

Chapter 4 Methodology

4.1 Participants

There were forty participants in this experiment who took CSA test for their cognitive styles. Forty participants were divided into four groups (WI, WV, AI, and AV) with ten participants in each group. The background information of the participants was classified into two groups: with prior experience using mobile handheld devices and with prior experience of online shopping using handheld devices. For the participants without prior experience using handheld devices they were trained by the practicing task.



4.2 Tasks

The tasks of the experiments are classified into two groups (using computers and using handheld devices). There were five types of online shopping tasks: browsing, searching, purchasing, booking, and comparing prices. There are ten tasks with two tasks for each type. To reduce the learning effect, different tasks were designed for different devices. All participants have to practice one task in the experimental website.

The tasks in the experiment are:

- The computers experiment

Practice task: Find out the lavender mask (no time limitation)

1. Browsing

- Browse the websites freely for 3 minutes.
- Browse the news search pages freely.

2. Search

- Search for today's headline of the political news.
- Find which drink is good for heavy computer users.

3 Purchasing

- Purchase one bunch of lilies.
- Purchase one bunch of roses.

4. Booking

- Order an Asian travel package.
- Book one American travel package.



5. Comparing the prices

- Please search for the most expensive sunflowers on the website.
- Please account for the price difference between the most expensive and the least for the lily bunch.
- The handheld devices experiment

Practicing task: Find out the travel book for London(no time limitation).

1. Browsing

- Browse the healthy information pages freely.
- Browse the flower purchasing pages freely.

2. Searching

- Find which drink can help decrease cholesterol.
- Find when Melatonin secretes the most in a day.

3. Purchasing

- Purchase one basin of orchid named “Purple butterfly”
- Purchase one bunch of sunflower named “Lilies and sunflowers”.

4. Booking

- Order a travel package in Asia.
- Order a travel package in Europe.

5. Price Comparison

- Search for the most expensive travel package in Asia and write it
- Find the most inexpensive free travel package of Europe and write down the answer.



4.3 Variables

The dependent variables were browsing performance and browsing tool. The independent variables were cognitive styles: Wholist-Analytic and Verbal-Imagery, and devices: computers and handheld devices. The covariates were prior experience of online shopping and prior experience of using mobile handheld devices.

4.3.1 Independent Variable

Wholist –Analytic: This reflects the way an individual organizes information either in parts or as a whole.

Verbal-Imagery : This reflects the way an individual represents knowledge, in mental pictures or in words.

The Cognitive Style Analysis (CSA) test (Riding 1991) is a computer-presented test, which assesses a person's position on the two dimensions of cognitive style (Wholist-Analytic and Verbal-Imagery). The CSA test comprises three subtests. The first accesses the verbal-imagery dimension by presenting 48 true/false statements with one at a time. Half of the statements contain information about conceptual categories, and half describe the appearance of items. Half of the statements of each type are true. It was assumed that imagers would respond more quickly to the appearance of item, because the participants could be readily represented as mental pictures and the information for the comparison could be obtained directly and rapidly from these images. It was assumed that Verbalisers would respond more quickly to conceptual category items because the semantic conceptual category membership is verbally abstract in nature and cannot be represented in visual form. The computer records the response time to each statement and calculates the verbal-imagery ratio. A low ratio means a Verbalisers and a high ratio indicates an imager, with the intermediate position to read both the verbal and the imagery items so that reading

ability and reading speed are controlled.

The second two subsets access the Wholist-analytic dimension. The first of these presents items containing pairs of complex geometrical figures that the individual is required either the same or different. Because this task involves judgments about the overall similarity of the two figures, it was assumed that a relatively fast response to this task would be possible by who lists. The second subset presents items each comprising a simple geometrical shape and a complex geometrical figure, and the individual is asked to indicate whether the simple shape is contained in the complex shape by pressing one of two marked response keys. It was assumed that analytics would be relatively quicker at this. Again, the computer records the latency of the latency of the responses and calculates the Wholist-Analytic ratio. A low ratio indicates a Wholist and a high ratio represents an analytic. Ratios between these positions correspond to intermediate (Robert 2001).

The following data could be distinguished which dimension of cognitive style. If the data of Wholist-Analytic dimension is greater than 1.35, and the verbal-imagery dimension is greater than or equal to 0.98. It implies the analytic verbalizing dimension of cognitive style.

According to the above dimensions of cognitive styles, the participants were

classified into four cognitive styles: Wholist-Verbal, Wholist-Imagery, Verbal-Wholist, and Verbal-Imagery.

The other is device with two levels: computer and handheld device. Every participant has to conduct all the tasks with both devices. Half of the participants conducted the computer experiment first, and the other half have to conduct the handheld experiments first.

4.3.2 Dependent Variable

In this experiment, there were two groups of dependent variables: browsing performance and browsing tool. Browsing performance includes: performance time, error, satisfaction, disorientation, mental workload, and total steps.

- Browsing Performance

Performance time measured the time interval from the moment the answer was presented on the screen to the moment when the participants finished each task. All these times and calculated automatically by a computer program, and recorded in a log file.

Error was defined as the total number of excessive steps utilized to complete the tasks. The number of excessive steps was determined by the difference of the total number of actual responses performed by each participant.

Total steps mean the total number of steps utilized to complete the tasks on the computer or on handheld devices.

Satisfaction was the score obtained through a general satisfaction questionnaire. There were fourteen questions in the satisfaction questionnaire.

Disorientation was defined as the extent that each participant felt lost when browsing websites. The disorientation scores were obtained through disorientation questionnaire. There was ten questions in the disorientation questionnaire.

Mental workload is measured by NASA_TLX in the experiment. (Hart and Staveland 1988). There are six evaluation scales: mental demand, physical demand, temporal demand, performance, effort, and frustration level. Based on the result of the evaluation of six scales, the separate results and the integrate average mental workload of each participant will be measured.

Browsing tool contains three variables: using key word search, using sitemap, and using drop down menu.

4.4 Experimental Design

Table 4.1 Experimental Design (N=40)

WI participants		WV participants		AI participants		AV participants	
Handheld-c	computer-	Handheld-c	computer-	Handheld-c	computer-	Handheld-c	computer-

omputer	Handheld	omputer	Handheld	omputer	Handheld	omputer	Handheld
W11-05	W06-10	WV1-05	WV06-10	AI1-05	AI06-10	AV1-05	AV06-10

AV: Analytic-Verbaliser cognitive style.

AI: Analytic- Imager cognitive style.

WV: Wholist- Verbaliser cognitive style.

WI: Wholist- Imager cognitive style.

Handheld-computer: means that the participants were given the Handheld tasks first, and the computer tasks second

Computer-Handheld: means that the participants were given the Handheld tasks first, and the computer tasks second

The analysis was run using the model expressed below.

$$Y_{ijk} = \mu + A_i + B_j + AB_{ij} + S_{k(ij)}$$

Where

A = W/ A cognitive style

B = I/ V cognitive style

e = error effect

i = 1- 2

j = 1-2

4.5 Apparatus and Experimental Shopping Website

4.5.1 Shopping Website

The experimental shopping websites for computers and handheld devices are shown in Figure 4.1a and 4.1 b. The content of the experimental shopping website for computers could be classified into two types: service and product. The service type includes a health information search and a news search; the latter part includes flower sales and international travel package booking. The structure of the experimental website for computer could be divided into five layers (Figure 4.1, Figure 4.2 and Figure 4.3).

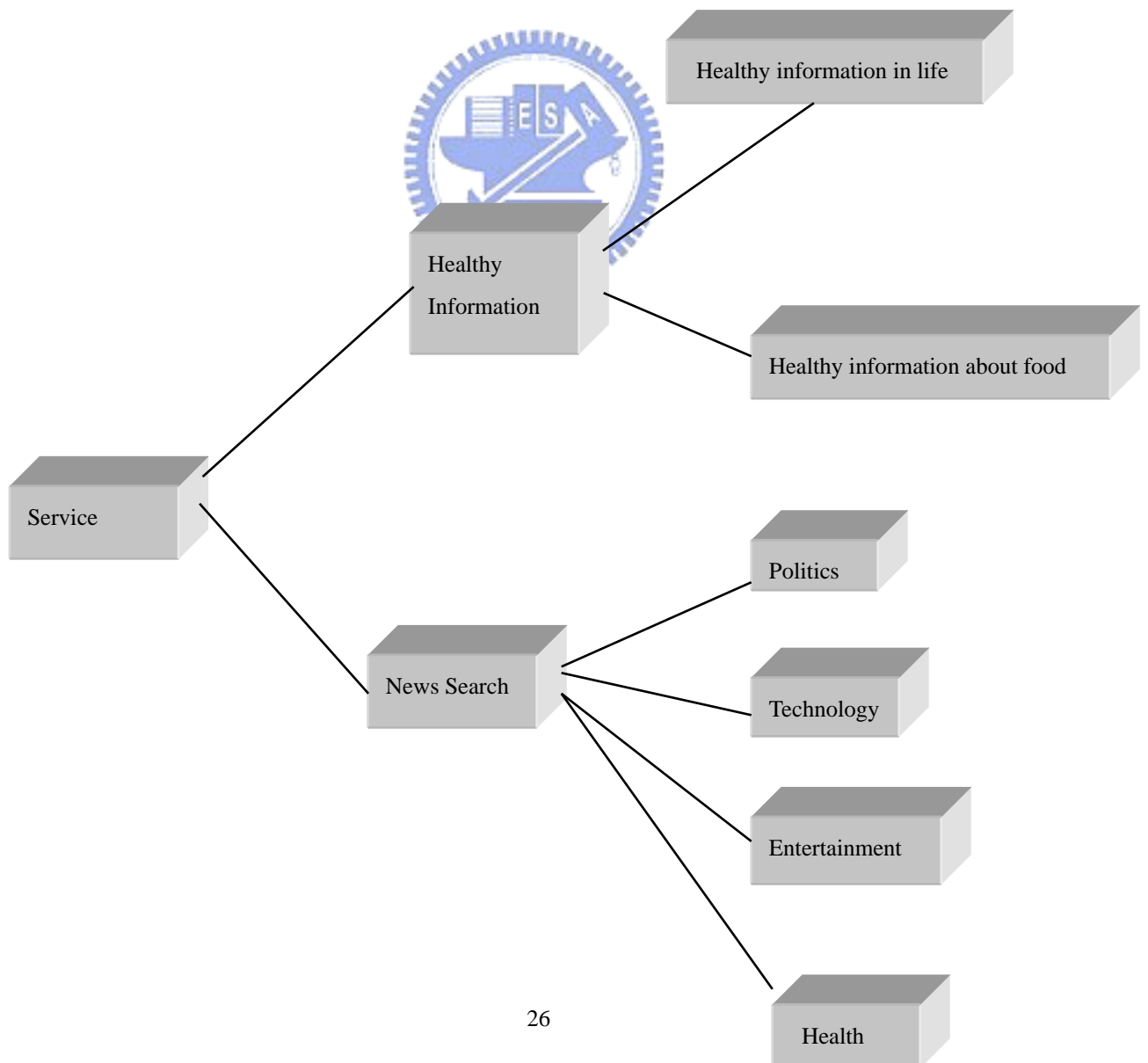


Figure 4.1a The interface structure of the formal experimental website for handheld devices and for computers

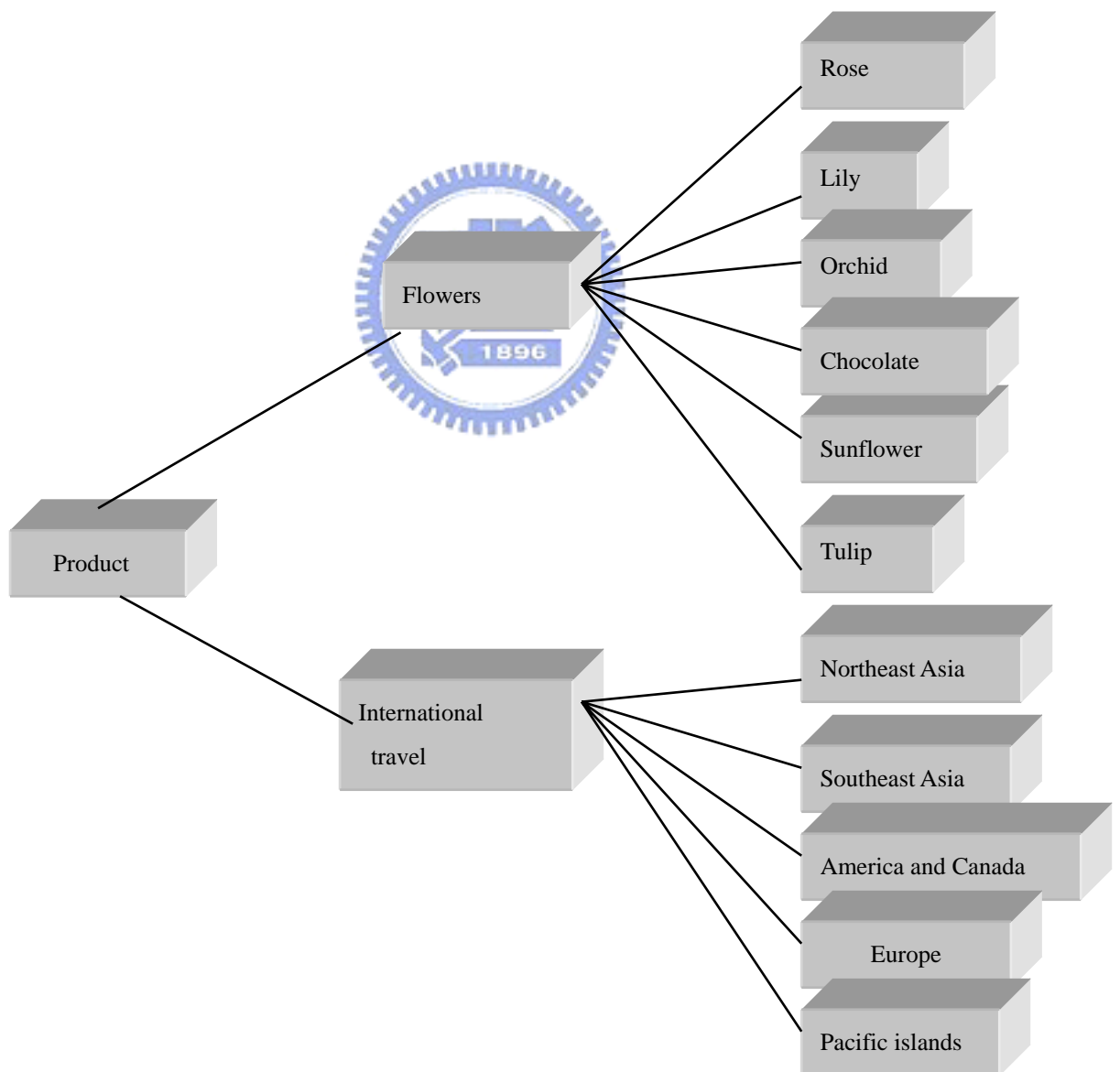


Figure 4.1b The interface structure of the formal experimental website for handheld device and for computers.

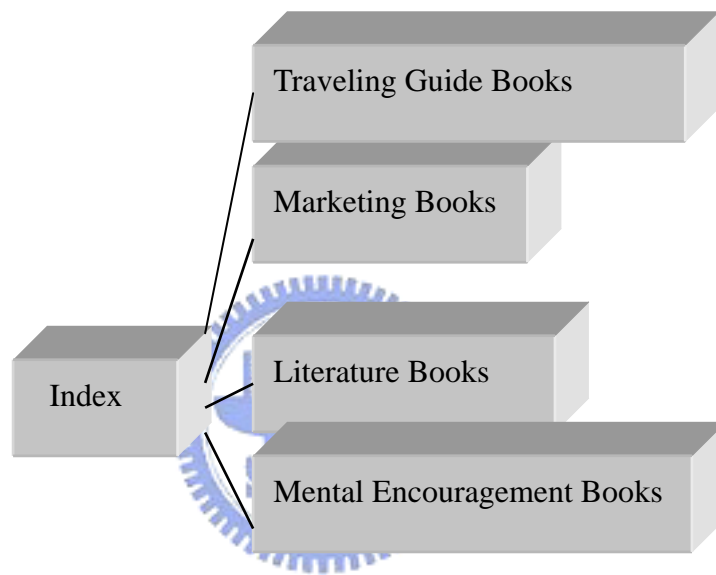


Figure 4.2 The interface structure of the practice web pages for handheld devices

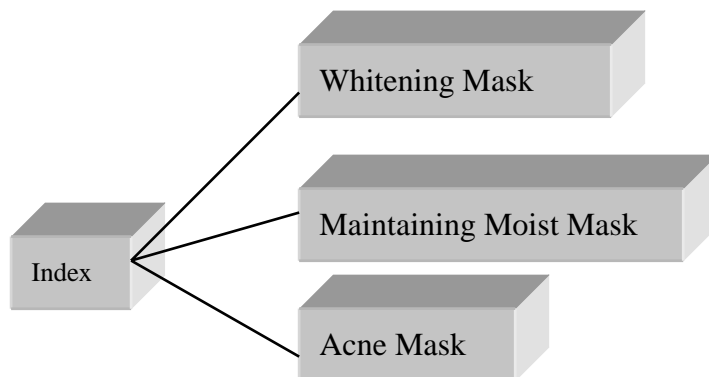


Figure 4.3 The interface structure of the practice web pages for computers

To record the precise time and each track in which the participant engaged in the experiment, the researcher used the ASP program log file on the server. The basic recording unit of the experiment was 0.01 seconds. One PDA, COMPAQ iPAQ H3630 Personal Digital Assistant, with 32 megabytes RAM, and one wireless adaptor. (fig 4.4) was used in the experiment. One IBM notebook computer (A22e) was used in the experiment.



Figure 4.4. Compaq iPAQ H3630

Two types of questionnaires were used in the experiment. One was used before the experiment, which asked the basic background of each participant. The background questionnaire consists of twelve questions. Questions 1, 2, 3, and 4 were

used to determine the participants' basic backgrounds, including age, gender, and education level and major. Moreover, questions 5, 6, 7, 8, 9, 10, 11 and 12 were used to assure the participants' experiences in using computers and handheld devices and in browsing the wireless shopping websites.

The others were used after the experiment, including satisfaction questionnaire, mental workload questionnaire, and disorientation questionnaire. The questionnaires were given to each participant upon the completion of tasks in both experiments. Firstly, the satisfaction question for assessing the participants' satisfaction in both experiments was designed based on the study by Cook (1991). The questionnaires were given to each participant upon the completion of tasks in both experiments. The disorientation questionnaire for assessing the participants' feeling of loss was adopted from the study by Beasley and Waugh (1995). The participants wrote their subjective disorientation after experiment. The mental workload questionnaire was adopted by NASA-TLX questionnaires (Hart and Demand, 1988), including six parts: mental demand, physical demand, temporal demand, performance, effort, and frustration level. The participants wrote their feelings toward the experiments with self-report method in the mental workload questionnaire.

4.6 Procedure

The experiment took every participant approximately an hour for CSA test. Each participant began the experiment by filling out the general information questionnaire concerning his or her personal characteristics and previous experiences with using computers or handheld devices

The participants were assigned to participate both in the computer and the handheld device experiments, with exactly 30 minutes or so in each. Before the formal tasks, a brief practice session was conducted to help the participants to understand the operation of the system and the tasks to be performed. Each participant would finish the practice session until he or she completed the task without time limitation. Since the purpose of the training session was for practice only, the information in the practice session was irrelevant to the real tasks to prevent possible interference with the performance measure. The participants were asked to search for the target items on screen as required in a task sheet for practice. For the handheld device experiment, the participants would be asked to practice the input device, such as small keyboard. Following the practice session, each participant performed the information search tasks for the computer and the handheld device.

Upon completion of the formal experimental tasks, each participant was given an unexpected free recall memory test. The purpose of the memory test was to assess the level of difficulty of information retrieval from the long-term memory of the

participant. The participants were not told about the memory test before performing the tasks to ensure that no participants would try to memorize information during task performance. The memory test required participants to give a written free recall of the names of the categories, sub-categories and items from the interface within a limited period of time. The time limit for each participant was 10 minutes.

Finally, the participants were asked to complete a satisfaction questionnaire regarding performing the experimental tasks. The 50 items questionnaire used a 7 point evaluation scale. Each participant performed the tasks alone and was instructed not to discuss the contents of the experiment with other participants in the process of the experiment.

