Chapter 2 Literature Review

2.1 Cognitive Style

Cognitive style could be defined as “consistent individual difference in preferred ways of organizing and processing information (Messick 1984). Studying cognitive styles as an individual difference is a researched area. Many researchers have studied the importance of cognitive styles in the area of HCI research and their implications (Van der Veer, et al 1985). As indicated by Riding and Cheema (1991) and Rayner and Riding (1997), the past studies of cognitive styles can be categorized into three groups of models or labels:

- relating to cognitive organization –the Wholist-analytic style dimension
- relating to mental representation –the verbal-imagery style dimension
- reflecting a deliberate attempt to integrate both the Wholist –analytic and Verbal-Imagery dimensions of cognitive style.

The Wholist-Analytic style dimension is the tendency of organizing information into wholes or parts while the Verbal-Imagery style dimension is the tendency of representing information verbally or in mental pictures during thinking (Riding and Cheema 1991).

WHOLIST	ANALYTIC VERBALISER	ANALYTIC IMAERY
ANALYTIC	WHOLIST VERBALISER	WHOLIST IMAGERY

VERBALISER-IMAGERY DIMENSION

Figure 2.1 The group of WA and IV dimensions of cognitive styles

2.1.1 Wholist-Analytic Dimension

This dimension depicts how the participants think about, view, and respond to information and situation. This affects how they organize information during learning, perceiving their work situation, and relate to other people. The Wholist treats a situation as a whole and tends to have an overall perspective, and to appreciate its total context. While the analytics treats a situation as a collection of parts and tends to focus on one or two aspects of the situation at a time to the exclusion of the others (Riding and Cheema 1991).

The major limitation for the Wholist is that it is difficult to distinguish the issues that make up the whole of a situation. The analytic focuses on only one aspect of the whole at a time. However, the positive aspect of the Wholist is that they tend to have a balanced view

and can see situations in their overall context. The positive aspect of the Analytic is that they tend to analyze a situation into its parts, which allows them to get to the heart of any problem (Richard 2001).

2.1.2 Verbal- Imagery Dimension

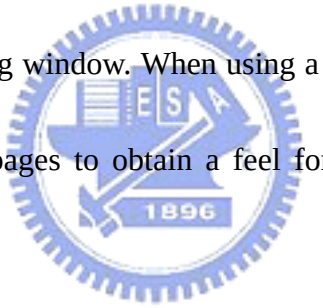
A second dimension of cognitive style identified by Riding and Cheema (1991) was the verbal-imagery dimension, dealing with the principal modes for representing information (Riding and Cheema 1991). Riding and Taylor (1976) indicated that learning performance was affected by the way knowledge was represented during thinking either using imagery, or verbally. In terms of the type of content, Imagers find concrete and readily visualized information easier than semantically and acoustically complex details, while Verbalisers are the opposite (Riding and Taylor, 1976; Riding and Calvey, 1981; Riding and Dyer, 1980). Verbalisers prefer and perform best on verbal tasks, while Imagers on concrete, descriptive, imaginable ones.

The Verbalisers think the information they read, see, or listen to, in words or verbal associations. The Imagers consider fluent, spontaneous, and frequently mental pictures either of representations of the information itself or of associations with it. Besides, the imagers would react more quickly to the appearance statements, because of the readily representation as mental pictures and the information for the comparison obtained directly and rapidly form these images. But the Verbalisers would have a shorter reaction time

because the semantic conceptual categories membership is verbally abstract and not represented in visual form (Riding and Rayner 1998).

2.1.3 Experimental Researches on Cognitive Styles

Riding (1998) indicated that several related factors to the cognitive styles: social behaviours, problem behaviours, personalities, physical situations, and gender differences (Riding and Rayner 1998). Riding and Sadler (1992) found that an analytic-imager, whose analytic style would not provide an overview of a situation, would attempt to use the whole-view aspect of imagery to make good the deficiency. Analytics tend to see material in parts and the restricted viewing window. When using a computer to produce hard copies of it so that they can scan the pages to obtain a feel for the overall structure. (Riding and Grimley 1999)



John and Boucouvalas (1999) reported on a set of experiments to assess the performance of the participants using interfaces that were designed to match their cognitive styles. The comparative experiments were carried out measuring scores over time duration. The cognitive styles they measured are Wholist-Analytic and Verbal- Imagery dimensions.

Riding and Grimley (1999) conducted two experiments with a sample of eighty 11-year-old students compared learning from computer-presented CD-ROM multimedia instructional materials on science topics with performance indicated by the results of

Standard Assessment Tasks (SATs) in science. When compared with the traditional work attainment for the analytics, the lower multimedia performance may partially reflect the fact that the computer has a limited window of reviewing and this reduces the performance of the analytics who find it more difficult to obtain a whole view, but does not adversely affect the Wholist.

2.2 Hypertext

There are strengths and weakness of hypertext-based systems. Hypertexts can give the users freedom to browse and interact with the information contained within them. hypertext-based system offers an extremely powerful way of accessing and organizing information. However, many hypertext systems do not achieve their full potential due to poor design (Otter and Johnson, 2000).

2.2.1 Problems in Hypertext

- Disorientation

One of the most frustrating usability problems is becoming lost. Otter and Johnson (2000) indicated that being disorientated is a difficulty which users experience when trying to navigate within hypertext systems. Getting lost in a display of network means that the user does not have a clear conception of relationships within the system, does not know

his/her present location relative to the display structure, and finds it difficult to decide where to look next in the system.

Three different forms of being lost are outlined when speaking in terms of hypertext, as opposed to navigation as follows (Otter and Johnson, 2000):

- Someone does not know where to go next;
- Someone knows where to go, but does not know how to get there.
- Someone does not know where he or she is in the overall structure of the document.

Users may often be disorientated by the sheer amount of choice offered by the hypertext, to the extent that they lack a clear understanding of the relationships lying within the system (Elm and Woods, 1985). In some cases the disorientated reader can miss entire sections of the hypertext document together, demonstrating a lack of closure (Hammond 1989).

- Mental workload

Conklin (1987) indicated that the hypermedia systems may indeed reduce learning by increasing cognitive load, also mental workload, but producing disorientation among users, particularly those with little experience in the medium or content domain.

2.2.2 Browsing

Marchionini and Shneiderman (1988) define browse as “an exploratory, information seeking strategy that depends on serendipity…especially appropriate for ill-defined problems and for exploring new task domains.” (Marchionini and Shneiderman,1988). Cove and Walsh (1988) use a three stage model to describe browsing:

- Search browsing; where the goal is known.
- General purpose browsing; consulting sources that have a high likelihood of items of interest.
- Serendipity browsing; purely random.

2.3 Mobile Commerce and Handheld Devices

The popularity of mobile phones and PDA in recent years is transfiguring the marketplace once again. Dollar increases in wireless services may soar from 37 billion dollars in 2001 to 74 billion in 2005 (William and Alan 2002). Therefore, the increased demand for handheld devices also grows extremely recently, by 2003, one-third of the population in Europe will surf the Internet from their cell phones and handheld devices, then more than 60 percent of the populations of Britain, France, Germany, Italy, and Sweden will have mobile phones (Marcia 2001). NTT DoCoMo, the wireless operator in Japan with 25 million subscribers, has partnered with vending machine and soft drink companies to accept payments for candy using wireless devices (William and Alan 2002).

Forty-four percent of mobile phone users surveyed would like to use their mobile phones for small cash transactions such as transit fees (bus, taxi, train) or items from vending machines (Card technology Today 2002). M-commerce offers new possibilities of the consumers, including banking, booking, or buying tickets, at anywhere and anytime (Stuart 2002).

Due to the relatively limited computing capabilities of handheld devices, the wireless web content must be simple, use relatively little memory and bandwidth, and need a small amount of processing by the device's central processing unit (CPU) prior to the content to the being displayed (Ray 2000). In addition, the mobility of the handheld devices is also another obvious characteristic. Ray (2000) indicated that a wireless user also faces some physical bandwidth constraints. It is hard to both make the users concentrate on the road and on the screen.

Regarding the designing of a small screen, Albert and Kim (Albert and Kim 2000) suggested the following limitations.

- The short-term memory limitation will impede from the comparative
- information competence for the users in the handheld devices.
- The small display will hinder the users from forming the mental model when browsing the content of the wireless websites.
- Scrolling and clicking will obstruct searching.

- The fact that the interface provides only the smallest pictures when browsing, it will decrease the ability of users to use the “landmarks.”
- One of the reading styles, skimming, will omit some text information block.

Han and Kwahk (1994) found that searching for menu items on a single line on a small display (such as those commonly found on consumer electronic devices) was three times slower than when a conventional display was used. However, Swierenga (1990) found that there was no significant effect on hierarchical menu search time with the smaller display with larger than single line displays.

Gessler (1995) found that the users of PDA are forced to frequently scroll to view all of the content, resulting in the whole browsing process being more difficult. Also, the battery of the PDA is also another weakness. The limitation of bandwidth postpones the users’ react time. However, as the technology develops, the two problems will be solved over time. Aaron et al.(1998) indicated two designation limitations of the handheld devices. One of the challenges has been to create clear and intuitive ways to access all the features. Another challenge has been to design graphics that indicate the phone’s status in various situations. Furthermore, the display the graphical indicators cannot all be displayed simultaneously.

Bryan and McGraw-Hill (2001) indicated three limitations of the handheld devices. First is the bandwidth of handheld devices. Next is the incomplete service coverage. Despite the global nature of the Web and of the telecommunications industries, coverage for the

wireless Web is far from global. Third, the content of the wired web may be the most paramount, but content is the undisputed supreme ruler on the wireless web.Even content designed for NTT DoCoMo's wildly popular I-Mode is limited to thousands, not millions of websites (Bryan Bergeron, McGraw-Hill, 2001).

Jennifer and DeAnna (2001) provided some considerations and suggestions for the designers to developing the handheld devices.

- Wireless users try to access specific information quickly. Due to the focused nature of wireless users, it is important to provide concise information that the wireless users can quickly scan.
- Due to the limited bandwidth and memory the largest deck should not exceed 1200 bytes.
- Device screen sizes vary, but typically the maximum screen resolution is 95 by 45 pixels.

Michael (2001) also offered that to prevent the wireless users from getting lost in the complex directory trees, developers will need to make wireless content shallow, based on a two-three-level architecture: home-page/index (or categorical headlines) and topic or full story. Some wireless gateways scale down conventional wireless web pages for the handheld devices, but some will not.