.	.6264
Q11	48.6154	23.2564	.6330	.	.6519
Q12	48.9231	21.9103	.6402	.	.6396
Q13	48.3846	26.5897	.0443	.	.7248
Q15	48.1538	25.3077	.1816	.	.7057
Q16	48.1538	30.9744	-.3371	.	.7938

Reliability Coefficients 13 items

Alpha = .7020 **Standardized item alpha =** .7652

Appendix 5.19. SPSS output for the reliability and validity checking for the transfer task (correlation) for data from parts C of experiment 2.

Correlations

			Second Marking	Author's Marking
Spearman's rho	Second Marking	Correlation Coefficient	1.000	.764(*)
		Sig. (2-tailed)	.	.046
		N	7	7
	Author's Marking	Correlation Coefficient	.764(*)	1.000
		Sig. (2-tailed)	.046	.
		N	7	7

* Correlation is significant at the 0.05 level (2-tailed).

Appendix 5.20. SPSS output for the reliability and validity checking for the qualitative concept map marks (correlation) for data from parts C of experiment 2.

Correlations

			Second Marking Node Quality	Author's Marking Node Quality
Spearman's rho	Second Marking Node Quality	Correlation Coefficient	1.000	.633
		Sig. (2-tailed)	.	.127
		N	7	7
	Author's Marking Node Quality	Correlation Coefficient	.633	1.000
		Sig. (2-tailed)	.127	.
		N	7	7

Correlations

			Second Marking Link Quality	Author's Marking Link Quality
Spearman's rho	Second Marking Link Quality	Correlation Coefficient	1.000	.765(*)
		Sig. (2-tailed)	.	.045
		N	7	7
	Author's Marking Link Quality	Correlation Coefficient	.765(*)	1.000
		Sig. (2-tailed)	.045	.
		N	7	7

* Correlation is significant at the 0.05 level (2-tailed).

Appendix 5.21. SPSS output for analyses of cognitive engagement in experiment 2 part C.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Total	Using Contents	7	45.4286	25.49416	9.63589	21.8504	69.0067	26.00	101.00
	Creating Contents	6	35.6667	26.02050	10.62283	8.3598	62.9735	5.00	76.00
	Embedded links	7	77.4286	52.24576	19.74704	29.1093	125.7478	14.00	160.00
	Total	20	53.7000	39.75861	8.89030	35.0924	72.3076	5.00	160.00
Planning/ Strategy (P)	Using Contents	7	1.7143	3.72891	1.40940	-1.7344	5.1630	.00	10.00
	Creating Contents	6	1.3333	2.80476	1.14504	-1.6101	4.2767	.00	7.00
	Embedded links	7	1.7143	1.97605	.74688	-.1133	3.5418	.00	5.00
	Total	20	1.6000	2.77963	.62154	.2991	2.9009	.00	10.00
Connecting to the Task Setting (CT)	Using Contents	7	3.2857	2.13809	.80812	1.3083	5.2631	.00	6.00
	Creating Contents	6	1.3333	2.80476	1.14504	-1.6101	4.2767	.00	7.00
	Embedded links	7	2.4286	2.69921	1.02020	-.0678	4.9249	.00	6.00
	Total	20	2.4000	2.54227	.56847	1.2102	3.5898	.00	7.00
Connecting Experiences (CE)	Using Contents	7	7.4286	3.69040	1.39484	4.0155	10.8416	3.00	14.00
	Creating Contents	6	5.5000	6.28490	2.56580	-1.0956	12.0956	.00	14.00
	Embedded links	7	11.1429	9.63377	3.64122	2.2331	20.0526	.00	28.00
	Total	20	8.1500	7.05076	1.57660	4.8501	11.4499	.00	28.00
Critiquing Text Content (CTC)	Using Contents	7	.4286	.78680	.29738	-.2991	1.1562	.00	2.00
	Creating Contents	6	1.1667	1.47196	.60093	-.3781	2.7114	.00	3.00
	Embedded links	7	2.7143	4.71573	1.78238	-1.6470	7.0756	.00	11.00
	Total	20	1.4500	2.96426	.66283	.0627	2.8373	.00	11.00
Monitoring Understanding (MU)	Using Contents	7	2.0000	1.73205	.65465	.3981	3.6019	1.00	5.00
	Creating Contents	6	.5000	.83666	.34157	-.3780	1.3780	.00	2.00
	Embedded links	7	5.1429	6.81734	2.57671	-1.1621	11.4478	.00	20.00
	Total	20	2.6500	4.43995	.99280	.5720	4.7280	.00	20.00
Employing Selected Technique (EST)	Using Contents	7	2.2857	2.13809	.80812	.3083	4.2631	.00	5.00
	Creating Contents	6	1.8333	1.47196	.60093	.2886	3.3781	.00	4.00
	Embedded links	7	3.2857	4.07080	1.53862	-.4791	7.0506	.00	11.00
	Total	20	2.5000	2.76253	.61772	1.2071	3.7929	.00	11.00
Restating Understanding (RU)	Using Contents	7	4.5714	3.82349	1.44514	1.0353	8.1076	.00	10.00
	Creating Contents	6	3.6667	3.44480	1.40633	.0516	7.2818	1.00	10.00
	Embedded links	7	11.4286	11.73111	4.43394	.5791	22.2780	.00	33.00
	Total	20	6.7000	8.00066	1.78900	2.9556	10.4444	.00	33.00
Alertness (A)	Using Contents	7	.8571	1.06904	.40406	-.1316	1.8458	.00	3.00

	Creating Contents	6	.3333	.81650	.33333	-.5235	1.1902	.00	2.00
	Embedded links	7	2.7143	2.75162	1.04002	.1695	5.2591	.00	7.00
	Total	20	1.3500	2.00722	.44883	.4106	2.2894	.00	7.00
Selecting Technique (ST)	Using Contents	7	5.7143	2.28869	.86504	3.5976	7.8310	3.00	10.00
	Creating Contents	6	4.5000	2.88097	1.17615	1.4766	7.5234	1.00	9.00
	Embedded links	7	7.2857	6.62607	2.50442	1.1576	13.4138	1.00	19.00
	Total	20	5.9000	4.36373	.97576	3.8577	7.9423	1.00	19.00
Monitoring Navigation (MN)	Using Contents	7	2.2857	1.88982	.71429	.5379	4.0335	.00	5.00
	Creating Contents	6	5.6667	5.20256	2.12394	.2069	11.1264	1.00	15.00
	Embedded links	7	6.4286	10.58076	3.99915	-3.3570	16.2141	.00	30.00
	Total	20	4.7500	6.86620	1.53533	1.5365	7.9635	.00	30.00

Table 1. Descriptive statistics for cognitive engagement.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
TOTAL	Using Contents	7	9.93
	Creating Contents	6	8.08
	Embedded links	7	13.14
	Total	20	
Planning/ Strategy (P)	Using Contents	7	9.43
	Creating Contents	6	9.42
	Embedded links	7	12.50
	Total	20	
Connecting to the Task Setting (CT)	Using Contents	7	12.71
	Creating Contents	6	7.83
	Embedded links	7	10.57
	Total	20	
Connecting Experiences (CE)	Using Contents	7	10.86
	Creating Contents	6	7.83
	Embedded links	7	12.43
	Total	20	
Critiquing Text Content (CTC)	Using Contents	7	9.36
	Creating Contents	6	11.75
	Embedded links	7	10.57
	Total	20	
Monitoring Understanding (MU)	Using Contents	7	11.00
	Creating Contents	6	5.67
	Embedded links	7	14.14
	Total	20	
Employing Selected Technique (EST)	Using Contents	7	10.64
	Creating Contents	6	9.83
	Embedded links	7	10.93
	Total	20	
Restating Understanding (RU)	Using Contents	7	9.64
	Creating Contents	6	8.33
	Embedded links	7	13.21
	Total	20	
Alertness (A)	Using Contents	7	10.07
	Creating Contents	6	7.17

	Embedded links	7	13.79
	Total	20	
Selecting Technique (ST)	Using Contents	7	11.64
	Creating Contents	6	8.92
	Embedded links	7	10.71
	Total	20	
Monitoring Navigation (MN)	Using Contents	7	8.50
	Creating Contents	6	12.67
	Embedded links	7	10.64
	Total	20	

Table 2. Total number of data points and mean rank for each condition for aspects of cognitive engagement.

Test Statistics(a,b)

	TOTAL	P	CT	CE	CTC	MU	EST	RU	A	ST	MN
Chi-Square	2.467	1.488	2.368	1.996	.731	7.059	.122	2.447	4.738	.707	1.645
df	2	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.291	.475	.306	.369	.694	.029	.941	.294	.094	.702	.439

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for cognitive engagement.

Appendix 5.22. SPSS output for analyses of ownership in experiment 2 part C.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Contents	7	4.0440	.50997	.19275	3.5723	4.5156	3.23	4.62
Creating Contents	6	4.0256	.29055	.11862	3.7207	4.3306	3.69	4.54
Embedded Links	7	3.7802	.42697	.16138	3.3853	4.1751	3.23	4.23
Total	20	3.9462	.42140	.09423	3.7489	4.1434	3.23	4.62□

Table 1. Descriptive statistics for total ownership.

	IV	N	Mean Rank
TOTAL OWNERSHIP	Using Contents	7	12.36
	Creating Contents	6	10.75
	Embedded Links	7	8.43
	Total	20	

Table 2. Total number of data points and mean rank for each condition for total ownership.

Test Statistics(a,b)

	TOTALOWN
Chi-Square	1.595
df	2
Asymp. Sig.	.451

a Kruskal Wallis Test
b Grouping Variable: IVTOTAL

Table 3. Chi-squared (or H) value for each condition and significance for total ownership.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Contents	35	4.1143	.99325	.16789	3.7731	4.4555	2.00	5.00
Creating Contents	30	4.0000	.87099	.15902	3.6748	4.3252	1.00	5.00
Embedded Links	35	3.5429	.98048	.16573	3.2060	3.8797	2.00	5.00
Total	100	3.8800	.97732	.09773	3.6861	4.0739	1.00	5.00

Table 4. Descriptive statistics for the control factor.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
CONTROL	1.00	35	57.77
	2.00	30	53.53
	3.00	35	40.63
	Total	100	

Table 5. Total number of data points and mean rank for each condition for the control factor.

Test Statistics(a,b)

	CONTROL
Chi-Square	7.279
df	2
Asymp. Sig.	.026

a Kruskal Wallis Test
b Grouping Variable: IV

Table 6. Chi-squared (or H) value for each condition and significance for the control factor.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Contents	35	3.8571	.91210	.15417	3.5438	4.1705	2.00	5.00
Creating Contents	30	4.0000	.64327	.11744	3.7598	4.2402	3.00	5.00
Embedded Links	35	3.9714	.92309	.15603	3.6543	4.2885	2.00	5.00
Total	100	3.9400	.83871	.08387	3.7736	4.1064	2.00	5.00

Table 7. Descriptive statistics for the responsibility factor.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
RESPONSIBILITY	Using Contents	35	48.01
	Creating Contents	30	51.70
	Embedded Links	35	51.96
	Total	100	

Table 8. Total number of data points and mean rank for each condition for the responsibility factor.

Test Statistics(a,b)

	RESPONSIBILITY
Chi-Square	.447
df	2
Asymp. Sig.	.800

a Kruskal Wallis Test
b Grouping Variable: IV

Table 9. Chi-squared (or H) value for each condition and significance for the responsibility factor.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Contents	21	4.2381	.94365	.20592	3.8086	4.6676	2.00	5.00
Creating Contents	18	4.1111	.90025	.21219	3.6634	4.5588	2.00	5.00
Embedded Links	21	3.8571	1.27615	.27848	3.2762	4.4380	1.00	5.00
Total	60	4.0667	1.05552	.13627	3.7940	4.3393	1.00	5.00

Table 10. Descriptive statistics for the value factor.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
VALUE	Using Contents	21	33.02
	Creating Contents	18	29.94
	Embedded Links	21	28.45
	Total	60	

Table 11. Chi-squared (or H) value for each condition and significance for the value factor.

Test Statistics(a,b)

	VALUE
Chi-Square	.848
df	2
Asymp. Sig.	.654

a Kruskal Wallis Test
b Grouping Variable: IV

Table 12. Chi-squared (or H) value for each condition and significance for the value factor.

Appendix 5.23. SPSS output for analyses of the transfer task in experiment 2 part C.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Total Written Transfer Task	Using Contents	7	51.4286	15.96955	6.03592	36.6592	66.1979	30.00	73.33
	Creating Contents	5	41.3333	25.66883	11.47945	9.4613	73.2054	23.33	86.67
	Embedded links	7	28.5714	9.39999	3.55286	19.8779	37.2650	10.00	40.00
	Total	19	40.3509	19.04818	4.36995	31.1700	49.5318	10.00	86.67
A	Using Contents	7	42.8571	17.99471	6.80136	26.2148	59.4995	20.00	60.00
	Creating Contents	5	40.0000	31.62278	14.14214	.7351	79.2649	.00	80.00
	Embedded links	7	42.8571	24.29972	9.18443	20.3837	65.3306	.00	60.00
	Total	19	42.1053	22.99250	5.27484	31.0232	53.1873	.00	80.00
B	Using Contents	7	68.5714	15.73592	5.94762	54.0181	83.1247	60.00	100.00
	Creating Contents	5	60.0000	31.62278	14.14214	20.7351	99.2649	20.00	100.00
	Embedded links	7	45.7143	9.75900	3.68856	36.6887	54.7399	40.00	60.00
	Total	19	57.8947	20.97060	4.81099	47.7872	68.0022	20.00	100.00
C	Using Contents	7	51.4286	50.14265	18.95214	5.0544	97.8028	.00	100.00
	Creating Contents	5	24.0000	32.86335	14.69694	-16.8052	64.8052	.00	60.00
	Embedded links	7	28.5714	48.79500	18.44278	-16.5564	73.6993	.00	100.00
	Total	19	35.7895	45.00812	10.32557	14.0963	57.4827	.00	100.00
D	Using Contents	7	48.5714	34.36499	12.98874	16.7891	80.3537	.00	100.00
	Creating Contents	5	48.0000	30.33150	13.56466	10.3385	85.6615	20.00	100.00
	Embedded links	7	34.2857	22.25395	8.41120	13.7042	54.8672	.00	60.00
	Total	19	43.1579	28.49028	6.53612	29.4260	56.8898	.00	100.00
E	Using Contents	7	37.1429	17.99471	6.80136	20.5005	53.7852	20.00	60.00
	Creating Contents	5	32.0000	41.47288	18.54724	-19.4954	83.4954	.00	100.00
	Embedded links	7	8.5714	10.69045	4.04061	-1.3156	18.4584	.00	20.00
	Total	19	25.2632	26.53476	6.08749	12.4738	38.0525	.00	100.00
F	Using Contents	7	60.0000	16.32993	6.17213	44.8973	75.1027	40.00	80.00
	Creating Contents	5	44.0000	21.90890	9.79796	16.7965	71.2035	20.00	80.00
	Embedded links	7	11.4286	15.73592	5.94762	-3.1247	25.9819	.00	40.00
	Total	19	37.8947	27.40214	6.28648	24.6873	51.1021	.00	80.00

Table 1. Descriptive statistics for the aspects of the written transfer task.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Total Written Transfer Task	Using Contents	7	13.93
	Creating Contents	5	9.20
	Embedded links	7	6.64
	Total	19	
A	Using Contents	7	9.93
	Creating Contents	5	9.60

	Embedded links	7	10.36
	Total	19	
B	Using Contents	7	13.21
	Creating Contents	5	10.40
	Embedded links	7	6.50
	Total	19	
C	Using Contents	7	11.71
	Creating Contents	5	8.80
	Embedded links	7	9.14
	Total	19	
D	Using Contents	7	10.93
	Creating Contents	5	10.60
	Embedded links	7	8.64
	Total	19	
E	Using Contents	7	13.57
	Creating Contents	5	10.20
	Embedded links	7	6.29
	Total	19	
F	Using Contents	7	14.57
	Creating Contents	5	11.10
	Embedded links	7	4.64
	Total	19	

Table 2. Total number of data points and mean rank for each condition for aspects of the written transfer task.

Test Statistics(a,b)

	Total Written Transfer Task	A	B	C	D	E	F
Chi-Square	6.090	.060	5.613	1.322	.699	6.416	11.742
df	2	2	2	2	2	2	2
Asymp. Sig.	.048	.970	.060	.516	.705	.040	.003

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for the written transfer task.

Appendix 5.24. SPSS output for analyses of the concept mapping task in experiment 2 part C.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Contents	7	33.8571	4.67007	1.76512	29.5381	38.1762	28.00	41.00
Creating Contents	6	33.5000	8.01873	3.27363	25.0849	41.9151	22.00	42.00
Embedded links	7	21.4286	10.56499	3.99319	11.6576	31.1996	5.00	38.00
Total	20	29.4000	9.75165	2.18054	24.8361	33.9639	5.00	42.00

Table 1. Descriptive statistics for the quantitative concept map marks.

Levene Statistic	df1	df2	Sig.
1.425	2	17	.268

Table 2. Levene test for homogeneity of variances for the quantitative concept map marks.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	684.729	2	342.364	5.187	.017
Within Groups	1122.071	17	66.004		
Total	1806.800	19			

Table 3. Parametric Analysis of Variance for the quantitative concept map marks.

(I) IV	(J) IV	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Using Contents	Creating Contents	.3571	4.51994	.997	-11.2381	11.9524
	Embedded links	12.4286(*)	4.34262	.028	1.2882	23.5689
Creating Contents	Using Contents	-.3571	4.51994	.997	-11.9524	11.2381
	Embedded links	12.0714(*)	4.51994	.041	.4762	23.6667
Embedded links	Using Contents	-12.4286(*)	4.34262	.028	-23.5689	-1.2882
	Creating Contents	-12.0714(*)	4.51994	.041	-23.6667	-.4762

* The mean difference is significant at the .05 level.

Table 4. Post-hoc Tukey HSD tests.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Contents	7	56.7857	13.12713	4.96159	44.6451	68.9263	45.00	80.00
Creating Contents	6	43.3333	7.01189	2.86259	35.9748	50.6919	35.00	52.50
Embedded Links	7	39.6429	14.46465	5.46713	26.2653	53.0204	25.00	67.50
Total	20	46.7500	13.88629	3.10507	40.2510	53.2490	25.00	80.00

Table 5. Descriptive statistics for the qualitative concept map marks.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Qualitative Concept Map Marks	Using Contents	7	15.29
	Creating Contents	6	9.25
	Embedded links	7	6.79
	Total	20	

Table 6. Total number of data points and mean rank for each condition for qualitative concept map marks.

Test Statistics(a,b)

	Total Qualitative Concept Map Marks
Chi-Square	7.671
df	2
Asymp. Sig.	.022

a Kruskal Wallis Test
b Grouping Variable: IV

Table 7. Chi-squared (or H) value for each condition and significance for qualitative concept map marks.

Appendix 5.25. SPSS output for analyses of navigation behaviour (no. of pages visited and no. of different pages visited) in experiment 2 part C.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Contents	7	63.4286	20.37038	7.69928	44.5891	82.2680	29.00	84.00
Creating Contents	6	144.3333	94.57202	38.60886	45.0861	243.5806	46.00	299.00
Embedded links	7	117.4286	67.59156	25.54721	54.9168	179.9403	35.00	239.00
Total	20	106.6000	71.46247	15.97949	73.1545	140.0455	29.00	299.00

Table 1. Descriptive statistics for the number of operations.

Levene Statistic	df1	df2	Sig.
4.126	2	17	.035

Table 2. Levene test for homogeneity of variances for the number of operations.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
No. of Operations	Using Contents	7	6.43
	Creating Contents	6	13.17
	Embedded links	7	12.29
	Total	20	

Table 3. Total number of data points and mean rank for each condition for the number of operations.

Test Statistics(a,b)

	No. of Operations
Chi-Square	5.176
df	2
Asymp. Sig.	.075

a Kruskal Wallis Test
b Grouping Variable: IV

Table 4. Chi-squared (or H) value for each condition and significance for the number of operations.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Contents	7	21.7143	1.49603	.56544	20.3307	23.0979	19.00	23.00
Creating Contents	6	22.6667	.51640	.21082	22.1247	23.2086	22.00	23.00
Embedded links	7	20.4286	2.37045	.89595	18.2363	22.6209	17.00	23.00
Total	20	21.5500	1.84890	.41343	20.6847	22.4153	17.00	23.00

Table 5. Descriptive statistics for the number of different pages visited.

Levene Statistic	df1	df2	Sig.
5.099	2	17	.018

Table 6. Levene test for homogeneity of variances for the number of different pages visited.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
No of Different Pages Visited	Using Contents	7	10.50
	Creating Contents	6	13.83
	Embedded links	7	7.64
	Total	20	

Table 7. Total number of data points and mean rank for each condition for the number of different pages visited.

Test Statistics[a,b]

	No. of Different Pages Visited
Chi-Square	3.927
df	2
Asymp. Sig.	.140

a Kruskal Wallis Test
b Grouping Variable: IV

Table 8. Chi-squared (or H) value for each condition and significance for the number of different pages visited.

Appendix 5.26. SPSS output for analyses of navigation behaviour (back, link and contents list usage) in experiment 2 part C.

	IV	N	Mean	Std. Deviation	Std. Error Mean
LINKS	Using Contents	7	58.1131	11.48634	4.34143
	Creating Contents	6	39.0544	5.54210	2.26255
BACK	Using Contents	7	24.7177	17.67438	6.68029
	Creating Contents	6	29.9295	9.01278	3.67945
CONTENTS LIST	Using Contents	7	17.1693	7.93357	2.99861
	Creating Contents	6	31.0161	12.17121	4.96888

Table 1. Descriptive statistics for back button, link and contents list usage.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Links	Equal variances assumed	3.416	.092	3.696	11	.004	19.0587	5.15716	7.70784	30.40950
	Equal variances not assumed			3.893	8.913	.004	19.0587	4.89563	7.96747	30.14988
Back	Equal variances assumed	3.000	.111	-.651	11	.529	-5.2118	8.01053	-22.84285	12.41926
	Equal variances not assumed			-.683	9.179	.511	-5.2118	7.62657	-22.41317	11.98957
Contents List	Equal variances assumed	.146	.709	-2.468	11	.031	-13.8469	5.60968	-26.19369	-1.50006
	Equal variances not assumed			-2.386	8.379	.043	-13.8469	5.80356	-27.12530	-.56845

Table 2. Independent samples t-tests for back button, link and contents list usage.

Appendix 5.27. SPSS output for analyses of the usability problems in experiment 2 part C.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Problem Instances	Using Contents	7	7.1429	5.01427	1.89521	2.5054	11.7803	1.00	15.00
	Creating Contents	6	10.6667	5.46504	2.23109	4.9315	16.4019	5.00	19.00
	Embedded links	7	10.2857	6.87300	2.59775	3.9293	16.6422	3.00	20.00
	Total	20	9.3000	5.77745	1.29188	6.5961	12.0039	1.00	20.00
Unique Problems	Using Contents	7	6.7143	4.99047	1.88622	2.0989	11.3297	1.00	14.00
	Creating Contents	6	9.8333	4.35507	1.77795	5.2630	14.4037	5.00	15.00
	Embedded links	7	9.1429	5.58058	2.10926	3.9817	14.3040	3.00	18.00
	Total	20	8.5000	4.95772	1.10858	6.1797	10.8203	1.00	18.00
Total Problem Severity	Using Contents	7	13.2857	9.12349	3.44836	4.8479	21.7235	2.00	26.00
	Creating Contents	6	21.1667	11.60029	4.73580	8.9929	33.3404	10.00	36.00
	Embedded links	7	20.4286	15.78878	5.96760	5.8264	35.0308	5.00	52.00
	Total	20	18.1500	12.40660	2.77420	12.3435	23.9565	2.00	52.00

Table 1. Descriptive statistics for usability problems.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Problem Instances	Using Contents	7	8.43
	Creating Contents	6	12.08
	Embedded links	7	11.21
	Total	20	
Unique Problems	Using Contents	7	8.07
	Creating Contents	6	12.67
	Embedded links	7	11.07
	Total	20	
Total Problem Severity	Using Contents	7	8.43
	Creating Contents	6	12.33
	Embedded links	7	11.00
	Total	20	

Table 2, Total number of data points and mean rank for each condition for usability problems.

Test Statistics(a,b)

	Problem Instances	Unique Problems	Total Problem Severity
Chi-Square	1.400	2.064	1.491
df	2	2	2
Asymp. Sig.	.496	.356	.474

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for usability problems.

Appendix 5.28. The full set of "unique" usability problems that fell into each category for each condition in experiment 2 part C.

USING A-Z INDEX CONDITION

General Confusion Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
34	The user comments that they are confused (either they are trying to remember the different "lists", i.e. methods, or they can't remember where they were).	2.2/1.2	ER intro	2	69

Text Content Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
12	The user says that the text doesn't say whether CW is time consuming or labour intensive. [It says this on this page].	1.8	CW dis	2	59
29	The user comments that the HE page is unclear because it doesn't say what 'heuristics' means.	2.1	HE intro	2	67
30	The user suggests that it would be better to have the ten heuristics before in the text (i.e. on the HE intro page), rather than after (i.e. on a separate page) so they would know what heuristics are.	2.4/1.10	Nielsen's Heuristics	2	67

Text Presentation Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
21	The user comments that the italic text explaining that the electronic text only presents formative evaluations is not very noticeable.	1.6	Types of UE	2	65
22	The user comments that 'formative' and 'summative' in italics do not stand out and are not very noticeable.	1.1/1.6	Types of UE	2	65

Using Aggregate Navigation Aids Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
1	The user comments that they are surprised that the pages that the embedded links link to are represented on the contents list too.	1.3	UE intro	2	59
15	The user comments that the screen is too small (appears to be referring to the text size on the contents list, rather than the screen size. This seems to have caused them to get lost in problem 14).	1.6	ER intro	2	61
20	The user is fustrated at the dotted boxes that appear around the page title/bullets on the contents list. [Because the pages are so close together on the contents list the highlighting box that appears around the last page you clicked on overlaps page titles above and below it on the list].	1.1	Types of UE	2	65

23	The user is confused as to why some of the page titles on the contents list appear to be in red.	1.2	HE dis	2	65
24	The user comments that someone with poor eyesight wouldn't be able to read the contents list.	1.6	UE intro	2	67

Navigation Predicting

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
31	The user is unsure where the 'method' embedded link will take them. [it links to OE method].	1.2	OE intro	2	69
42	The user expects that the 'usability problems' embedded link will take them to examples of UPs. [It does not. It takes them to a definition of UPs].	1.2	UE intro	2	71

Navigation Disorientation

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
4	The user makes a point of reading through the text first before going to the embedded links so they will know where they are. [Implies caution about getting lost].	1.1	UE intro	2	59
14	The user is lost. [seems to be because they clicked back too far and forgot where they were].	1.2	ER intro	3	61
16	The user suggests that there should be a link from HE advantages to HE disadvantages (to prevent them getting lost).	1.10	HE advs	2	61
17	The user comments that when you click through several pages you can forget where you are (when looking for a page).	1.2	HE dis	2	61

Navigation Efficiency

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
2	The user is unsure whether to use the contents list or the embedded links to navigate.	1.2	UE intro	2	59
5	The user comments they have already been to this page.	1.8	Usability, Nielsen's Heuristics	2	59, 69
6	The user is unsure where information on formative evaluation is. (Has to go back to see where it is, rather than being able go straight to it on the contents list).	1.7	HE meth	2	59
10	The user went to the wrong page.	1.7, 1.8	HE dis, HE advs	2	59, 69
25	The user comments that the highlighted embedded links make you want to follow them, but this takes time (i.e. is too slow/inefficient).	1.7	OE intro	2	67

26	The user comments that there are too many embedded links (especially when there are embedded links nested within embedded links, and this is inefficient).	1.7, 1.1	OE intro, HE intro	2	67, 69
27	The user is unsure where to go next to find a page they haven't already seen.	1.2	Role of UE	2	67
28	The user comments that if you follow the embedded links from UE intro you have already been to half the pages on the contents list.	1.1	HE intro	2	67
33	The user comments that there is a lot of information.	1.1/2.1	CW intro	2	69
35	The user suggests that there should a forward button.	1.10	UE intro	2	69
36	The user is surprised that they have already read this page.	1.8/1.3	Types of UE	2	69
38	The user is unsure if there is anything else that they haven't already seen/read.	1.2	UE intro	2	69
43	The user says "oops" when they clicked back from CW dis to HE analysis. (They seem to have clicked back too far).	1.8	HE analysis	2	71
44	The user says "oops" when they clicked back to map home page. [They then need some help adjusting the window dividers to re-enter the electronic text].	1.8	Map home	3	71

Understanding Text Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
3	The user is unscertain what formative and summative mean (hasn't read types of UE yet).	2.2	UE intro	2	59
7	The user thinks that creating a prototype is creating a whole system that would be similar to the ideal system.	2.2	HE meth	2	59
8	The user thinks that summative evaluation is similar to heuristic evaluation.	2.2	HE meth	2	59
9	The user thinks that through iteration (formative evaluation) a "perfect" solution would be reached.	2.2	HE analysis	2	59
11	The user is unsure what type of problems identified by HE are not real problems.	2.2	HE dis	2	59
13	The user thinks that UPs refers to problems with usability, rather than usability problems.	2.2	UPs	2	59
18	The user is confused because in the advantages it says that CW is cheap to perform and the disadvantages say it's costly. [Has failed to notice that it says that CW is costly compared to HE].	2.2	CW dis	2	61
19	The user is unsure of how the HE method can be used alongside OE.	2.2	HE meth	2	63
32	The user is unsure what ERs are. [Hasn't visited that page yet].	1.2/2.2	UE intro	2	69
37	The user is unsure of their understanding of ERs.	2.2	UE intro	2	69

39	The users comments suggest they have forgotten something on this page (exactly what is unclear).	2.2	OE meth	2	69
40	The user is unsure of whether to use formative or summative with OE for the task. (Implies they haven't noticed that all of the electronic text is on formative and that formative would be more appropriate for the task).	2.2	UE intro	2	69
41	The user thinks that they could use OE and summative evaluations to prevent errors.	2.3	UE intro	3	69

CREATING CONTENTS LIST CONDITION

Hardware Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
17	The user comments that they pressed the wrong button on the mouse. [A right click menu pops up].	1.3	OE data	2	64

Text Content Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
25	The user comments that the text keeps 'repeating' (referring) back to previously visited pages.	2.1	OE data	2	66
27	The user comments that every word in the text is explained. When asked if this is helpful they said "yeah, but...".	1.1	ER intro	2	66

Text Presentation Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
45	The user suggests that more colour (in the interface) would be good.	1.10	OE intro	2	72
46	The user comments that because every page is the same it is hard to concentrate.	1.1	OE intro	2	72

Creating Aggregate Navigation Aid

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
1	The user comments that they are putting the bullet points on the contents list separately so that they can read through them. (Implies that the positioning of bullet points as they appear is difficult to read).	1.1	ER intro	2	62
2	The user comments that creating a contents list is annoying.	1.1	Types of UE, UE intro	2	62,72
3	The user clicked on Role of UE and two concept boxes appeared. The user says this was because they were pressed the shift button to try and select multiple pages. (Didn't really say much about this).	1.2	Role of UE	2	62
4	The user comments that it's a pain that you have to drag each page one at a time and that you can't select multiple pages and drag them together.	1.1	Role of UE	2	62
5	The use complains that if you use the multi-selector tool [mulitple pages can be selected by dragging a box around the required pages to select them] you have to group together all the pages you want to select first.	1.1	Role of UE	2	62

6	The user comments that some page titles on the contents list are different colours to others.	1.2	CW intro	2	62
7	The user comments that when you visit a page the text in the contents list changes from brown back to black, but some pages stay black. They are confused why some pages are brown. They comment that when they visit the page again and go to another page the colour will return to black.	1.2	CW intro	2	62
8	The user suggests that there should be an 'undo' button.	1.10	HE advs	2	62
9	The user has been trying to move a group of pages using the multi-selector, but it didn't select all pages [it missed the top and the middle pages from the selection].	1.7	HE intro	3	62
10	The user suggests that the bag and bin should scroll down as the contents list gets bigger in the Nestor window.	1.10	HE intro	2	62
11	The user comments that the mouse scroller works in the text window, but not in the Nestor window.	1.1	Nielsen's Heuristics	2	62
12	The user is confused because two pages have got stuck behind the bag and bin and appeared there without any obvious action from the user (may have been because they were scrolling up and down the page).	1.1	Nielsen's Heuristics	3	62
24	The user is unsure whether they should put every page in the text into the contents list.	1.2	HE intro	2	66
36	The user wants to delete the references page bullet from the contents list, but is unsure how to do it. [Instructed to put it to one side by the experimenter].	1.1/1.2	HE advs	2	68
42	The user comments that there isn't enough space in the Nestor window for all of the pages on the contents list.	1.1	CW dis	2	70
48	The user comments that if there was another way of putting the pages into order in the contents list it might be improved.	1.1	UE intro	2	72
49	The user suggests that navigation that showed (a list) of where they had been, i.e. first here, second there, would be better.	1.10	OE intro	2	72

Navigation Predicting Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
16	The user notices that 'formative' and 'summative' embedded links link to the same page.	1.2	UE intro	1	64
20	The user notices that all reference embedded links link to the same page.	1.2	Refs	1	64
35	The user is unsure whether the 'data' embedded link in OE intro is the same as the 'analysed' embedded link in OE method. [They both link to OE data].	1.2	OE intro	2	68

Navigation Disorientation Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
47	The user comments that they feel lost when they have clicked on several embedded links and have been through several pages and they don't know where they started from.	1.2	ER intro	2	72

Navigation Efficiency Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
18	The user comments that they have to scroll down.	1.3	Nielsen's Heuristics	2	64
19	The user comments that they changed their mind about going back to UE intro ("main bit") using the contents list and goes to HE instead. (Implies they are unsure where to go).	1.2	UE intro	2	64
21	The user cannot find the page they want. (target unclear).	1.2	Nielsen's Heuristics	2	64
22	The user comments that they have gone to the wrong page.	1.8	OE data	2	64
23	The user is unsure whether they can find the first page they looked at (looking for Usability or UE intro).	1.7	CW intro	2	64
26	The user comments that there are different ways (embedded links and contents list) to go to the same page.	1.1	UPs, UE intro	2	66
28	The user comments that because every word is explained by embedded links when you keep going to the same page and have to click (back) again to the page that you wanted.	1.7	HE intro	2	66
29	The user suggests that each page should be numbered.	1.10	ER intro	2	66
30	The user suggests that instead of having a embedded link to UPs, the text should explain what UPs are in CW analysis, because if you click the embedded link you might forget what the last page you were in was.	1.10/2.4	CW analysis	2	66
31	The user comments that sometimes they find it difficult when there are links to click. (This may be because they get confused about where they have been).	1.1	HE analysis	2	66
32	The user comments that even though there are embedded links they find it easier to use the contents list.	1.1	OE meth	2	66
33	The user comments that sometimes they find it easier to use the embedded links and sometimes they find it easier to use the contents list.	1.1/1.2	CW meth	2	66
40	The user is unsure where to go next.	1.2	OE dis	2	70
41	The user is unsure whether they have followed all the embedded links/been to all the pages.	1.2/1.9	OE dis, UE intro	2	70, 72
50	The user is unsure of where they came across CW analysis and is trying to find the method/embedded link that they used to get to that page. [Looks in CW intro and CW dis].	1.2	UE intro, CW intro	72	3
51	The user is unsure about which pages they haven't visited yet.	1.2	CW intro, CW meth	2	72
57	The user is having trouble finding information on quantitative and qualitative evaluation. [Seems to be looking for OE data, but can't remember the name of the page or where it is].	1.7	OE intro	2	72

Understanding Text Category

Unique ID	Problem description and context	Criterion IDs	Location	Severity	Participant Numbers
13	The user thinks that HE reveals "real-world" problems.	2.3	CW dis	3	62
14	The user thinks that HE allows the evaluator to make a model of real world problems.	2.3	CW dis	3	62
15	The user thinks that CW involves real users.	2.3	CW dis	3	62
34	The user is unsure about where OE data fits into the text. [They have to go back and check].	1.2	OE data	2	68
37	The user thinks that CW is only used in formative evaluations.	2.3	CW advs	2	68
38	The user is unsure how formative, summative and OE fit together.	1.2/2.2	Types of UE	2	68
39	The user comments that the texts says that "access to users is difficult" in HE advs. (This implies confusion about the circumstances in which HE is useful).	2.2	HE advs	2	68
43	The user thinks that CW and HE aren't really "actual evaluation methods". They think they are only "while you're still working on design".	2.2	HE intro	2	70
44	The user comments that they find it hard to understand how the desinger can see what the user would see during a walkthrough.	2.2	HE meth	2	70
52	The user is unsure whether OE and HE are evaluation techniques.	1.2/2.2, 1.7	OE intro, HE intro	3	72
53	The user comments that they have read through the text three or four times, but they have forgotten which ones (are the techniques).	1.2/2.2	OE intro	3	72
54	The user is confused that OE includes interviews and questionnaires - they thought that these would be separate.	2.2	OE intro	2	72
55	The user is unsure whether there are other types of evaluation techniques [they have been to OE and types of UE].	2.2	Types of UE	3	72
56	The user is unsure about summative evaluation.	2.2	Types of UE	2	72

For the unique usability problems in the embedded links condition see appendix 4.27.

Appendix 6.1. Experimental script for experiment 3.

Pre-checks

- ❑ Pack contents
  - ❑ Introductory information
  - ❑ Consent form.
  - ❑ Task1- pretest
  - ❑ Task 2- training
  - ❑ Task 3
  - ❑ Task 4- e-text questionnaire (inc usability and cog load questions)
  - ❑ Task 5 – task transfer
  - ❑ Task 6 – concept maps
- ❑ Pencils, rubbers
- ❑ Clear IE history
- ❑ Open training materials from **C** drive.
- ❑ Check materials are from **C**.
- ❑ Only Nestor open
- ❑ Check Nestor browser window is fully maximised

Intro

- ❑ I will be reading from my notes to make sure I remember everything and that I keep everything consistent.
- ❑ Please read through the introductory information.
- ❑ I'm doing a study investigating factors that affect the way that people use electronic texts.
- ❑ We're going to run through six tasks. The entire session should take about 1 ½ hours.
- ❑ All the data collected will be anonymous.
- ❑ Do you have any questions?

Administer consent form.

Pre-test and Demographic Questionnaire

- ☐ Assign participant IDs.

First of all I'd like you to complete a pre-test questionnaire. Don't worry if you don't know the answer to some of the questions- you are not expected to. It is not a test of your abilities, it is just to find out about your background knowledge. If you don't know the answer just write 'N/A'.

Training Task

- ❑ Could you all please open Nestor
- ❑ These are some training materials- they are just to give you a chance to use some electronic texts and to have a go at creating a map of pages in the materials.
- ❑ You have 10 minutes to read through the training sheet and explore the materials.
- ❑ Please follow the instructions on the training sheet as you go along.

- ❑ Your start time is....., you have 10mins, your stop time is.....

After training...

- ☐ Please make sure you can check off all the items on the checklist on the last page.
- ❑ Any questions about using the electronic texts?

Task using the electronic text

- ❑ Please have a quick read through the task information sheet and tell me when you have finished reading.
- ❑ I'm going to come round and open up some more electronic texts for you.
- ❑ Open materials
- ❑ Check they are open from **C**.
- ❑ You will be given some electronic text materials on usability and usability evaluation.
- ❑ This information is very relevant to the module you are taking.
- ❑ I would like you to use the information in these materials to choose a usability evaluation technique or combination of techniques that are appropriate for this setting.
- ❑ You have space to record your decision on the other side of the task sheet.
- ❑ For the creating map and adapting map conditions:
    - ❑ You're also asked to create/adapt the map of the pages in the materials, you can add links, delete links, delete page bullets and rearrange the pages.
- ❑ The main focus of the task is for you to recommend a usability evaluation technique or techniques for the City Music website.
- ❑ Please record your decision on the task sheet in the space provided.
- ❑ Do you have any questions?
- ❑ Now it's Xtime. Your start time is..... And you have 30 minutes so your stop time is..... Go ahead...

Ownership Questionnaire

- ❑ Please click on the save icon (disk) on the Nestor tool bar.
- ❑ Close the materials.
- ❑ Here is a questionnaire to complete. Please respond according to your first reaction to each question. Let me know when you have completed the questionnaire.

Written Transfer Task

- ❑ Please have a quick read through the task information sheet and tell me when you have finished reading.
- ❑ Do you have any questions?
- ❑ This is similar to the previous task. I would like you to choose a UE technique (or combination) for this setting and write about your decision in the spaces provided on the task sheet.
- ❑ Do your best, but remember this is not a test of your personal abilities.

- Now it's Xtime. Your start time is..... And you have **20** minutes so your stop time is..... Go ahead...

Concept-Mapping Task

- Last task. Here's the information sheet, please have a quick read through it.
- I would like you to draw a concept map on usability and usability evaluation techniques from the info you can remember from the materials.
- Do your best but remember it is not a test of your personal abilities.
- Do you have any questions?
- Now it's Xtime. Your start time is.... And you have **5** minutes so your stop time is.... (fill in on sheet). Go ahead...

De-briefing

OK! This is the end of the study. Thanks very much for your participation!!!

The overall aim of the study is to look at the way people use electronic text materials with different navigation aids.

Please don't discuss this study with any of your classmates until after your lecture on usability evaluation.

Appendix 6.2. Task sheets for the training task for conditions in experiment 3.

EXPERIMENT 3 – EMBEDDED LINKS CONDITION

Training materials: The American Museum in Britain

The purpose of these training materials is to give you a chance to use some electronic text materials. The materials contain information about the American Museum in Britain.

You have 10 minutes to read through this training information and explore the materials.

If you have any questions please ask the experimenter.

Start time_____ Stop time_____

How to use the materials

1. Text about the museum is presented in the browser window. You can move between pages by clicking on the embedded links in the text. These appear as blue underlined text (see figure 1). Some pages contain several embedded links, some pages have no embedded links. Once you have already visited a page the embedded links that link to that page will change colour. Please practice accessing pages using the embedded links in the materials.

2. You can access the last page you visited using the 'Back' button on the browser toolbar (see figure 1). Now use the back button to go back to the last page you visited.

3. If the text goes off the bottom of one screen you can scroll down to see the remainder of the text using the scroll bar on the right hand side of the screen (see figure 1). Try this out on the 'Main Collection' page of the electronic text materials.

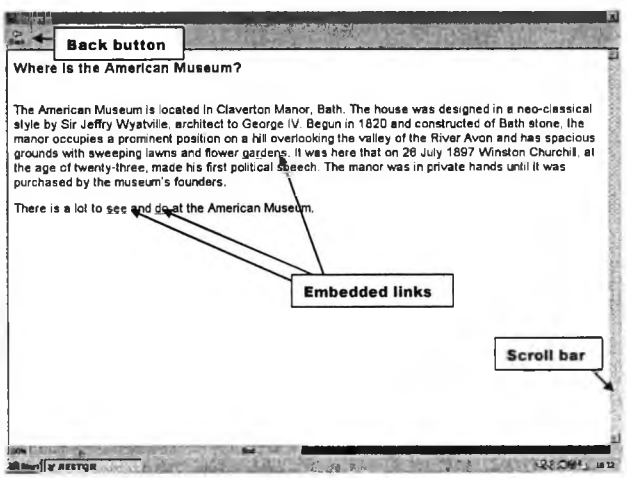


Figure 1- The Nestor Browser window.

NOTE- Please do not press the Back button on the first page of the materials- 'Where is the American Museum'.

If you want to find out more about the American Museum in Britain, when the experiment is over, you can visit their website at http://www.americanmuseum.org/.

Please tick off the list below if you are happy with using each of these facilities:

- ☐ Embedded links.
- ☐ Back button.

EXPERIMENT 3 – USING MAP CONDITION

Training Materials: The American Museum in Britain

Participant ID:_____

The purpose of these training materials is to give you a chance to use some electronic text materials. The materials contain information about the American Museum in Britain.

You have 10 minutes to read through this training information and explore the materials.

If you have any questions please ask the experimenter.

Start time_____ Stop time_____

How to use the materials

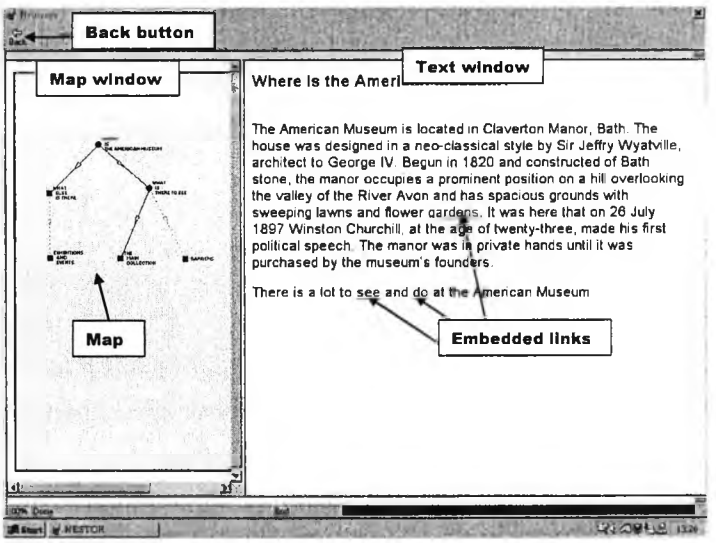


Figure 1. The electronic text materials.

The Text Window

1. Text about the museum is presented in the text window. You can move between pages by clicking on the embedded links in the text. These appear as blue underlined text (see figure 1). Some pages contain several embedded links, some pages have no embedded links. Once you have already visited a page the embedded links that link to that page will change colour. Please practice accessing pages using the embedded links in the materials.

2. You can access the last page you visited using the 'Back' button on the browser toolbar (see figure 1). Now use the back button to go back to the last page you visited.

3. If the text goes off the bottom of the window you can scroll down to see the remainder of the text using the scroll bar on the right hand side of the text window (see figure 2). Try this out on the 'Main Collection' page of the electronic text materials.

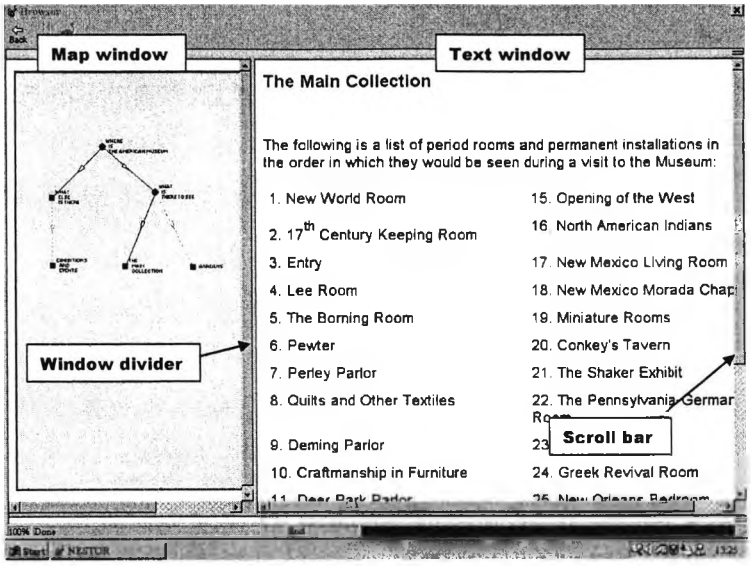


Figure 2. The electronic text materials- the scroll bar and window divider.

The Map Window

1. In the map window, a map of pages in the materials is displayed. Each node of the map is called a *page bullet*. You can visit any of the pages by clicking on the page bullet next to the title of the page that you want to visit. Round bullets represent pages containing embedded links, square bullets represent pages with no embedded links. Lines with arrows on them represent links between pages. Complete lines represent actual embedded link links between pages, whereas dotted lines represent additional conceptual links between pages (see figures 1 and 2). Now practice accessing pages using the map.
2. If you want to see more/less of the text or map, you can move the window divider between the text and the map windows by clicking on the divider and dragging it into a desired position (see figure 2). Please practice this now.

If you want to find out more about the American Museum in Britain, when the experiment is over, you can visit their website at http://www.americanmuseum.org/.

Complete the checklist below if you understand how to use each of these facilities:

- ☐ Embedded links.
- ☐ Back button.
- ☐ Accessing pages using the page bullet on the map (round bullets represent pages with embedded links, square bullets represent pages without embedded links).
- ☐ Moving the window divider.
- ☐ You will not need to the bag and bin.
- ☐ If you press back on the first page you will be taken out of the electronic texts. To return, click on the forward button, then resize the window dividers.

EXPERIMENT 3 – CREATING MAP CONDITION

Training Materials- The American Museum

Participant ID: _____

The purpose of these training materials is to give you a chance to use some electronic text materials. The materials contain information about the American Museum in Britain.

You have 10 minutes to read through this training information and explore the materials.

If you have any questions please ask the experimenter.

Please fill in your start and stop times (the experimenter will tell you these times).

Start time_____ Stop time_____

How to use the materials

The Text Window

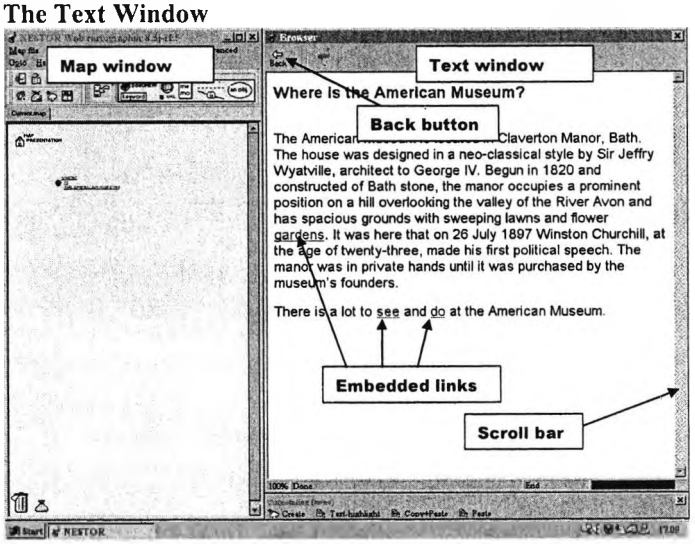


Figure 1. Nestor Navigator- Aspects of the embedded links and browser window.

1. Text about the museum is presented in the text window. You can move between pages by clicking on the embedded links in the text. These appear as blue underlined text (see figure 1). Some pages contain several embedded links, some pages have no embedded links. Once you have already visited a page the embedded links that link to that page will change colour. Please practice accessing pages using the embedded links in the materials.

2. You can access the last page you visited using the 'Back' button on the browser toolbar (see figure 1). Now use the back button to go back to the last page you visited.

3. If the text goes off the bottom of the window you can scroll down to see the remainder of the text using the scroll bar on the right hand side of the text window (see figure 1). Try this out on the 'Main Collection' page of the electronic text materials.

The Map Window

1. As you move through the text a trace of your path through the materials is generated in the map window on the left-hand side of the screen. This shows the titles of the pages you have visited, and

links between them that you have traversed using embedded links (see figure 2). Notice this as you navigate the embedded links in the text.

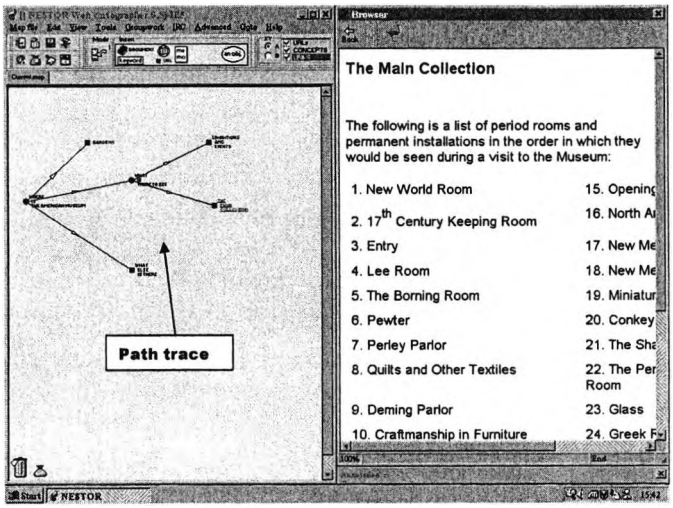


Figure 2. Trace of a path through the electronic text materials.

Representations of a Page. When you open a new page the page title will appear in the Nestor window. There will be a bullet point next to this title (see figure 3). The bullet for the page you are currently displaying will be shown in red. All other bullets are shown in blue. Circular bullets represent pages that contain embedded links, square bullets represent pages with no embedded links.

Representations of Links. Lines with arrows on them represent links between pages. The arrow shows the direction of the link (see figure 3).

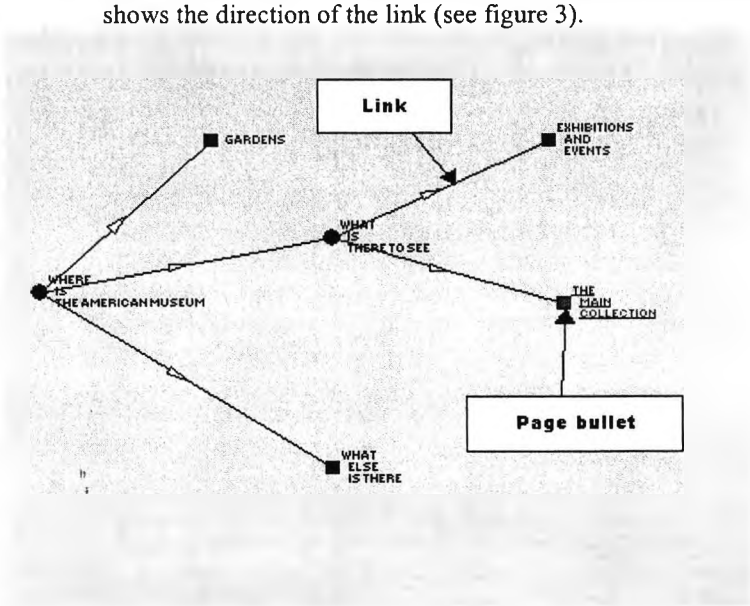


Figure 3. Representations of links and pages in the Nestor window.

2. You can access pages by clicking on the bullet next to the title of the page you want to visit, as well as by using the embedded links and the back button (see section 1). As you explore the materials re-arrange the bullets in the map to create your own map of the materials. Rearrange the shape of the map by clicking and dragging the page bullets into a desired position. You can use this map to access pages in the electronic texts. Practice using the map to access pages.

3. Delete pages from the map by moving the pointer over their corresponding bullet for a page until a red square appears around the bullet. Then click on the right mouse button. From the displayed menu you can then select 'Delete' (see figure 4). Practice this by deleting the 'Gardens' page from the map.

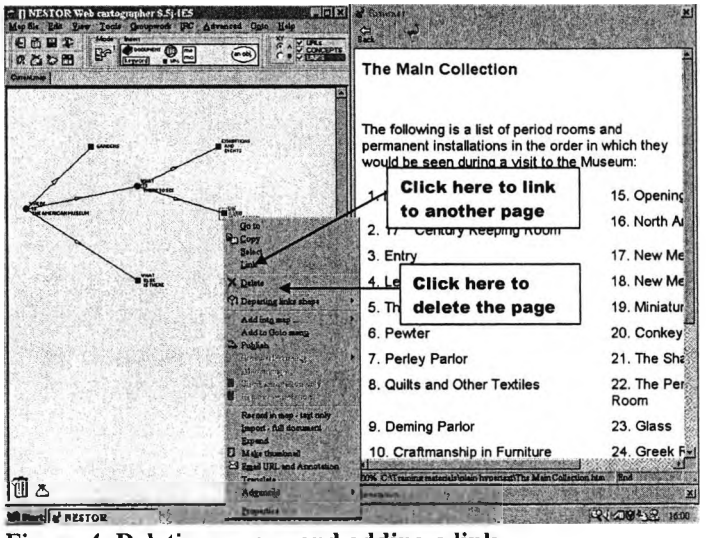


Figure 4. Deleting a page and adding a link.

4. Add a link between 2 pages by moving the mouse pointer over the page bullet, until the red square appears around the bullet. Then click on the right mouse button. From the displayed menu select 'Link' (see figure 4). A dotted line is then shown attached to the page bullet. You can click and drag this line so it links to another page bullet on the map. When you do this a embedded link for the linked page appears in the annotation window (see figure 5). Practice this by linking 'The Main Collection' page to the 'Exhibitions and Events' page.

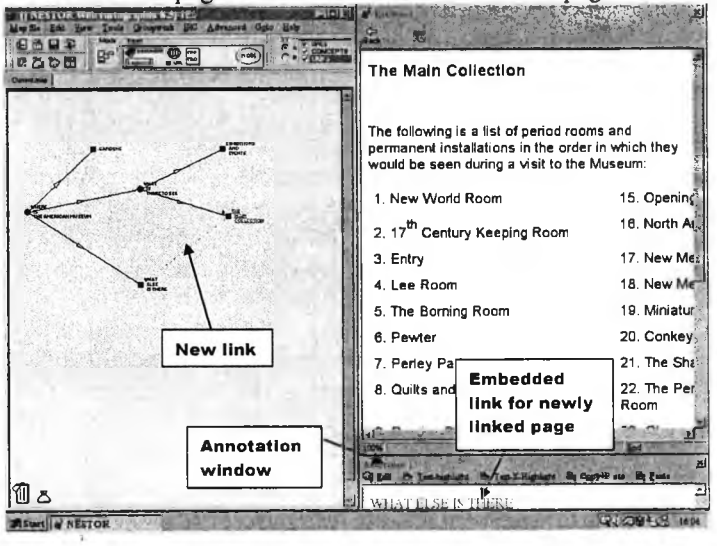


Figure 5. Adding new links.

5. You can also delete links. Click the right mouse button on the link you want to delete. Next select 'Delete' from the displayed menu (see figure 6). Practice this by deleting the link between 'Where is the American Museum?' and 'What is there to see?'.

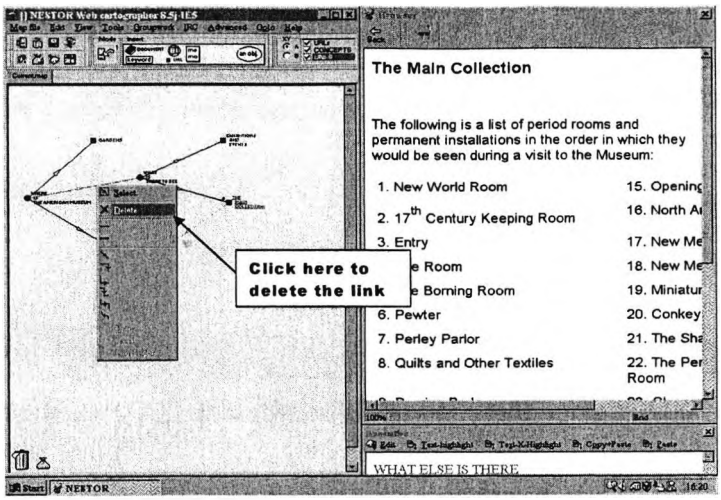


Figure 6. Deleting links.

Figure 7 shows an example of the type of map you might create for the materials on the American Museum in Britain.

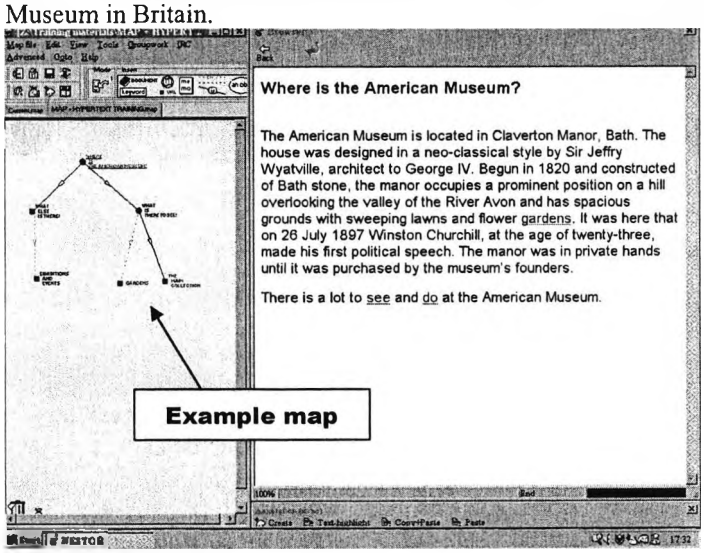


Figure 7. Example map of the materials.

If you want to find out more about the American Museum in Britain, when the experiment is over, you can visit their website at http://www.americanmuseum.org/.

Additional Points to Note

Bin and Bag- these are located in the bottom left-hand corner of the map window (see figure 8). *You will not need to use these during the experiment.*

Pop-up previews- text summaries of a page pop up when you hold the mouse pointer over a page bullet (see figure 8). These previews appear for a few seconds then disappear. Please try to *avoid using these* during the experiment, as the aim of the experiment is to see the way that you use the text in the text window.

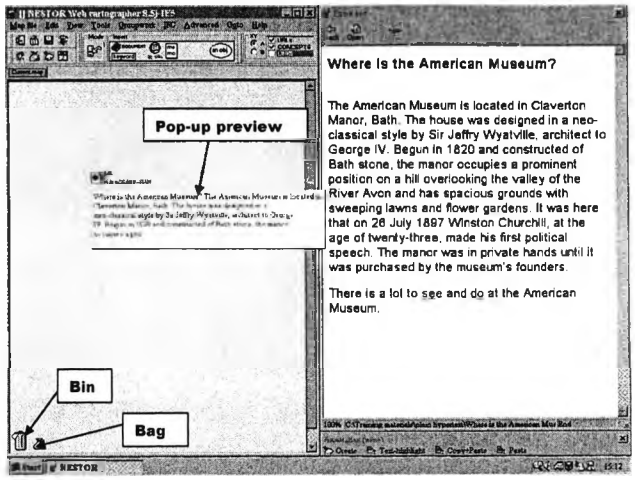


Figure 8. Additional points- the bin, the bag and the pop-up preview.

Complete the checklist below if you are happy with using each of these facilities:

- ☐ Embedded links.
- ☐ Back button.
- ☐ Accessing pages using the page bullet (round bullets indicate pages with embedded links, square bullets indicate pages without embedded links, and red bullets indicate the page you are currently displaying).
- ☐ Rearranging pages in the map.
- ☐ Adding new links to the map.
- ☐ Deleting links/pages from the map.
- ☐ Window divider.
- ☐ You will not need to use the toolbar, pop-up previews or the bag and bin.

Training Materials: The American Museum in Britain

The purpose of these training materials is to give you a chance to use some electronic text materials. The materials contain information about the American Museum in Britain.

You have 10 minutes to read through this training information and explore the materials.

If you have any questions please ask the researcher.

Start time_____ Stop time_____

How to use the materials

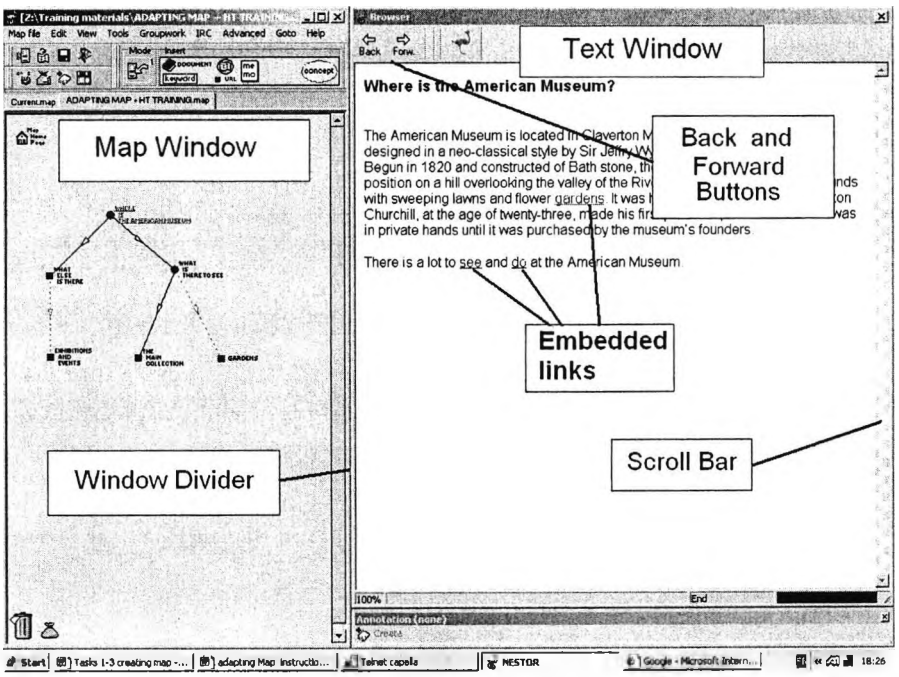


Figure 1. The electronic text materials.

The Text Window

1. Text about the museum is presented in the text window. You can move between pages by clicking on the embedded links in the text. These appear as blue underlined text (see figure 1). Some pages contain several embedded links, some pages have no embedded links. Once you have already visited a page the embedded links that link to that page will change colour. Please practice accessing pages using the embedded links in the materials.

2. You can access the last page you visited using the 'Back' button on the browser toolbar (see figure 1). Now use the back button to go back to the last page you visited.

3. If the text goes off the bottom of the window you can scroll down to see the remainder of the text using the scroll bar on the right hand side of the text window (see figure 1). Try this out on the 'Main Collection' page of the electronic text materials.

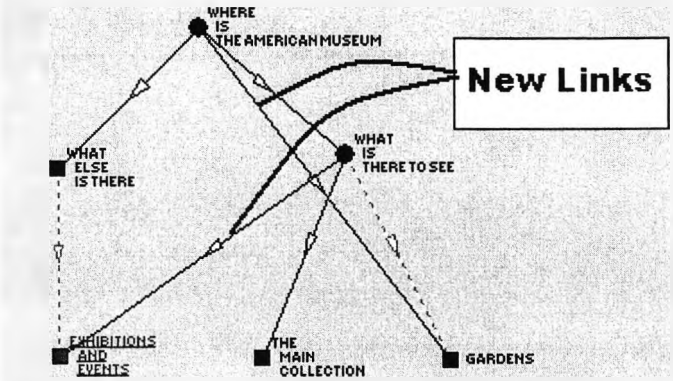


Figure 2. New links on the map.

The Map Window

1. In the map window, a map of pages in the materials is displayed. Each node on the map is called a *page bullet*. You can visit any of the pages by clicking on the page bullet next to the title of the page that you want to visit.

   Round bullets represent pages containing embedded links, square bullets represent pages with no embedded links. Red bullets indicate the page currently displayed.

   Lines with arrows on them represent links between pages. Complete lines represent actual embedded link links between pages, whereas dotted lines represent additional conceptual links between pages (see figure 1).

   Now practice accessing pages using the map.

2. As you navigate using the embedded links, any links that are not already represented on the map will appear (see figure 2). If you have not already done so, notice this when you use the 'special exhibitions' embedded link in the page 'What is there to see?'

3. You can rearrange the shape of the map by clicking and dragging the pages into a position of your choice. Practice this now.

4. You can delete pages from the map by moving the pointer over their corresponding page bullet, until a red square appears around the bullet. If you click on the *right mouse button* a menu will be displayed. Selecting 'Delete' will delete the page bullet from the map (see figure 3). Practice this by deleting the 'Gardens' page from the map.

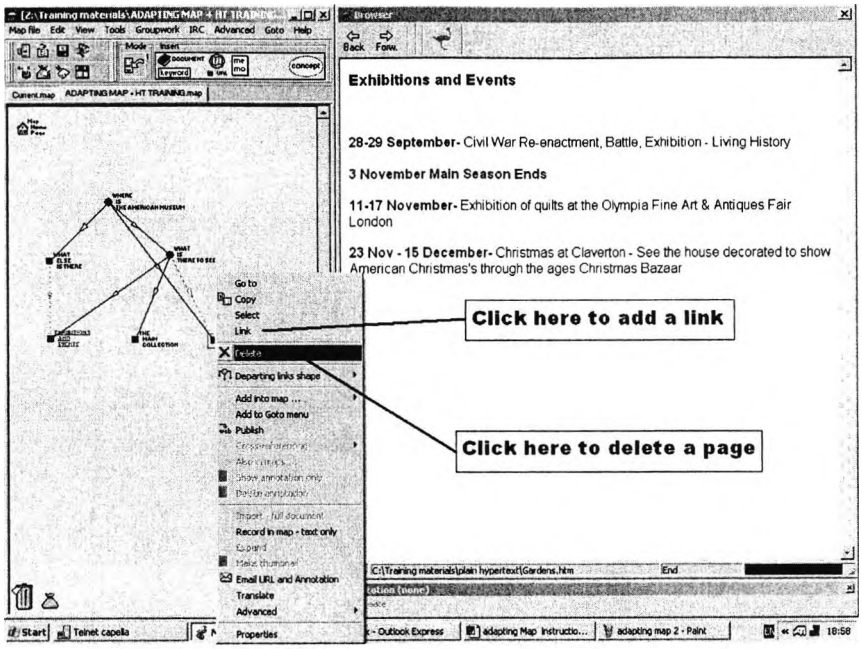


Figure 3. Deleting a page from the map.

5. You can also delete links. Click the *right mouse button* on the link you want to delete. Next select 'Delete' from the displayed menu (see figure 4). Practice this by deleting the link between 'Where is the American Museum?' and 'What is there to see?'.

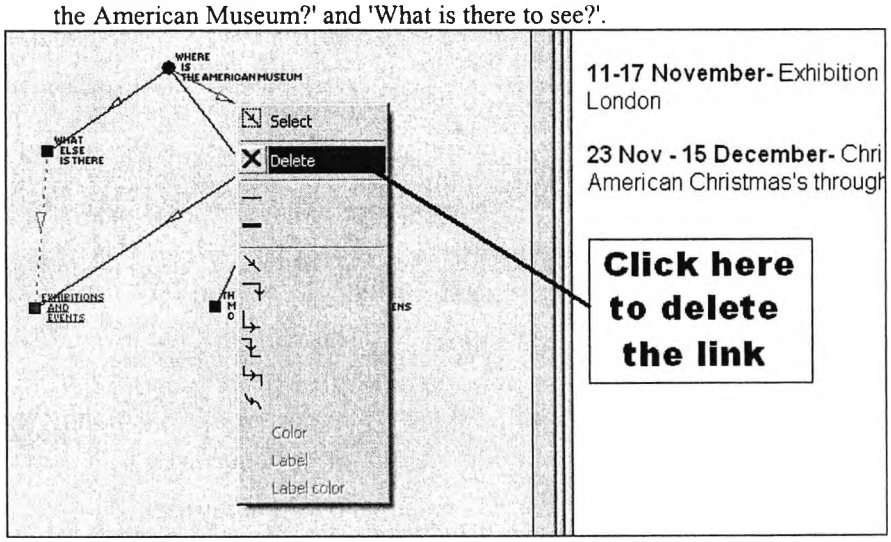


Figure 4. Deleting a link.

6. You can add your own *conceptual* links between pages by moving the mouse pointer over the page bullet, until the red square appears around the bullet. You can then click on the *right mouse button*. From the displayed menu select 'Link' (see figure 5). A dotted line is then shown attached to the page bullet. You can click and drag this line so it links to another page bullet on the map. When you do this a embedded link for the linked page appears in the annotation window (see figure 6). Practice this by linking 'The Main Collection' page to the 'Exhibitions and Events' page.

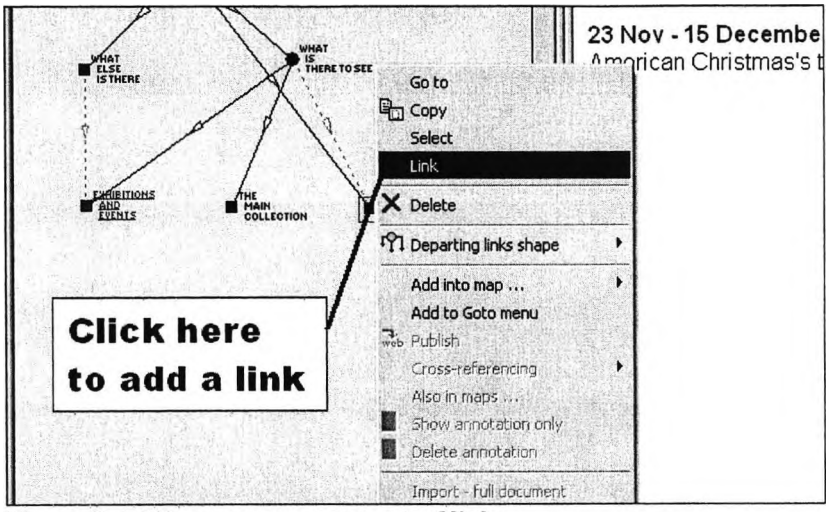


Figure 5. Adding your own *conceptual* links.

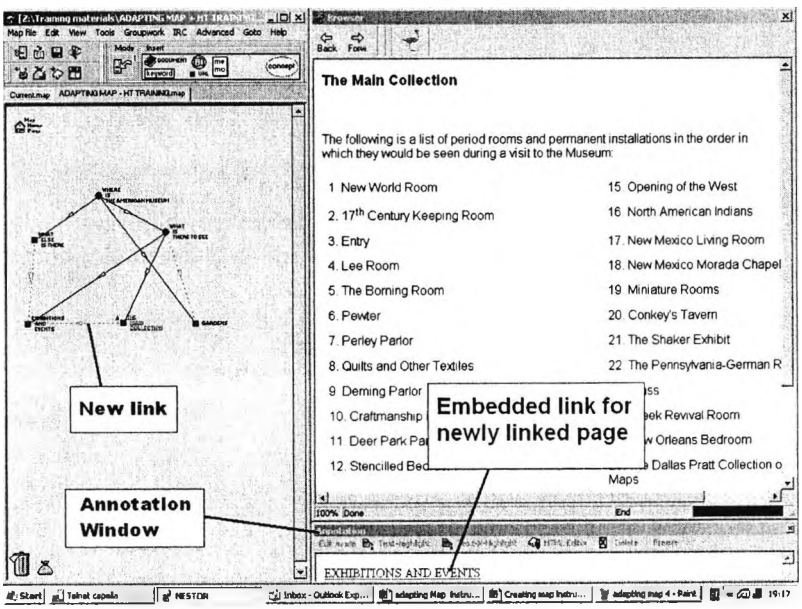


Figure 6. New *conceptual* links.

7. If you want to see more/less of the text or map, you can move the window divider between the text and the map windows by clicking on the divider and dragging it into a desired position (see figure 1). Please practice this now.

If you want to find out more about the American Museum in Britain, when the experiment is over, you can visit their website at http://www.americanmuseum.org/.

Additional Points to Note

Bag and Bin - these are located in the bottom left-hand corner of the map window (see figure 7). *You will not need to use these during the experiment.*

Pop-up previews- text summaries of a page pop up when you hold the mouse pointer over a page bullet (see figure 7). These previews appear for a few seconds then disappear. Please try to *avoid using these* during the experiment, as the aim of the experiment is to see the way that you use the text in the text window.

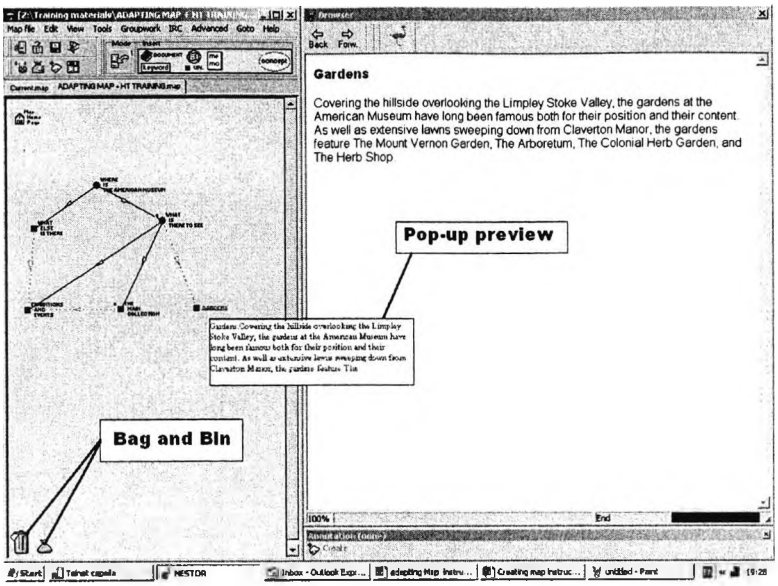


Figure 7. Additional points- the bin, the bag and the pop-up preview.

Complete the checklist below if you are happy with using each of these facilities:

- ☐ Embedded links.
- ☐ Back button.
- ☐ Accessing pages using the page bullet (round bullets indicate pages with embedded links, square bullets indicate pages without embedded links, and red bullets indicate the page you are currently displaying).
- ☐ Rearranging pages in the map.
- ☐ Deleting links/pages from the map.
- ☐ Adding new links to the map.
- ☐ Moving the window divider.
- ☐ You will not need to use the toolbar, pop-up previews or the bag and bin.

Appendix 6.3. Task sheets for the task while participants used the electronic text in experiment 3.

Participant ID.: _____

Please read through this information sheet and follow the instructions. Please remember that we are interested in assessing the materials rather than your personal abilities.

5. The paragraphs below give details of a scenario for a usability evaluation. Read the evaluation-scenario description carefully.

   CityMusic Website

   You work for a team of usability consultants that have been employed to evaluate the usability of the CityMusic website. CityMusic is a small music store that wants to develop a new website to sell CDs and vinyl. The staff at CityMusic have developed some software-based prototypes. These prototypes have limited content and functionality. Instead, they focus on site navigation and the overall 'look' of the website. Staff at CityMusic want to get feedback about the usability of these prototypes.

   There is a large budget for this usability evaluation. CityMusic are keen to have a highly usable website in order to make their customer's online experience pleasurable and without problems.

   CityMusic have allocated 3 months for the evaluation of their prototypes and they would like feedback on any usability problems and redesign suggestions within this timescale. Any findings from the usability evaluations will be taken into account and fed back into the design.

   There are three others in your team of usability consultants that you could use to help you in this usability evaluation. However, they all have extremely busy schedules and it would be difficult to involve them. Alternatively, potential users of the website are readily available and your consultancy has its own usability lab.

6. You are presented with electronic text materials on usability and usability evaluation techniques. Please read through the electronic text materials and use the information to **select a usability evaluation technique, or combination of techniques, that would be appropriate for use in the above scenario**.

[[For the creating and adapting map conditions:

7. You are also asked to **adapt your navigation map**. This is to help you navigate the electronic texts. However, **the main focus of this task is for you to choose a usability evaluation technique for the above scenario.]]**

8. Please use the sheet overleaf to record your choice of technique(s).

9. You have **30 minutes** to read through the text and make your decision.

If you have any questions please ask the researcher before you start.

Your start and stop times will be shown below (to be completed by the researcher):

Start time _____

Stop time_____

Please state your recommended usability evaluation technique(s) for the City Music website:

_____

_____

Give two reasons why you think this/these technique(s) is/are appropriate for the City Music website:

1. _____

2. _____

Give two reasons why you do not recommend the other technique(s) presented in the electronic texts?

1. _____

2. _____

Appendix 6.4. Questionnaire on ownership, usability and cognitive load given to participants in experiment 3.

E-Text Questionnaire

Please read the instructions below and complete the following questionnaire on your feelings about using the electronic text materials on usability evaluation.

Adapted from a questionnaire developed by Marina Milner-Bolotin (Milner-Bolotin, 2001).

Participant ID.:_____

The following statements on this questionnaire may or may not describe your feelings and beliefs about using these electronic text materials. Please rate each statement by circling a number between 1 and 5 according to the following scale:

1: Strongly Disagree; **2**: Disagree; **3**: Neutral; **4**: Agree; **5**: Strongly Agree

These statements should be taken as straightforward and simple descriptions of your attitudes. If you think the statement is very true of you, circle 5; if a statement is not at all true of you, circle 1. If the statement is more or less true of you, find the number between 1 and 5 that best describes you.

	Strongly Disagree				**Strongly Agree**
1. I found personal value in the use of the electronic text.	1	2	3	4	5
2. I felt I had control over the use of the electronic text.	1	2	3	4	5
3. I feel responsible for the usability evaluation decisions I made when using the electronic text.	1	2	3	4	5
4. I felt that my progression through the electronic text materials was guided.	1	2	3	4	5
5. I think I will be able to use what I have learned from the electronic text materials in other courses, and/or in everyday life.	1	2	3	4	5
6. I had a sense of ownership for my use of the electronic text materials to choose a usability evaluation technique(s).	1	2	3	4	5
7. I felt responsible for my final choice of evaluation technique(s).	1	2	3	4	5
8. I think I had control over my progression through the electronic text materials.	1	2	3	4	5
9. I felt responsible for the exploration of the materials on usability evaluation.	1	2	3	4	5
10. I think that the skill I have learned when using these materials will help me to succeed in the future.	1	2	3	4	5
11. I do not feel a personal responsibility for the decisions I made when using the electronic texts to choose a usability evaluation technique.	1	2	3	4	5
	Strongly Disagree				**Strongly Agree**
12. I felt ownership for my final choice of usability evaluation technique(s).	1	2	3	4	5

13. I felt I was free to choose the way I progressed through the electronic text materials.	1	2	3	4	5
14. I think freedom to decide the way you use electronic text materials is very important to learning with these materials.	1	2	3	4	5
15. I found no personal value in the information in the electronic texts.	1	2	3	4	5
16. I felt I could not access the pages I wanted to in the electronic texts.	1	2	3	4	5
17. The electronic texts were very easy to use.	1	2	3	4	5
18. I found it easy to work out how to access pages in the electronic text.	1	2	3	4	5
19. It will be difficult to remember information in the electronic texts.	1	2	3	4	5
20. I had no problems using the electronic texts.	1	2	3	4	5
21. I found using the electronic texts enjoyable.	1	2	3	4	5
22. I would not use this type of electronic text again.	1	2	3	4	5
23. I could easily work out where I wanted to go in the electronic texts.	1	2	3	4	5
24. I often had problems using the electronic texts.	1	2	3	4	5
25. The navigation aids always did what I expected.	1	2	3	4	5
26. It was difficult to work out how to use the electronic texts.	1	2	3	4	5
27. I found the using the electronic texts confusing.	1	2	3	4	5
28. It was not easy to find the information I needed in the electronic texts.	1	2	3	4	5
29. If I used the electronic texts again it would be easy to remember how to use them.	1	2	3	4	5
30. The electronic texts were very difficult to use.	1	2	3	4	5
31. I had to put a lot of mental effort into understanding the information in the electronic texts.	1	2	3	4	5

	Strongly Disagree				**Strongly Agree**
32. I did not have to put a lot of mental effort into navigating the electronic texts.	1	2	3	4	5
33. I had to put a lot of mental effort into working out where I was in the electronic texts.	1	2	3	4	5
34. I often felt that I had too many things to think about at once when using the electronic texts.	1	2	3	4	5

35. It took little mental effort to work out where I was in the electronic texts. 1 2 3 4 5

Appendix 6.5. Task sheet for the written transfer task in experiment 3.

Participant ID: _____

Please read through this information sheet and follow the instructions.

1. Below you are given another scenario for a usability evaluation. Read the evaluation-scenario description carefully.

   Usability evaluation context:

   A large telecoms company is creating software for writing short memos on mobile phones. You work for a team of usability consultants that have been employed to evaluate this software.

   The telecoms company are in the early stages of their designs and have developed some paper prototypes. The paper prototypes are in the form of a cardboard model of the mobile phone to give the impression of the size of the screen that users will be working on. Additionally, they have created actual size screen shots of each of the screens that users traverse when undertaking typical tasks with the memo software, such as adding a new memo. These screen shots can be stuck on to the screen of the cardboard model.

   Your team is made up of five usability consultants, three of which are also experts in mobile computing. Access to users is also good. However, you don't have access to a formal usability lab.

   The usability budget for this iteration of the project is relatively low. Also, as the telecoms company want to keep the iterations short they have requested that you give them feedback on the usability of their prototypes within just two weeks. Any findings from the usability evaluations will be taken into account and fed back into the next design iteration.

2. Please select a usability evaluation technique, or combination of techniques, that would be appropriate for this scenario. Please consider the information you read in the electronic text materials when making this decision.

3. Please use the sheet overleaf to record your record your choice of technique(s), and answer the associated questions.

   You are given **20 minutes** to give this information. Please fill in your start and stop times (the researcher will tell you these).

   Start time _____

   Stop time_____

Briefly explain what usability evaluation is (bullet points are sufficient):

_____

_____

_____

_____

_____

_____

Give **brief** details of each of the techniques presented in the materials and the advantages/disadvantages of using each one to evaluate the memo software (bullet points are sufficient):

Give **brief** details of your recommended usability evaluation technique for evaluating the memo software and say why you think it is the best technique (bullet points are sufficient):

Appendix 6.6. SPSS output for the reliability and validity checking for the pretest (correlation) for data from experiment 3.

Correlations

			Second Marking	Author's Marking
Spearman's rho	Second Marking	Correlation Coefficient	1.000	.880(**)
		Sig. (2-tailed)	.	.000
		N	15	15
	Author's Marking	Correlation Coefficient	.880(**)	1.000
		Sig. (2-tailed)	.000	.
		N	15	15

** Correlation is significant at the 0.01 level (2-tailed).

Appendix 6.7. SPSS output for the internal reliability analysis for the ownership section of the questionnaire.

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

N of Cases = 32.00

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	50.9667	44.3782	6.6617	13

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
Q1	47.1667	41.0402	.3403	.2836	.7920
Q2	46.7000	41.7345	.2194	.3878	.7997
Q3	47.1667	37.1092	.5417	.7316	.7745
Q5	47.0333	39.4126	.3863	.6662	.7883
Q6	47.4333	35.1506	.6870	.6159	.7598
Q7	47.0333	35.2057	.6761	.7861	.7607
Q8	47.2333	39.6333	.2629	.5235	.8014
Q9	47.1333	38.2575	.4953	.5443	.7795
Q11	47.2667	35.0989	.5465	.7509	.7730
Q12	47.0333	36.0333	.7281	.7373	.7599
Q13	46.8667	41.9816	.1187	.2616	.8112
Q15	46.7000	39.5276	.5029	.3997	.7816
Q16	46.8333	39.6609	.2183	.6362	.8088

Reliability Coefficients 13 items

Alpha = .7981 **Standardized item alpha =** .8035

Appendix 6.8. Marking scheme for the transfer task in experiment 3.

1) Briefly explain what usability evaluation is (bullet points are sufficient):[5 marks]

- description/purpose of usability evaluation
  - evaluating/testing/assessment/measurement of usability (investigating how easy a product is to use) [2] (or [1] if they've partially fulfilled this).
  - identifying usability problems [2] (or [1] if they've partially fulfilled this).
- bonus mark for description of usability or usability factors that might be looked for in a usability evaluation [1]
  - any two from: ease of use, easy to remember, easy to learn, utility, efficiency, effectiveness

2) Give *brief* details of each of the techniques presented in the materials and the advantages/disadvantages of using each one to evaluate the memo software (bullet points are sufficient):

a) details of evaluation techniques and advantages/disadvantages [max 5 marks]

- observation involves real users being observed while using/interacting/completing set tasks with a system [1]
- expert reviews
  - expert reviews involve experts using a system and identifying usability problems [1] **or**
    - heuristic evaluation involves experts using a system and checking for conformity to a set of heuristics/rules/guidelines/principles [1]
    - cognitive walkthrough involves experts walking through set tasks (i.e. is task focussed) [1] **or**
      - simulating the behaviour/mental processes of a typical user[1] **or**
      - and checking to see if users can achieve their task goals [1] **or**
      - focus is on learning through exploration [1]
- up to [2] marks for advantages/disadvantages (i.e. 1 mark for one or two advantages/disadvantages, 2 marks for several).
- Good details of formative and summative evaluations and their advantages/disadvantages can get 1 mark.
- N.B. just naming the techniques does not get any marks, they have to give some description. However, when they don't name a technique, a reasonable description that obviously relates to a particular technique can get marks, depending on the quality of the description as above.
- Also, specific data collection techniques (e.g. audio recording, video recording) if explained in detail can get 1 mark.

3) Give *brief* details of your recommended usability evaluation technique for evaluating the memo software and say why you think it is the best technique (bullet points are sufficient):

a) brief details of selected technique[5]:

1 – Stating technique name only. Formative or summative on their own gets no marks.

3 – Good suggestions of how to use the techniques (one or two) – choosing task, choosing prototypes, ordering of techniques, variations on the technique, participants, how data will be gathered, testing environments, whether it will be formative or summative.

5 – Several of the above + more detailed/advanced suggestions of how the technique would be employed e.g. adapting heuristics for mobile phones (if heuristic evaluation is chosen).

b) why they have chosen that technique [5]:

0 – no explanation.

1 – minimal explanation i.e. one advantage of the chosen technique(s) or disadvantage of other techniques not selected e.g. cheap. No relation to the task setting.

3 – Several advantages of the chosen technique(s) that are appropriate for the given setting or disadvantages of other discarded techniques. **Or**, one or two advantages that are related to the task setting (constraints e.g. budget, timescales and access to users). **Or**, they have just stated several factors of the

task setting which relate to the advantages/disadvantages of the chosen technique without explicitly stating these advantages/disadvantages e.g. they choose heuristic evaluation, and say this is because there is a low budget, short timescale and there is good access to experts.

5 – Several appropriate advantages of the chosen technique(s) or disadvantages of other discarded techniques **and** relation to the task setting.

Note: mark positively, i.e. marks are not deducted for errors.

Example Solution

Briefly explain what usability evaluation is (bullet points are sufficient):[5]

Usability evaluation is the assessment of the usability of a system and has the purpose of either identifying usability problems or giving some measure of usability, such as measures of effectiveness, efficiency and how satisfying a system is to use.

Give *brief* details of each of the techniques presented in the materials and the advantages/disadvantages of using each one to evaluate the memo software (bullet points are sufficient):

The electronic text materials presented three techniques for usability evaluation: observational evaluations, and two forms of expert review, heuristic evaluations and cognitive walkthroughs. The focus of these techniques was on their use in a formative approach to usability evaluation where the results of the evaluation are fed back into design. This approach is in contrast to summative evaluations where the usability of a final product is assessed.

Observational evaluations involve observing users as they complete typical tasks and recording their interactions with a system either by audio, video, interaction logging or pen and paper. Users are commonly asked to give verbal protocols as they complete the tasks where they say any thoughts or reactions that come to mind. The data about the users' interactions is then analysed for usability problems.

Heuristic evaluations involve expert evaluators assessing how well a system complies with a set of heuristics, or rules/guidelines. Experts walkthrough a set of typical user tasks with the system and at each stage of the task check conformity to the heuristics. Any time that a heuristic is broken details of the location of the problem are recorded on a coding sheet. At the end of the evaluation the problems are then grouped and often ordered in terms of the most significant problems.

Cognitive walkthroughs are another form of expert reviews. It involves experts walking through a set of typical user tasks trying to predict user's thoughts and behaviours. At each stage of the task the expert asks themselves questions related to user's goals- whether they will form the correct goal and whether they can achieve it. Any time that there is a negative answer to these questions the location of the problem is recorded. At the end of the evaluation the problems are grouped and ordered for importance.

Give *brief* details of your recommended usability evaluation technique for evaluating the memo software and say why you think it is the best technique (bullet points are sufficient):

Due to the good access to experts, from both experts in mobile computing and HCI, the short timescale and the low budget heuristic evaluation is the recommended technique for this setting since it is cheap and quick to perform. Since the focus is on the evaluation of a mobile phone a set of heuristics, adapted from Nielsen's to be specific to mobile phones, will be used. The experts can walkthrough the task of creating a memo and at each stage of the task check whether the interface conforms to the heuristics.

Cognitive walkthroughs are not appropriate since these can be more expensive and time consuming and there is a tight budget and time is short.

Although access to users is good, observational evaluations are not recommended because there is no access to a usability lab, and observational evaluations can be potentially costly and the data analysis may be time consuming.

Appendix 6.9. SPSS output for the reliability and validity checking for the transfer task (correlation) in experiment 3.

Correlations

			Second Marking	Author's Marking
Spearman's rho	Second Marking	Correlation Coefficient	1.000	.845(**)
		Sig. (2-tailed)	.	.000
		N	13	13
	Author's Marking	Correlation Coefficient	.845(**)	1.000
		Sig. (2-tailed)	.000	.
		N	13	13

** Correlation is significant at the 0.01 level (2-tailed).

Appendix 6.10. SPSS output for the reliability and validity checking for the concept-mapping task (correlation) in experiment 3.

Correlations

			Second Marking	Author's Marking
Spearman's rho	Second Marking	Correlation Coefficient	1.000	.869(**)
		Sig. (2-tailed)	.	.000
		N	15	15
	Author's Marking	Correlation Coefficient	.869(**)	1.000
		Sig. (2-tailed)	.000	.
		N	15	15

** Correlation is significant at the 0.01 level (2-tailed).

Appendix 6.11. SPSS output for the internal reliability analysis for the cognitive load section of the questionnaire in experiment 3.

****** Method 1 (space saver) will be used for this analysis ******

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	12.0313	13.0635	3.6143	5

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
Q31	9.2500	7.9355	.5366	.5210
Q32	10.0000	9.4194	.5153	.5554
Q33	9.9375	9.0927	.4038	.5925
Q34	9.6250	8.2419	.5954	.5003
Q35	9.3125	10.8024	.0755	.7565*

*Item removed due to low item total correlation.

Reliability Coefficients

N of Cases = 32.0 N of Items = 5

Alpha (5 items) = .6470 **Final alpha (4 items) =** .7565

Appendix 6.12. SPSS output for the internal reliability analysis for the usability section of the questionnaire in experiment 3.

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

N of Cases = 32.0

Statistics for Scale	Mean	Variance	Std Dev	N of Variables
	61.0938	32.9264	5.7382	14

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
Q17	56.5938	28.7006	.5758	.7787	.8073
Q18	56.4375	30.1250	.4849	.6372	.8148
Q19	57.8750	29.8548	.2616	.3056	.8290
Q20	56.4688	29.5474	.5105	.6538	.8122
Q21	57.3438	28.4264	.3749	.4835	.8218
Q22	56.9063	29.1845	.2695	.2914	.8321
Q23	56.6250	27.5968	.6385	.6298	.8013
Q24	56.5313	29.2248	.6327	.5718	.8073
Q25	56.7188	29.6925	.3548	.5672	.8206
Q26	56.5625	29.5444	.2921	.5555	.8270
Q27	56.5313	26.7732	.6652	.6369	.7977
Q28	56.7813	26.2409	.5565	.5381	.8065
Q29	56.6875	26.6089	.6905	.7456	.7957
Q30	56.1563	31.2974	.5700	.6532	.8189

Reliability Coefficients 14 items

Alpha = .8251 Standardized item alpha = .8536

Appendix 6.13. SPSS output for analyses of ownership in experiment 3.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Map	8	3.9519	.57994	.20504	3.4671	4.4368	3.23	5.00
Adapting Map	8	4.2500	.39385	.13925	3.9207	4.5793	3.77	4.92
Creating Map	8	3.6827	.38006	.13437	3.3650	4.0004	3.15	4.15
Embedded links	8	3.7981	.50179	.17741	3.3786	4.2176	3.08	4.54
Total	32	3.9207	.49717	.08789	3.7414	4.0999	3.08	5.00

Table 1. Descriptive statistics for total ownership.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Total Ownership	Using Map	8	16.75
	Adapting Map	8	22.69
	Creating Map	8	12.19
	Embedded links	8	14.38
	Total	32	

Table 2. Total number of data points and mean rank for each condition for total ownership.

Test Statistics(a,b)

	Total Ownership
Chi-Square	5.618
df	3
Asymp. Sig.	.132

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for total ownership.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Map	40	4.4000	.63246	.10000	4.1977	4.6023	3.00	5.00
Adapting Map	40	4.1250	1.04237	.16481	3.7916	4.4584	2.00	5.00
Creating Map	40	3.7250	1.01242	.16008	3.4012	4.0488	1.00	5.00
Embedded links	40	3.8500	1.00128	.15832	3.5298	4.1702	1.00	5.00
Total	160	4.0250	.96446	.07625	3.8744	4.1756	1.00	5.00

Table 4. Descriptive statistics for the control factor.

	IV	N	Mean Rank
CONTROL	Using Map	40	96.15
	Adapting Map	40	87.43
	Creating Map	40	66.24
	Embedded links	40	72.19
	Total	160	

Table 5. Total number of data points and mean rank for each condition for the control factor.

Test Statistics(a,b)

	CONTROL
Chi-Square	11.991
df	3
Asymp. Sig.	.007

a Kruskal Wallis Test
b Grouping Variable: IV

Table 6. Chi-squared (or H) value for each condition and significance for the control factor.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Map	40	3.6500	1.14466	.18099	3.2839	4.0161	1.00	5.00
Adapting Map	40	4.3500	.83359	.13180	4.0834	4.6166	2.00	5.00
Creating Map	40	3.5000	.87706	.13868	3.2195	3.7805	2.00	5.00
Embedded links	40	3.7750	.94699	.14973	3.4721	4.0779	2.00	5.00
Total	160	3.8188	1.00234	.07924	3.6622	3.9753	1.00	5.00

Table 7. Descriptive statistics for the responsibility factor.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
RESPONSIBILITY	Using Map	40	74.81
	Adapting Map	40	105.09
	Creating Map	40	64.75
	Embedded links	40	77.35
	Total	160	

Table 8. Total number of data points and mean rank for each condition for the responsibility factor.

Test Statistics(a,b)

	RESPONSIBILITY
Chi-Square	18.192
df	3
Asymp. Sig.	.000

a Kruskal Wallis Test
b Grouping Variable: IV

Table 9. Chi-squared (or H) value for each condition and significance for the responsibility factor.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Map	22	4.0455	.72225	.15398	3.7252	4.3657	3.00	5.00
Adapting Map	24	4.2917	.75060	.15322	3.9747	4.6086	3.00	5.00
Creating Map	24	3.9167	.65386	.13347	3.6406	4.1928	2.00	5.00
Embedded links	24	3.7500	.84699	.17289	3.3923	4.1077	2.00	5.00
Total	94	4.0000	.76200	.07859	3.8439	4.1561	2.00	5.00

Table 10. Descriptive statistics for the value factor.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
VALUE	Using Map	22	48.57
	Adapting Map	24	57.19
	Creating Map	24	44.88
	Embedded links	24	39.46
	Total	94	

Table 11. Total number of data points and mean rank for each condition for the value factor.

Test Statistics(a,b)

	VALUE
Chi-Square	6.294
df	3
Asymp. Sig.	.098

a Kruskal Wallis Test
b Grouping Variable: IV2

Table 12. Chi-squared (or H) value for each condition and significance for the value factor.

Appendix 6.14. SPSS output for analyses of the transfer task in experiment 3.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Written transfer task	Using Map	8	31.8750	17.10002	6.04577	17.5790	46.1710	10.00	60.00
	Adapting Map	8	45.0000	16.47509	5.82482	31.2265	58.7735	15.00	60.00
	Creating Map	8	45.0000	16.03567	5.66947	31.5938	58.4062	25.00	65.00
	Embedded links	7	37.8571	11.85227	4.47974	26.8956	48.8187	20.00	50.00
	Total	31	40.0000	15.86401	2.84926	34.1810	45.8190	10.00	65.00
A	Using Map	8	37.5000	7.07107	2.50000	31.5884	43.4116	20.00	40.00
	Adapting Map	8	27.5000	18.32251	6.47798	12.1820	42.8180	.00	40.00
	Creating Map	8	55.0000	23.29929	8.23754	35.5213	74.4787	20.00	80.00
	Embedded links	7	48.5714	15.73592	5.94762	34.0181	63.1247	40.00	80.00
	Total	31	41.9355	19.56517	3.51401	34.7589	49.1120	.00	80.00
B	Using Map	8	35.0000	33.38092	11.80194	7.0929	62.9071	.00	100.00
	Adapting Map	8	70.0000	30.23716	10.69045	44.7211	95.2789	20.00	100.00
	Creating Map	8	60.0000	30.23716	10.69045	34.7211	85.2789	20.00	100.00
	Embedded links	7	34.2857	15.11858	5.71429	20.3034	48.2681	20.00	60.00
	Total	31	50.3226	31.35643	5.63178	38.8209	61.8242	.00	100.00
C	Using Map	8	22.5000	16.69046	5.90097	8.5464	36.4536	.00	40.00
	Adapting Map	8	32.5000	14.88048	5.26104	20.0596	44.9404	20.00	60.00
	Creating Map	8	25.0000	17.72811	6.26783	10.1789	39.8211	.00	60.00
	Embedded links	7	22.8571	17.99471	6.80136	6.2148	39.4995	.00	60.00
	Total	31	25.8065	16.48721	2.96119	19.7589	31.8540	.00	60.00
D	Using Map	8	32.5000	30.11881	10.64861	7.3200	57.6800	.00	80.00
	Adapting Map	8	50.0000	21.38090	7.55929	32.1251	67.8749	20.00	80.00
	Creating Map	8	40.0000	28.28427	10.00000	16.3538	63.6462	.00	60.00
	Embedded links	7	45.7143	22.25395	8.41120	25.1328	66.2958	20.00	80.00
	Total	31	41.9355	25.48455	4.57716	32.5877	51.2833	.00	80.00

Table 1. Descriptive statistics for the written transfer task.

Kruskal Wallis Analysis of Variance

	IV	N	Mean Rank
Total written transfer task	Using Map	8	11.25
	Adapting Map	8	19.38
	Creating Map	8	18.75
	Embedded links	7	14.43
	Total	31	
A	Using Map	8	14.06
	Adapting Map	8	10.56
	Creating Map	8	20.69
	Embedded links	7	19.07
	Total	31	
B	Using Map	8	11.56
	Adapting Map	8	21.50
	Creating Map	8	18.81
	Embedded links	7	11.57
	Total	31	
C	Using Map	8	14.88
	Adapting Map	8	19.63
	Creating Map	8	15.31
	Embedded links	7	13.93
	Total	31	
D	Using Map	8	12.75
	Adapting Map	8	18.69
	Creating Map	8	15.81
	Embedded links	7	16.86
	Total	31	

Table 2. Total number of data points and average rank for each condition for each aspect of the transfer task.

Test Statistics(a,b)

	Total written transfer	A	B	C	D
Chi-Square	4.281	8.440	7.617	2.195	1.929
df	3	3	3	3	3
Asymp. Sig.	.233	.038	.055	.533	.587

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for the written transfer task.

Appendix 6.15. SPSS output for analyses of the concept-mapping task in experiment 3.

Quantitative Concept Map Marks

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Maps	8	25.0000	11.74734	4.15331	15.1790	34.8210	10.00	47.00
Adapting Maps	7	25.2857	4.82059	1.82201	20.8274	29.7440	19.00	33.00
Creating Maps	8	30.1250	10.77613	3.80994	21.1159	39.1341	15.00	49.00
Embedded links	7	25.5714	10.11364	3.82260	16.2179	34.9250	14.00	37.00
Total	30	26.5667	9.59771	1.75229	22.9828	30.1505	10.00	49.00

Table 1. Descriptive statistics for the quantitative concept map marks.

Levene Statistic	df1	df2	Sig.
1.134	3	26	.354

Table 2. Levene test for homogeneity of variances for the quantitative concept map marks.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	139.349	3	46.450	.477	.701
Within Groups	2532.018	26	97.385		
Total	2671.367	29			

Table 3. Parametric Analysis of Variance for quantitative concept map marks.

Qualitative Concept Map Marks

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Maps	8	39.3750	19.49130	6.89121	23.0799	55.6701	15.00	75.00
Adapting Maps	7	43.5714	17.19115	6.49764	27.6723	59.4706	25.00	65.00
Creating Maps	8	40.9375	17.57319	6.21306	26.2459	55.6291	25.00	70.00
Embedded links	7	40.3571	15.30445	5.78454	26.2029	54.5114	25.00	65.00
Total	30	41.0000	16.68160	3.04563	34.7710	47.2290	15.00	75.00

Table 4. Descriptive statistics for the qualitative concept map marks.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
QUALITATIVE CONCEPT MAP MARKS	Using Maps	8	14.00
	Adapting Maps	7	17.50
	Creating Maps	8	15.25
	Embedded links	7	15.50
	Total	30	

Table 5. Total number of data points and mean rank for each condition for qualitative concept map marks.

Test Statistics(a,b)

	QUALITATIVE CONCEPT MAP MARKS
Chi-Square	.609
df	3
Asymp. Sig.	.894

a Kruskal Wallis Test
b Grouping Variable: IV

Table 6. Chi-squared (or H) value for each condition and significance for the qualitative concept map marks.

Appendix 6.16. SPSS output for analyses of cognitive load in experiment 3.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Map	8	2.2500	.79057	.27951	1.5891	2.9109	1.00	3.50
Adapting Map	8	1.9375	.90386	.31956	1.1819	2.6931	1.00	3.50
Creating Map	8	2.0938	.51647	.18260	1.6620	2.5255	1.00	2.75
Embedded links	8	3.0313	.68709	.24292	2.4568	3.6057	2.00	3.75
Total	32	2.3281	.82168	.14525	2.0319	2.6244	1.00	3.75

Table 1. Descriptive statistics for cognitive load.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
COGNITIVE LOAD	Using Map	8	15.56
	Adapting Map	8	11.88
	Creating Map	8	14.31
	Embedded links	8	24.25
	Total	32	

Table 2. Total number of data points and mean rank for each condition for cognitive load.

Test Statistics(a,b)

	COGNITIVE LOAD
Chi-Square	8.002
df	3
Asymp. Sig.	.046

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for cognitive load.

Appendix 6.17. SPSS output for analyses of usability in experiment 3.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Using Map	8	4.4911	.32941	.11646	4.2157	4.7665	4.00	4.86
Adapting Map	8	4.5893	.27992	.09897	4.3553	4.8233	4.07	5.00
Creating Map	8	4.3839	.30529	.10794	4.1287	4.6392	3.93	4.79
Embedded links	8	3.9911	.47754	.16884	3.5918	4.3903	3.36	4.71
Total	32	4.3638	.40987	.07246	4.2161	4.5116	3.36	5.00

Table 1. Descriptive statistics for usability.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
USABLITY	Using Map	8	19.63
	Adapting Map	8	21.13
	Creating Map	8	16.19
	Embedded links	8	9.06
	Total	32	

Table 2. Total number of data points and mean rank for each condition for usability.

Test Statistics(a,b)

	USABLITY
Chi-Square	7.930
df	3
Asymp. Sig.	.047

a Kruskal Wallis Test
b Grouping Variable: IV

Table 3. Chi-squared (or H) value for each condition and significance for usability.

Appendix 6.18. SPSS output for analyses of navigation maps in experiment 3.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Nodes	Using Map	8	23.0000	.00000	.00000	23.0000	23.0000	23.00	23.00
	Adapting Map	8	23.0000	.00000	.00000	23.0000	23.0000	23.00	23.00
	Creating Map	8	19.8750	3.31393	1.17165	17.1045	22.6455	13.00	23.00
	Total	24	21.9583	2.36789	.48334	20.9585	22.9582	13.00	23.00
Navigation Links	Using Map	8	19.0000	.00000	.00000	19.0000	19.0000	19.00	19.00
	Adapting Map	8	22.8750	5.71808	2.02165	18.0946	27.6554	16.00	31.00
	Creating Map	8	20.1250	3.72012	1.31526	17.0149	23.2351	13.00	25.00
	Total	24	20.6667	4.11431	.83983	18.9293	22.4040	13.00	31.00
Conceptual Links	Using Map	8	3.0000	.00000	.00000	3.0000	3.0000	3.00	3.00
	Adapting Map	8	5.1250	3.52288	1.24553	2.1798	8.0702	2.00	12.00
	Creating Map	8	.2500	.46291	.16366	-.1370	.6370	.00	1.00
	Total	24	2.7917	2.82811	.57728	1.5975	3.9859	.00	12.00

Table 1. Descriptive statistics for the navigation map measures.

	Levene Statistic	df1	df2	Sig.
Nodes	10.612	2	21	.001
Navigation LInks	6.173	2	21	.008
Conceptual Links	21.333	2	21	.000

Table 2. Levene test for homogeneity of variances for the navigation map measures.

Kruskal Wallis Analysis of Variance by Ranks

	IV	N	Mean Rank
Nodes	Using Map	8	15.50
	Adapting Map	8	15.50
	Creating Map	8	6.50
	Total	24	
Navigation Links	Using Map	8	10.00
	Adapting Map	8	15.06
	Creating Map	8	12.44
	Total	24	
Conceptual Links	Using Map	8	15.50
	Adapting Map	8	17.50
	Creating Map	8	4.50
	Total	24	

Table 3. Total number of data points and mean rank for each condition for the navigation map measures.

Test Statistics(a,b)

	Nodes	Navigation Links	Conceptual Links
Chi-Square	14.930	2.177	18.233
df	2	2	2
Asymp. Sig.	.001	.337	.000

a Kruskal Wallis Test
b Grouping Variable: IV

Table 4. Chi-squared (or H) value for each condition and significance for the navigation map measures.