

CHAPTER III. METHODOLOGY AND RESEARCH DESIGN

This research intends to investigate: (1) the structure of travel information search on the Internet in the context of trip planning; and, (2) the satisfaction of travel information search on the Internet and its determinants. In the proposed conceptual framework, the concept of mental models is a central construct in explaining both a travel information searcher's navigation behavior and her/his satisfaction with travel information search. Thus, the concept, the representations and the measurement of semantic models were discussed first; second, two methods, thinking aloud protocol and process tracing method, were discussed in order to capture the travel information searchers' online behavior; third, the measurement and data collection methods for capturing the satisfaction and the travel information searchers' individual characteristics were discussed; last, the design of the study including detailed methods of analysis was discussed.

3.1 The Concepts, Representations and Generations of Semantic Models

This section details the different concepts of mental models, and explains their representation and the methods to generate them.

3.1.1 Defining the Concept of Mental Models

Mental models are a central concept in explaining usability when information searchers seek information in a hypertext system. However, different researchers define mental models through different perspectives. According to Norman, a mental model is "the model people have of themselves, others, the environment, and the things with which

they interact. People form mental models through experience, training and instruction” (Norman, 1988, p. 17). Furthermore, Johnson-Laird (1983) suggested that mental models are the basic structure of cognition: "... mental models play a central and unifying role in representing objects, states of affairs, sequences of events, the way the world is, and the social and psychological actions of daily life." (p. 397). However, mental models are incomplete and constantly evolving and usually are not accurate representations of a phenomenon (Kearsley, 2001). They are parsimonious, typically contain errors and contradictions and provide simplified explanations of complex phenomena. A mental model is also a construct frequently used in describing the interaction between the user and the information system and considered an important determinant of usability of information retrieval. Jacob and Shaw (1998) define a mental model as an “internal cognitive structure that the individual constructs, explicitly or implicitly, to represent a particular target domain, be it an event, an activity, an object, or a subject area.” (pp. 158). They further argued that the concept of mental models subsumes several related constructs such as scripts (Schank & Abelson, 1977), schemata (Rumelhart, 1980), and frames (Minsky, 1986). According to cognitive scientist Anderson (2000), knowledge can be divided into declarative knowledge and procedural knowledge. Declarative knowledge represents our understanding of concepts/ideas and the relationships between them; procedural knowledge stands for the knowledge of accomplishing a task. In other words, declarative knowledge is about “what” and procedural knowledge is about “how”. Since the Web is mainly text-based, and Internet browsers have relatively fewer functions (bookmarks, printing, history list, and Back and Forward buttons) which are easier to learn compared with frequent use of

Internet browsers, the mental model regarding declarative knowledge is much more important in information search on the Internet. Semantics deal with different concepts or different keywords regarding one concept. Therefore, the concept of semantic mental model is used here to differentiate the concept of mental models in the declarative knowledge sense (following Carley & Palmquist, 1992) from traditional view of mental models in HCI (Norman, 1990).

3.1.2 Representing Semantic Models

Connectionism is a movement in cognitive psychology which tries to explain human mind using artificial intelligent networks or similar constructs. This trend of research in cognitive psychology is in line with the macro-level of social network analysis, which treats social entities, concepts or individuals as nodes in a connected network (Wasserman & Faust, 1994; Doerfel & Barnett, 1999). As the hypertext world of the Internet changed our learning habit into non-linear and non-hierarchical (McKnight, Dillon & Richardson, 1991), it is argued that network model is a better way to represent this world and our mental models. As Theodore Nelson put it (1982):

“Intertwingularity is not generally acknowledged – people keep pretending they can make things hierarchical, categorizable, and sequential when they can’t. Everything is deeply intertwined.”

(Nelson, 1982)

The network view of cognition has been supported by various studies. The starting point of finding shared meaning and language is the understanding of cognitive process and the language comprehension (Doerfel & Barnett, 1999). According to Collins and

Quillian (1972), human beings have a networked semantic memory, in which concepts and their relations are represented by networked nodes. To demonstrate the existence of the semantic network, an experiment was carried out to test the subject's response time of the judgment of "true" or "false" for certain questions, for example, "Canaries can sing", "Canaries have feathers", to "Canaries have skin". According to their hypothetical semantic network (see Figure 3-1), the subjects would spend a longer time judging "Canaries have skin", since a subject needs to traverse from Canary node, to bird node and finally to animal node in order to validate this assertion. Judging "Canaries can sing" will take shorter time since the "can sing" is directly connected with "canary" node. The results of the experiment results confirmed their assumption. Furthermore, if two concepts were frequently encountered, they would be stored together even though the relationship could be inferred from the semantic network.

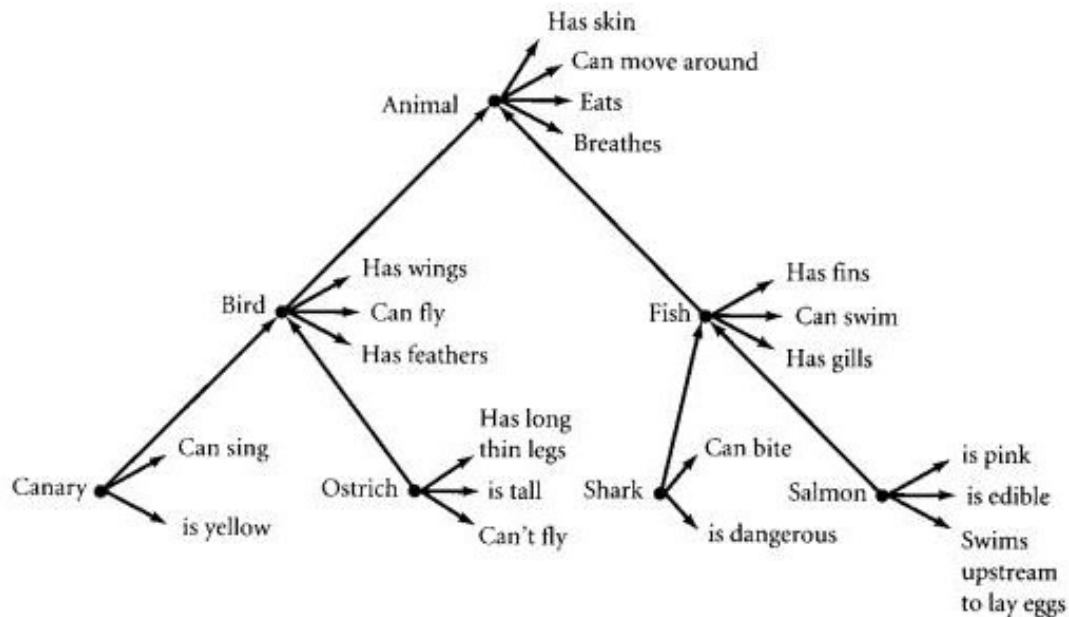


Figure 3-1. Collins and Quillian's Semantic Network (1972)

Similar concepts have been proposed to explain mental models including script (Schank & Abelson, 1977), schema (Arbib, 1986), frame and k-lines (Minsky, 1986), which are more related to procedural knowledge. The concept of script is based on the assumption of case-based reasoning (Schank & Abelson, 1977). Case-based reasoning relies on elementary unit which is called “case”. Human memory stores all types of known cases. When a novel situation arises, people will interpret the situation based on similar cases and take appropriate action. In Arbib’s view (1986) schema is a representation of the outside world including procedures for action. It can be seen as “habit”, a set of operational rules with stability and adaptability; it is also general characteristics of an action that allows the application of the same action to a different context. Furthermore, Minsky proposed that the human mind is composed of networked “dummy” agents (Minsky, 1986), which is similar to the concept of semantic networks advanced by Collins and Quillian (1972). By combining those agents using different hierarchy and networks into a “society”, Minsky demonstrated that human intelligence is possible. Even though Minsky’s agent has more functionality than “concept nodes” in Quillian’s semantic networks, it also demonstrated that networked entity is a valid representation of the knowledge state of human being’s mind. “Frame” and “K-Line” are two other important constructs related with mental models. A "frame" is a packet of information that helps to recognize and understand a scene. It represents stereotypical situations and shortcuts to ordinary problems. When a perception or a problem-solving task takes place, a data structure called "K-Line" (Knowledge Line) records the current activity (all the agents are active at the same time). The memory of that event or problem is a process of rebuilding what were active at that time.

3.1.3 Generating Semantic Mental Models

People have mental models which can be seen as internal representations of the world. Language is the key since language mediates thoughts and affects categorization of concepts and even social behavior (Vygotsky, 1962). According to Stryker (1980), human beings respond to their symbolic world which has been classified and categorized. Accordingly, we can use language as a window to explore a human being's minds (Carley & Palmquist, 1992). According to Carely and Palmquist (1992), "By studying language, we can build representations of the mental models that inform social action. Moreover, through analyzing the social use of language – in both written and oral texts – we can build representations of the models that inform and shape those texts" (p. 603). Therefore, semantic networks which are networked concepts with different proximity values between them can represent mental models (Doerfel, 1998).

According to Carley and Palmquist (1992), there are three major ways to elicit mental models: content analysis, procedural mapping, and task analysis. Content analysis has a long history in communication research and more recently has been used in research on Internet (Fahrman, Hartz, Wendling & Yoder, 1997; Cohen & Still, 1999; Bucy, Lang, Potter & Grabe, 1999; Bauer & Scharl, 2000; Haas & Grams, 1998a, 1998b, 2000). When travelers search information on the Internet, it is reasonable to assume that communication relies on the cooperation between the authors and the readers in order to convey meaning (Grice, 1975). By putting web pages in a structured format, the authors try to communicate with their readers based on their own understanding of web space

and domain knowledge. Readers, on the other hand, follow links, read text and pictures, and try to interpret the meaning of web pages (Haas & Grams, 2000).

3.1.4 Measuring A Travel Information Searcher's Semantic Mental Model and Semantic Model of Travel Information Space

The totality of the travel information space on the Internet comprises of a large quantity of travel related web sites. The information in this space is provided by various parties in tourism industry and they have their unique languages. Therefore, we refer to the concepts and languages of the travel information space as the semantic model of the travel information space. The understanding of traveler's semantic mental models and the semantic model of the travel information space as well as the interaction process of these two are essential in designing useful information systems. In this research, semantic mental models refer to the conceptual networks in the travel information searchers' minds when they interact with the Internet. These semantic mental models reflect a travel information searcher's search tasks, background knowledge, and their understanding of the travel information space.

3.1.5 Generating the Semantic Model of Travel Information Space

The representation of the results of the content analysis takes the form of networked concepts. Semantic network analysis as a quantitative method has been used to analyze communication content and generate networked representation of semantic models (Doerfel, 1998). The content of communication message, either phone conversations (Rice & Danowki, 1993), published journal articles (Doerfel & Barnett, 1999),

messages in a Bulletin Board System (Danowski, 1982), or a policy statement (Woelfel, 1993), have all been used for semantic network analysis. Different from traditional social network analysis, semantic network analysis uses text to capture the relationships between different concepts (keywords) (Doerfel, 1998). In general, semantic network analysis is a research method on shared meaning and a theoretical framework of analysis of cognitive process (Woelfel & Fink, 1980; Doerfel, 1998; Doerfel & Barnett, 1999). Research in communication states that the meaning of a concept can only be determined by the relationship with other concepts, and a model of networked concepts can accurately determine the meaning (Woelfel & Fink, 1980; Palmer & Barnett, 1984; Barnett, Palmer & Noor Al-Deen, 1984; Rice & Danowski, 1993). Since the concepts are embodied by the words in languages, semantic networks can represent sharing semantic models and collective mental models. The adjacency of two concepts in the text reflects their relative distance of their semantic meaning. Traditional content analysis for texts requires human-coding of the text (Krippendorff, 1980), which involves tedious and potentially biased operations. Alternatively, semantic network analysis uses the concepts and words as they appear in the text to construct mental maps (Woelfel & Stoyanoff, 1993). The advantage of this method is that there is no need for preconceived categories and the test of reliability between different human coders, and it has been used in organizational culture, communication research, marketing research and organizational structure (Doerfel & Barnett, 1999).

Semantic network analysis begins with a content analysis of textual data to extract the most frequently used symbols. The relative frequencies of co-occurrence of symbols

represent the relative distances between these symbols. Neural network analysis is then used to obtain the networked mental models of symbols. Neural network theory proposes that like the human brain which consists of a set of neurons, network connections can be switched “on” or “off” to denote if the information is transferable. The concepts in the text which are represented by keywords can be thought of as neurons in a neural network. Woelfel and Stoyanoff (1993) designed a program (CATPACII) to derive a semantic network from text. When reading a piece of text, CATPACII begins by passing a scanning window through the text, which contains specified number of consecutive words. When the words appear together in the window, the neurons representing these words are activated. Whenever two or more neurons are simultaneously active, the connections between them are strengthened by a small amount. CATPACII then reads a following window by skipping a specified number of words. Any neurons that were in the first window but are not in the second will lose part of their activation value, and neurons associated with words in the second window will become active. Since the neurons in the first window formed connections with the each other, the activations of the neurons now active can travel across these active connections to activate those neurons as well, so more neurons that are in the window might (or might not) become active. The connections among all the neurons are strengthened. The process continues until the end of the text.

Semantic network analysis can be performed on a range of communication discourses in order to extract semantic mental models (Doerfel & Barnett, 1999). Various tourism parties in the tourism industry, along with technological professionals, place

information on the Web, and use content including metatags to convey information. Metatags on web pages, including titles, descriptions, and keywords, are similar to the titles, keywords, and abstracts appearing in journal articles and other academic publications. However, metatags do not appear on all the web pages even though they contain valuable information. The downloaded HTML files also contain a substantial amount of information regarding the nature of the travel information space. The downloaded web pages can be put into semantic network analysis software to generate semantic models of the travel information space. Therefore, the tourism marketers' communication efforts, represented by the web pages they publish on the Internet and the metatags they use, can be analyzed using semantic network analysis.

For semantic networks, centrality values can be calculated in order to explore different positions of keywords in a semantic network. Centrality measures how "important" or "prominent" a node is in a network (Wasserman & Faust, 1994). In a nondirectional network a prominent node is the one which has many ties to other nodes, and it's more visible and involved with other concepts. Concepts with higher centrality values represent those concepts in the central positions of the semantic network. Those concepts with higher centrality value in the network can be compared across two semantic networks. Furthermore, group centrality measures how different the concepts in a semantic network are in terms of their centrality values (Borgatti, Everett & Freeman, 1999).

3.1.6 Generating Traveler Information Searchers' Semantic Mental Models

The mental models of travelers can be captured using semi-structured interviews regarding their goals, background knowledge regarding a specific destination, their general travel preference and travel experience. However, semantic network analysis uses neural networks to generate networked entities. A large set of training data is desirable. For communication content which is in small volume, this approach of semantic network analysis is not appropriate. Instead, map analysis can be used to generate a semantic mental model (Carley & Palmquist, 1992), whereby the keywords appearing in each subject's interview were put in a graph and when two keywords appeared in one sentence in the subject's verbalization, a link is formed between these two keywords.

3.1.7 Measuring the Congruence of Travel Information Searcher's Semantic Mental Models and Semantic Model of Travel Information Space

This research examines the congruence of two semantic models representing two different sets of languages and views regarding online tourism. The semantic model of the travel information space can be generated from semantic network analysis of the full text of travel related web sites. The semantic mental model of the travel information searchers, on the other hand, can then be generated from map analysis of transcripts of interviews with the travel information searchers regarding their information search goals, background knowledge of a specific destination and travel experience, and their understanding of the Internet as a travel information source. The results of the two analyses actually are matrices of concepts with weights representing the degree of

connections between them. The most commonly used measure of congruence between the two matrices is the number of common keywords where the more keywords they have in common indicates a greater degree of overlapping. Furthermore, the common keywords may have different relationships in the two matrices. For example, “hotel” may be closely related with “luxury” in one matrix but it is far away from it in another one. Since the cells in a matrix are not totally independent to each other, QAP analysis (Quadratic Assignment Procedure) proposed by Krackhardt (1987, 1988) can be used to measure the relationship of two matrices with common keywords. The traditional regression analysis will generate small standard error terms. Instead, random permutation of rows and columns is performed in QAP analysis. The correlation of the random permutation is compared with the observed value in the actual data, and the position of the observed value on the distribution of all possible permutation can be obtained. For example, if only 3.3 percent of random permutations have a correlation value larger than 0.8 (we assume 0.8 is the actual observed value), then the correlation of 0.8 is significant at .03 level. Monte Carlo simulation tests showed that QAP analysis is superior to Ordinary Least Square (OLS) in terms of bias and efficiency (Krackhardt, 1987, 1988).

3.2 Thinking Aloud Protocol and Process Tracing Methods

In order to understand the structure of travel information search on the Internet, the thinking aloud protocol can be used to explore the information processing when travelers search for travel related information on the World Wide Web (Van Waes, 2000; Eveland & Dunwoody, 2000). Thinking aloud protocol was advocated by

Ericsson and Simon (1993) and is widely used in usability testing of computer products in recent years (Rubin, 1994). It is argued that language mediates thoughts and therefore, we can understand the cognitive process during information search through the language of the subjects (Carley & Palmquist, 1992). When a subject is carrying out a task, s/he is asked to verbalize his or her thoughts, feelings, and opinions. In order to familiarize the subjects with this method, prior to their search task, a training session usually is performed in order to coach the subjects to talk about their thoughts. In the traditional method of protocol analysis advanced by Ericsson and Simon (1993), any interaction between the test administrator and the subjects were considered to contaminate the information processing of the subjects. However, Ramey and Boren (2001) argued that this method is rarely applicable in a usability testing context, since most of time the task is not a single problem-solving task and the products being tested are always under development; therefore, many unexpected events may happen. Instead, Ramey and Boren provided a framework which allows a greater level of interaction between the subject and the test administrator including prompting. The second method was used in this study.

The coding and analysis of verbal protocols takes many forms depending on the theoretical assumption of the research. Usually a coding scheme is devised and the protocol is broken up into different segments. Aggregation of individual segments is based on different theoretical considerations, which can be aggregation by episodes, aggregation by solution steps, or aggregation by processes (Ericsson & Simon, 1993).

Process-tracing methods have been used to capture the clickstreams of the subjects (Wang, Hawk & Tenopir, 2000). Payne, Bettman & Johnson (1993) used a MouseLab system to explore decision making process. Subjects were presented alternatives hidden under some boxes. In order to retrieve the information, the subjects need to click on the boxes to reveal a piece of information regarding certain alternatives. The clickstream (which is similar to clickstream on the Internet) and the time for each view can be captured using computer software. Wang, Hawk & Tenopir (2000) used the processing-tracing method to capture information search behavior on the Internet. In the study they tracked both the information search behavior through clickstream and verbal reports through thinking-aloud protocol. NetSnitch, a monitoring program installed on the computer was used to create log files of URL visited; a camcorder recorded a continuous screen shots with timestamps, which also captures the subjects' verbalization during the process.

3.3 Measurements and Data Collection Methods

In order to explore the travel information search on the Internet in the context of trip planning, a formal trip planning exercise was designed with the following measurements and data collection methods (see Figure 3-2 for an overview). In the exercise, the subject will be asked to plan a trip to a designated destination using the Internet within certain period of time.

3.3.1 Pre-exercise Survey

The goal of the pre-exercise survey was to collect each subject's individual characteristics, including their travel experience, computer and Internet use experience, and the experience of using the Internet as a travel information source (See Appendix A for a copy of the survey).

The subjects' travel experience was measured using the general questions regarding: the number of trips in an average year (Question 1); the trips taken in the last year (Question 2); self-evaluated travel experience (Question 3); and, destination-specific travel experience (Questions 4, 5 and 6) (In Table 3-1).

Multiple questions were proposed to measure the subjects' computer and Internet use experience. In Table 3-2, the questions measure their actual computer and Internet access (Questions 1 and 2), computer, Internet, and email use history (Questions 3, 4, and 5), amount of email received and Internet access (Questions 6 and 7), and self-evaluated computer and Internet use experience (Question 8 and 9).

In terms of measuring computer and Internet use experience and travel related Internet use experience, the questions regarding whether or not the travel information searchers have used the Internet to check out destination information, hotel information, airline information, book airline tickets, reserve hotel rooms, and rent cars online were used to measure their experience of using the Internet as travel information source. (Table 3-3).

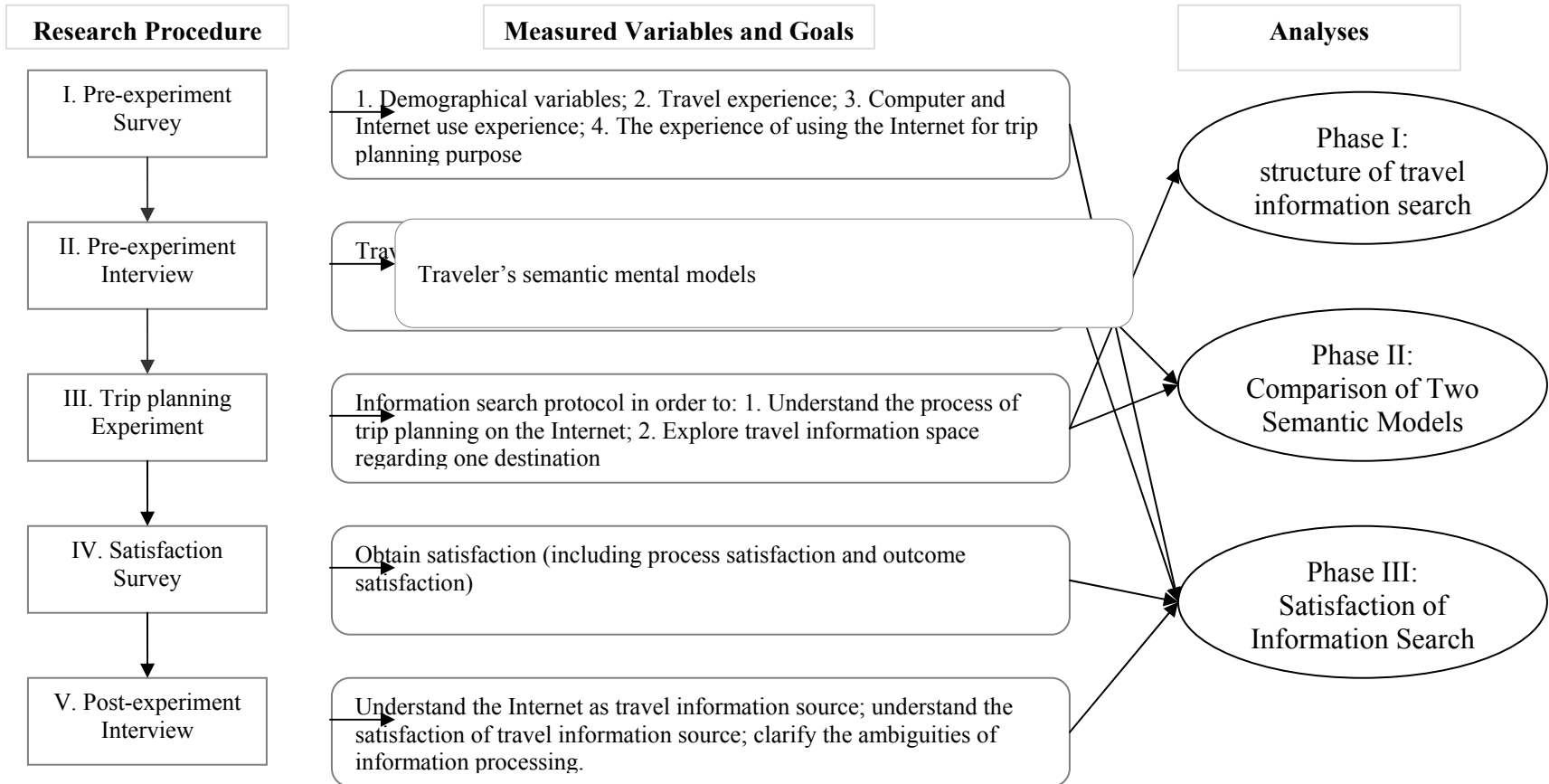


Figure 3-2. Formal Research Procedure

Table 3-1. Measurement of Travel Experience

| | |
|----|--|
| 1. | How many pleasure trips (more than one day) have you taken in the last 12 months? _____ Number of pleasure trips |
| 2. | Generally speaking, how many pleasure trips (more than one day) do you usually take in a typical year? _____ Number of pleasure trips |
| 3. | Do you consider yourself an experienced traveler? Not At All 1 2 3 4 5 6 7 Definitely |
| 4. | Have you been to San Diego before? a. Yes, _____ time (times) b. No |
| 5. | Have your family members or relatives been to San Diego before? a. Yes, _____ time (times) b. No |
| 6. | Have you been to California before? a. Yes, _____ time (times) b. No |

Table 3-2. Measurement of Computer and Internet Use Experience

| | | | |
|----|--|------------------|----------------|
| 1. | Do you or members of your household own a computer? If YES, is this computer connected to the Internet? | a. Yes a. Yes | b. No b. No |
| 2. | Can you access a computer in your office? If YES, is the computer connected to the Internet? | a. Yes a. Yes | b. No b. No |
| 3. | When did you start to use computer? | Year 19____ | |
| 4. | When did you start to access World Wide Web? | Year 19____ | |
| 5. | When did you have your first email address? | Year 19____ | |
| 6. | How many days do you access your email during an average week? _____ Days On such a day, approximately how many email messages do you receive? _____ Emails | | |
| 7. | How many days do you access WWW during an average week? _____ Days On a day you use the WWW, about how long do you use it? _____ Hours | | |
| 8. | What do you think about your computer experience level? No experience 1 2 3 4 5 6 7 A lot of experience | | |
| 9. | What do you think about your Internet experience level? No experience 1 2 3 4 5 6 7 A lot of experience | | |

3.3.2 Pre-exercise Interview

The objective of pre-exercise interview was to obtain data that would be used to measure the subjects' semantic mental model of San Diego prior to their trip planning. Their semantic mental models represent their search tasks, background knowledge, and their understanding of the travel information space (Hsieh-Yee, 2001). The interview followed a semi-structured format in order to elicit different semantic mental models (see Appendix B).

3.3.3 Online Information Search Exercises

The objectives of this exercise were to explore the travel information search and trip planning process as a goal-oriented activity as the interaction between traveler information searchers and the travel information space. Prior to the exercise, the subjects were informed about the intention of this exercise and asked to write a short paragraph regarding their travel plan upon the completion of the exercise. A maximum of one hour was set for the duration of the exercise to ensure that the subjects were not exhausted and they had sufficient time to complete the travel plan.

Table 3-3. Measurement of Experience of Using the Internet for Trip planning

Have you ever used the Internet to:

| | Yes | No |
|-----------------------------------|-----|----|
| Check out destination information | | |
| Check hotel information | | |
| Check airline information | | |
| Book airline tickets | | |
| Reserve hotel rooms | | |
| Rent cars online | | |

Prior to the exercise, the subjects were asked to verbalize their thoughts during their information search (Ericsson & Simon, 1993). A microphone between the subject and the computer monitor was used to pick up the subject's verbalization. A warm-up exercise was conducted in which the subject was asked to find out the weather information. An online camcorder program (Camtasia) was used to record the screen activities as a movie file, including the add-on sound effect of mouse clicking and keyboard activities (TechSmith, 2003). Another computer and Internet monitoring software (iOpus Starr) was used to record web pages visited, timestamp, keystrokes, and computer programs used (IOpus, 2003). A digital camcorder was used to record the facial expression and information behavior of the subjects; for example, writing down information on a piece of paper, print out web pages from the printer, and etc. The physical setting of the trip planning exercise can be seen in Figure 3-3. Four sets of data were obtained: (1) clickstream data from the Internet monitoring software; (2) online movie recorded from the screen capturing software; (3) movie of the subject's behavior from the digital camcorder; and, (4) artifacts from travel information search, including print-out and sheets of paper used for information organization. The combination of these four sets of data provided sufficient information for assessing the information processing during travel information search.

3.3.4 Post-exercise Satisfaction Questionnaire and Interview

After the exercise, the subjects were asked to complete a survey regarding their levels of satisfaction toward their travel information search and trip planning process (see Appendix D). Few studies have been conducted on the satisfaction of information

search except satisfaction of online shopping experience (Cho & Park, 2001). Extensive studies have been regarding users' satisfaction toward information systems or computer systems (Mullins & Treu, 1991; Mahmood, Burn, Gemoets & Jacquez, 2000). Two aspects of satisfaction, process satisfaction, which implies satisfaction toward the process of travel information search, and outcome satisfaction, which measures directly how the subjects feel about the outcome of travel information search, were measured using multiple questions (de Bruijin and de Vreede, 1999). In Table 3-4, outcome satisfaction was measured by Question 2, 3, 4, 7, 8, 9, 10 and process satisfaction was measured by Question 1, 5 and 6. Furthermore, the subjects were interviewed in order to clarify their information search by going through the recorded movies along with the test administrator.

3.3.5 Content Analysis of Travel Information Space

The travel information space regarding San Diego was operationally defined as those web sites which were visited by more than one subject. The full text of the top two levels of web pages of these web sites were downloaded and analyzed using semantic network analysis (Woelfel & Stoyanoff, 1993). The resultant semantic network represents the semantic model of San Diego's travel information space. From the actual results, it was found out that the subjects used a large amount of web sites for trip planning. Various methods were explored in the pilot study, including downloading the complete tourism web sites. Further analysis showed that this method was not feasible because: (1) the quantity of web pages downloaded is huge and the analysis is not

feasible; (2) the result was significantly biased toward those web sites with a large quantity of web pages on one specific aspect of tourism.

3.4 Research Design and Procedure

In general, the travel information space is huge and diversified. One destination was chosen for the trip planning purpose in the experimental settings. To simulate the real world situation, a real destination was selected as the hypothesized destination. Since background knowledge is one important element in determining semantic mental models, a destination with relatively long distance was selected to obtain various levels of background knowledge. Furthermore, this destination should have relatively diverse attractions and a variety of images. On the other hand, the number of attractions should not be enormous since it will produce a huge travel information space which is difficult to analyze. In this study, San Diego, California in the United States was chosen as the destination for trip planning purpose.

The study was divided into a pilot study and a formal online trip planning exercise. In the pilot study, the research methods were inspected and the instrumentation was refined. Five subjects were recruited using convenient sample from a major mid-west university (University of Illinois at Urbana-Champaign). The pilot study was conducted in May and June of 2002. In the formal exercise, the structure and satisfaction of travel information search on the Internet was explored using refined instruments. Fifteen students and researchers from the same university were recruited by advertising in the university newsgroups and the formal exercise was conducted in August of 2002.

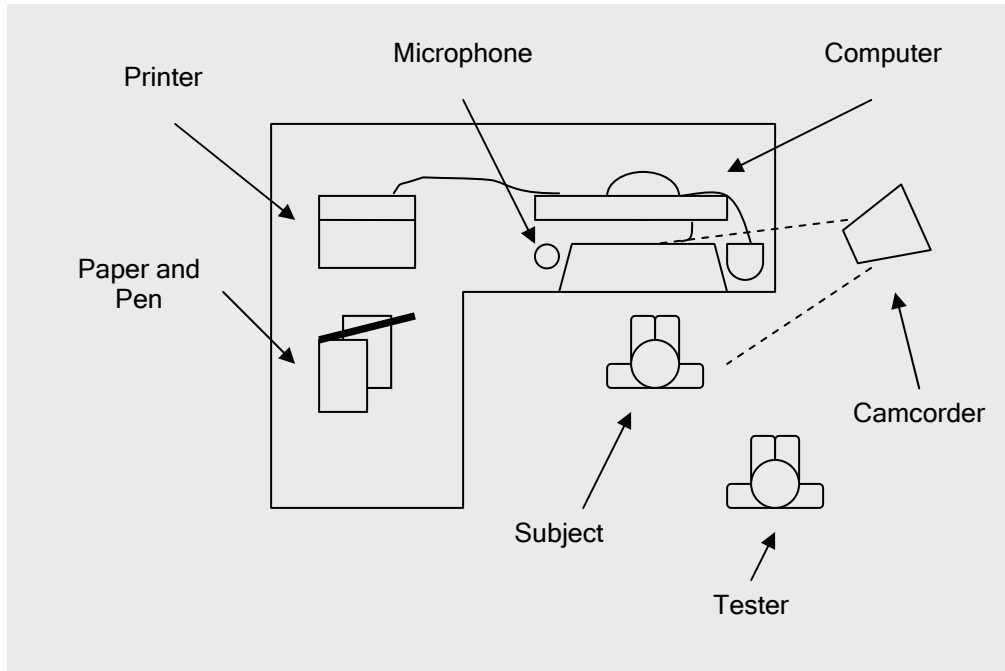


Figure 3-3. Physical Settings of Trip planning Exercise

Table 3-4. Measurement of Satisfaction of Travel Information Search

| |
|--|
| 1. I was satisfied with the information search today. |
| 2. The information search met my expectations. |
| 3. I am confident about my travel plan. |
| 4. I am ready to take the trip next week. |
| 5. I had a wonderful experience planning my trip. |
| 6. I was frustrated by looking for the information on the Internet. |
| 7. The result of today's information search is satisfactory. |
| 8. With respect to the outcomes of today's trip planning, I have many complains. |
| 9. The outcome of today's activities does not meet my initial expectations. |
| 10. I will need to find more information before I take the trip. |

3.5 Analysis Phases

A large amount of data was collected, including the original records from the Internet monitoring software, movies from the online screen capturing software, and digital movies from the digital camcorder, transcribed verbalization of the subjects, and information artifacts (e.g. print-out of web pages and paper used by the subjects for

organizing information). The triangulation of these data sets forms a general protocol including informational behavior, URL visited, subject's verbalization, and the interpreted behavior. With generated data described above, the following analysis was performed:

3.5.1 Phase I: Understanding the Process of Travel Information Search on the Internet

The goals of process-tracing method and protocol analysis were to explore different information processing behavior and the structure of travel information search. Mapping the search sequence into directed graph and undirected graph was used to look at different episodes during users' travel information search (Hodkinson, Kiel & McColl-Kennedy, 2000). Hodkinson, Kiel and McColl-Kennedy used different web sites as nodes in their graph to represent a consumer's web search behavior. For every click in the information search, the clicked link anchors represent the semantic focus of the travel information searcher's mental model at a certain point of time. Therefore, in this research, click anchors were used to represent the prominent semantic concepts in an information searcher's mind. Furthermore, from information searchers' verbalization, different episodes can be distinguished. For example, the information searchers may get frustrated and say, "I can't find it so I'm going to try a different site..." or "now the hotel is out of the way, let's see the parks..." Usually there is an end result to an episode: either the user got frustrated so s/he switched web sites or the user made her/his decision and s/he took on next sub-goal. The end results were represented in square boxes to distinguish them from round boxes which represent web

nodes. Additionally, the navigation behavior was represented by labels on the paths of the graph; for example, the user may click a link to move to the next web page, or s/he can switch to a different web site by typing the URL in the browser's address box. For access to the same node at different times, sequential numbers were added on the path labels (see Figure 3-4 for an example).

3.5.2 Phase II: Understanding the Congruence and Discrepancies of Traveler's

Semantic Mental Models and the Semantic Model of Tourism Information Space

The goal of Phase II analysis was to compare the semantic models of the subjects and the travel information space in a global level. The discrepancies and congruence between the two models reflected their different views on tourism and further revealed the root of usability problems of the Internet as a travel information source. The transcribed interviews were aggregated and analyzed using CATPACII in order to generate a general semantic mental model of travelers. The downloaded web pages from most visited tourism web sites (visited by at least two subjects) were aggregated and analyzed using CATPACII in order to generate the semantic model of San Diego's travel information space (Woefel & Stoyanoff, 1993). The number of common concepts is the first measure of the degree of their commonality. Furthermore, QAP analysis was performed using the two matrices in order to generate the correlation between these two matrices. The two measures, number of common concepts and correlation between two matrices of the two matrices of common concepts, were then used to measure the differences of these two semantic models.

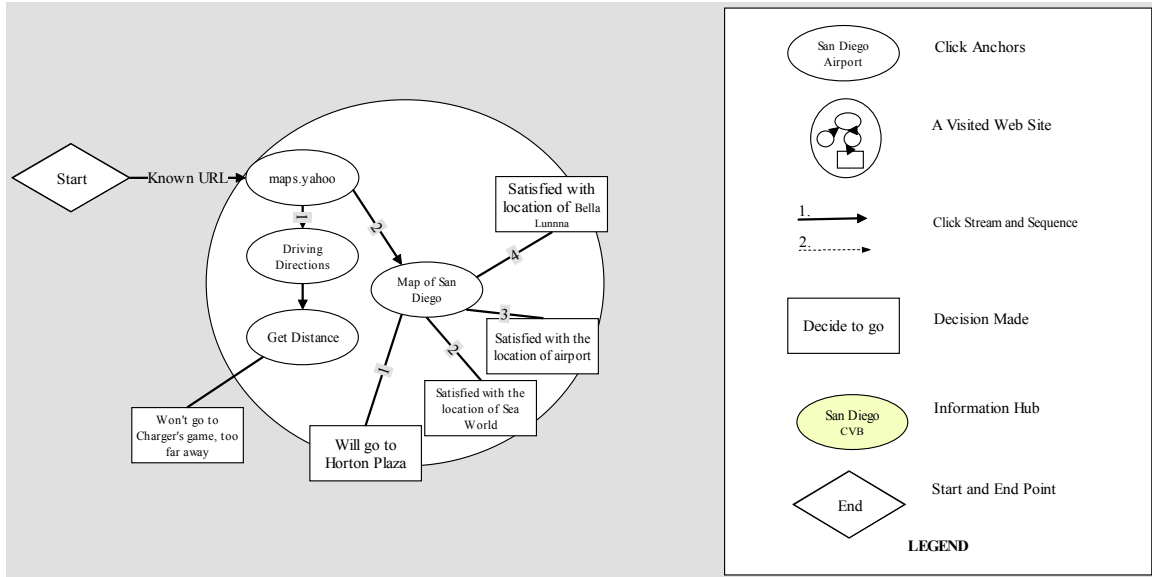


Figure 3-4. Information Search Graph Example

3.5.3 Phase III: Explore Relationships between Congruence of Two Semantic Models with Satisfaction of Travel Information Search and Individual Characteristics

In phase III, the objective was to explore the relationship between: (1) traveler's individual characteristics; (2) the congruence of each travel information searcher's semantic mental model with the semantic model of the travel information space; and, (3) satisfaction of travel information search. Each subject's individual characteristics and satisfaction level with the travel information search were obtained through pre-experiment and post-experiment surveys. Map analysis (Carley & Palmquist, 1992) was used to generate semantic maps from each individual travel information searcher's transcribed interview (see Figure 3-5 for an example). The keywords appeared in each subject's interview was put in a graph and when: (1) two keywords appeared in one sentence; or (2) two keywords are closely related in the subject's verbalization, a link is formed between these two keywords. An undirected graph can be formed through this

method. The concept matrix of the travel information space had already been obtained from Phase II, so the number of common concepts was counted as the first measurement of their congruence; furthermore, QAP correlation analysis was performed on the pair of common concept matrices to generate the second measurement of their congruence. The congruence measures, subjects' individual characteristics, and satisfaction with travel information search can be correlated in order to explore their relationships.

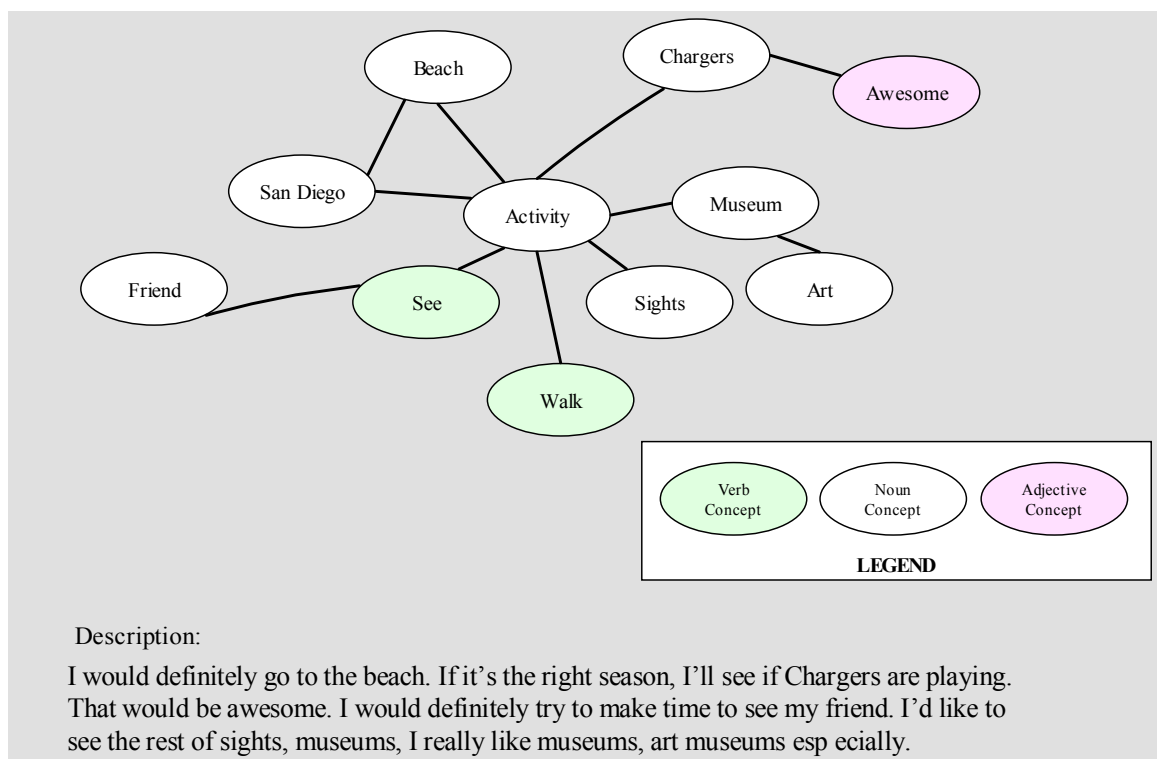


Figure 3-5. Generating Semantic Mental Model from Description

3.6 Summary

In this chapter, the central concept of mental models, research methodology, research design, and research procedure were outlined. A distinction was made between semantic mental models and the concept of mental models in HCI area. Semantic

network analysis was proposed as a method to extract semantic mental models of travelers and the semantic model of the travel information space. Protocol analysis and process-tracing methods were used on a trip planning exercise on the Internet to investigate the information processing and information behavior. Two different methods were used to capture the semantic models of the subjects and the travel information space: semi-structured interview was used to elicit information searcher's mental model prior to their information search; semantic network analysis on full text of web pages was used to extract the semantic model of the travel information space. Surveys were used to capture a travel information searcher's individual characteristics (travel experience, computer and Internet use experience, the experience of travel information search on the Internet) and the satisfaction of travel information search on the Internet. The congruence between semantic mental models of travelers and the semantic model of the travel information space was measured by counting the number of overlapping concepts and correlation from QAP analysis (Krackhardt, 1987, 1988) on common concepts. Correlation analysis was used to explore the relationship between the congruence of the two semantic models, with satisfaction of travel information search, and the relationship between the congruence with information searcher's individual characteristics (travel experience, computer and Internet use experience, and the experience of using the Internet as a travel information source). The next chapter detailed the outcomes of the research and conclusions drawn.