CHAPTER II

LITERATURE REVIEW

Presenting information about a place on a Web site involves interpretation of that place and publishing it in a hypermedia environment. The purpose of this presentation is to evoke an awareness and appreciation for the natural attractions of that place through learning. Therefore, designing a virtual tour Web site to create an environment for learning can implement concepts of topophilia, interpretation, and the optimal experience theory. The part that appears to be missing is an intermediate framework that builds a bridge between these areas and translates information into the hypermedia context. The concepts of topophilia and interpretation can provide insights into the representation of a geographical place as texts and images. The optimal experience theory provides tools for analyzing and examining the effects of this representation. The perspective taken in this research is that of visiting a virtual tour Web site is an information-seeking behavior. A virtual tour Web site also stages an experience for the visitor. It is a problem-solving activity that is dependent on, and influenced by, the interpretive material that is presented, the visitors' prior knowledge and experiences, and communication channels.

Interpretation

Interpretation and Creating a Place

Developing a virtual tour Web site involves introducing visitors to tourist attractions over the Internet. These attractions might be ignored otherwise. Kimmel (1999a) suggests that the core of nature tourism is interpretation. Tilden (1957, 8) defines interpretation as "an educational activity which aims to reveal meanings and relationships through the use of original object, by firsthand experience, and by illustrative media, rather than simply to communicate factual information." An interpretive aspect of designing a virtual tour Web site for nature tourism would convey the intrinsic value of nature through text, photographs, and sound, and introduce an appreciation of the natural qualities of a place. It would involve translating "nature" into words and images where important characteristics could be readily recognized.

Interpretation is applied geography (Kimmel 1999b). It helps people to develop a sense of place (Knudson, et al. 1999). A place is "a portion of geographical SPACE occupied by a person or thing" (Duncan 1994, 442). Geographers have recognized that interpretation is important in the creation of a place. Tuan uses "topophilia" to describe the emotional attachment that people have to geographic place. It is the relations, perceptions, attitudes, values, and views that bond people and places.

Then what are the roles of interpretation in the recognition of a place? According to Tuan (1977), places can be created by catching people's attention. People can create a place by pointing out one place rather than another (Tuan 1977). Places do not have to have visual prominence in order to catch attention. Artistic representation can draw

attention to areas that may otherwise fail to be noticed (Tuan 1977). In other words, places become real through "dramatization" (Tuan 1977, 178).

What are the roles of images and iconography in place recognition? Representing spatial information as images is intuitively appealing (Lloyd 1997). Kosslyn and Pomerantz (1977, 53-57) argue that (1) "images are spatial representation . . . that provides an experience similar to seeing an object during visual perception;" and (2) "the visual system in the brain supports imagery." The symbols and metaphors for a place reflect and affect people's attitudes toward a particular place and create a sense of place. It is one of the many characteristics that convey local identity.

Learning about a Place through Interpretive Information on the Internet

In his more recent articles, Tuan (1991, 1994) recognizes the role of interpretation through media and communication to make a place and create a sense of place, though he does not use the word "interpretation." He states that what media present can significantly influence how people perceive. Then, how does the Web as an interpretation medium help to stimulate affection for a place through informing and learning? The Web offers the opportunity to construct representations of real places as virtual worlds and share them with others (Brunn and Cottle 1997). Laurel (1993, 14) notes that the virtual world can "raise consciousness about the natural world by giving people remote firsthand access to places on the earth." Brunn and Cottle (1997) use the term "cyberboosterism" to describe the practice of publicizing a place on the Web.

Taylor (1997) believes that virtual worlds provide opportunities for learning by stimulating more of the senses than in a traditional classroom. There are three modes of

learning: enactive, iconic, and symbolic (Bruner and Olsen 1973). Enactive learning is defined as learning by doing. Iconic learning is learning by depiction in an image. Symbolic learning is learning by restatement in words. Successful learning strategies would combine all three of these modes of learning**.** In other words, they should be active and engaging, and multi-representational. Virtual tour Web sites can facilitate all three modes of learning. The interactivity of the Web provides an enactive learning environment. Audiences can explore the content of the Web pages through interactions with the computer according to their own needs and at their own pace. Multimedia contents with images, sounds, and text materials that represent local geographic features can enhance the iconic and symbolic representation.

The Web as a Medium for Interpretation: Hypertext and Hypermedia Environment

Definitions of Hypertext and Hypermedia

Information flow occurs on the Internet through navigation in a hypertext or hypermedia environment. There are many definitions of what constitutes hypertext. Nelson (1967) defines hypertext as machine-readable text that is not sequential but is organized so related items of information are connected. The most important characteristics of hypertext are that it implies a network of nodes and links and it is nonsequential. “There is no single order that determines the sequence in which the text is to be read” (Nielsen 1995, 1). Therefore, Bornman and von Solms (1993, 260) define hypertext as: “the concept of nonsequential writing of information that allows the user to connect information together by means of different paths or links.” Halasz (1988)

proposes a much narrower definition. He suggests that a true hypertext system should include an explicit representation of the network structure in its user interface. Many current hypertext systems lack this important feature. At any given time, the audience can only see the current node, or when they precede, the links that follow this node. A practical reason that many systems do not graphically represent the structure is that for a large complex system, it would be difficult to fit all the nodes and links on a computer screen.

The traditional definition of the term "hypertext" implies that the system deals with plain text (Nielson 1995). Because many current systems actually include multimedia materials, people use "hypermedia" to highlight the multimedia aspects of the system. Conceptual definitions for hypertext and hypermedia are essentially the same (Dix, Abowd, and Beale 1993). Newton (1993, 494) defines hypermedia as "A way of delivering information that provides multiple connected pathways through a body of information. Hypermedia allows the user to jump easily from one topic to related or supplementary material found in various forms, such as text, graphics, audio or video." Because these two terms are often used interchangeably in the literature this research will use the term "hypermedia."

Characteristics of Interpretation on the Internet

The Internet represents a fundamentally different communication environment from traditional media (Hoffman and Novak 1996). The characteristics of communication on the Internet include interactivity, nonsequential exhibition through network navigation, and a multimedia environment.

Interactivity and nonsequential exhibition

The Internet has revolutionized the way we communicate. One advantage of this new computer-mediated environment is that it supports interactivity and nonsequential exhibition. Rogers (1986) defines interactivity as the ability of new communication systems to talk back to the user, almost like an individual participating in a conversation. [Interpretation] "research has shown that interactivity exhibits of any sort are more effective than passive exhibits at attracting and holding attention, and enhancing learning" (Beck and Cable 1998, 106).

According to Ham (1992), there are two types of presentation in interpretation: linear or sequential and nonlinear or nonsequential presentation. Sequential communication has a beginning, middle, and an end. The presentation designer establishes a format that the audience must follow. With linear representation, audiences have no selection of the sequence of information that is presented. Nonsequential communication has no set order to follow. It allows the audience to pick and choose what it wants. The designer has only limited control over the choices that the audience makes.

Traditional ways of exhibiting places and attractions include brochures, slide shows, TV programs, videos, or books and articles. These media are sequential communication. Interactive computer exhibits facilitate nonsequential exhibition (Beck and Cable 1998, 107). In a hypermedia environment, nonsequential searches and retrieval of information are supported through the process of navigation. The nonsequential nature of a hypermedia computer-mediated environment can facilitate an audience reaching different layers of information according to its own needs (Nielsen 1995). A geographical

metaphor for “navigation” in a hypermedia environment is “travel in cyberspace.” It refers to the activity of on-line interaction as taking place with locations (Stone 1994).

Multimedia environment

According to Newton (1993), multimedia is the combination of different types of media to communicate information between two users and their computers. Bornman and von Solms (1993, 261) define multimedia as “the combining of the different media technologies, for example text, graphics, full motion video, sound and animation.” A hypermedia environment is the combination of multimedia and hypertext (Bornman and von Solms 1993). The multimedia characteristics of a hypermedia environment make it possible to present interpretive information in the form of text, animation, pictures and sounds in a nonsequential manner.

Interpretation Qualities on Web Page Designs

Interpretation Literature on Qualities of Interpretive Presentation

Brigish (1993) argues that a successful Web site must be easy to use, fun, fast, personalizable, comprehensive, highly visual, and browsable. The following section overviews essential qualities of the interpretive approach that have been identified in the interpretation literature.

Interesting and enjoyable

Interpretation should be done in a way that is entertaining and interesting to the audience. Interpretive presentations should be designed in a way that informs, entertains,

and enlightens (Beck and Cable 1998). Although local information is the basis of interpretation, it is not interpretation (Tilden 1957). “Interpretive messages must be interesting to capture attention, meaningful so that people care, and compelling so that people no longer think or act the same afterwards” (Beck and Cable 1998, 16). In his list of nine universal steps of instruction, Gagné (1987) emphasizes gaining the audience’s attention. Beck and Cable (1998) believe that an interpretive program must address the audience’s interests, and effective interpretive delivery must be applied after the audience’s interests are stimulated. The use of multimedia is one strategy that can be used to catch the audience’s attention.

Dependable

Incorporating high technology into an interpretive program must be done with care (Beck and Cable 1998). The Internet allows people to view and experience places and to learn new things that were previously difficult or even impossible to gain access to. However, its complexity and sophistication can intimidate people who are computer illiterate. A very common problem in viewing Web sites is that the contents are not compatible among different browsers. Beck and Cable (1998) suggest that the high-tech industry sometimes exhibits a technological arrogance. Therefore, applications of new technologies must be dependable.

Avoid information overload

According to Hiltz and Turoff (1985), information overload refers to the reception of too much unwanted information. Information overload is a common problem in this information age. Information overload generally refers to the idea that the amount of

information has reached such proportions that it no longer has any relation to the solution of problems. Winett (1986), from a marketing perspective, suggests that, because most information acquisition comes from low-involvement learning, information that is available must be easy to find and see, be comprehensive, and be simple to remember. On the other hand, excessive information results in information overload.

There are limits to the cognitive processing capabilities of humans (Hutchins 1996). "Research generally supports the notion that excess leads to a loss of attention" (Beck and Cable 1998, 118). Studies have shown that visitors spend less time viewing exhibits as the number encountered increases (Beck and Cable 1998). However, there appears to be no answer to how much is too much.

Engaging all senses

Multimedia representation is an approach to stimulating multi-senses. Research (e.g. Palmer 1995) has suggested that multi-sensory presentation and interaction is superior to more restricted communication channels.

Meaningful and thematic interpretation

All interpretation should have a theme that has a specific message to communicate (Ham 1992; Beck and Cable 1998). Thematic interpretation occurs when all information presented is related to a key idea and gives a central message (Sindelar 1999). Thematic presentation is easier to comprehend and more meaningful than nonthematic presentations (Ham 1992). People tend to remember themes and forget facts (Ham 1992; Beck and Cable 1998). The theme is also a good way to organize the

material. Starting with a clearly defined theme can simplify planning and the presentation design (Ham 1992).

Just as theme titles can be used for exhibits with other interpretive media, they can also be used in Web pages. Pages with theme titles are a good way to help people understand the message, as the title may be the only thing they read and remember. Themes may also be a good way to help organize a Web site.

Computer Science Literature on the Quality of a Web Site

Nielsen (1995, 361) compares the advantages and disadvantages of using hypermedia versus printed paper materials as follows.

Advantages

1. Can show moving images, animations, film
2. Easy to update -- can permit automatic downloading of changes
3. Can be shipped over networks
4. Making single copies is easy
5. Takes up less physical storage space
6. Can be shared by several people
7. User-oriented reading
8. Potentiality: The whole world's literature a click away

Disadvantages

1. 30% slower reading speed on current displays

2. Lower resolution graphics
3. Overhead in having to set up computer
4. No user interface standard
5. No standard for data transfer
6. No regular publishing channels
7. Computer text “homogenized”

Not all applications can take advantage of the hypermedia environment of the Internet. Shneiderman (1989) proposed that there are three golden rules to determine if an application is suitable for using hypermedia:

1. A large body of information that is organized into numerous fragments
2. The fragments are related to each other
3. The user needs only a small fraction at any time

It appears that interpretation for nature tourism with the Internet can utilize all the advantages provided by the hypermedia environment. Information about features and attractions of places can be easily represented in small pieces. However, the problem of slow reading speed should be a major concern in Web site design. Solutions to this problem can include using plenty of white space, concise text, and multimedia presentation of materials, together with other design considerations.

Research and online surveys (Vora 1998; Graphic Visulization and Usability Center (GVU) 1998, 1999) have demonstrated that many Web sites have failed to achieve their goals because of usability problems. According to a GVU survey in 1999, one of the

main problems encountered by Web users is the slow response time or speed. Other problems include inconsistencies in design and broken links (Vora 1998). Vora (1998) believes that one of the reasons is the lack of design methodology and guidelines (Vora 1998). He (1998, 155, 164) suggests (1) understanding the goals of the Web site, (2) understanding users and use environments, and (3) creating consistent Web site style.

Black and Elder (1997, 33, 45, 54, 57) suggested some rules that should be followed in Web site design.

1. White and black color should be the first choice of colors
2. Make everything as big as possible
3. Do not design pages that require scrolling
4. Do not use big, slow graphics
5. Do not use a lot of colors
6. Do not have a lot of text

Research at Microsoft Corporation suggests three navigation guidelines for Web site design:

1. Simplify the virtual “landscape” for users so that spatial information can be easily learned.
2. Make users aware of where they are at all times.
3. Make users aware of where and how to travel in the space. Create a persistent navigation structure (Kanerva et al. 1998, 194).

A well-designed hypermedia environment for interpretation provides greater freedom for users than is available through a traditional, centrally controlled media

system. However, empirical research is needed. It is imperative to understand visitors' experiences with a Web site. What, then, are the factors in this hypermedia environment that influence the experience of visitors? How can researchers measure those experiences? And how this experience is related to the effectiveness of the interpretation?

Visitors' Interpretive Experience: Optimal Effectiveness of Interpretation and the Optimal Experience Theory

Great Web sites are not about navigating content, but staging experience.
--- Mihaly Csikszentmihalyi, 1996

What Csikszentmihalyi (1996) calls "staging experience" is essentially the role of interpretation. Interpretation on a Web site is not just about providing information; it is about facilitating people's experience. The central concerns of interpretation are to provide interpretive experiences and maximize their impacts. However, interpretation has a weak theoretical foundation. As quoted in Knapp and Barrie (1998), "Interpretation services have frequently been less than successful in establishing identifiable program objectives" (Nielsen and Buchanan 1986, 1). Knapp and Barrie (1998) suggest looking beyond the field of interpretation to find theory. Mullins (1985, 36) believes that adopting theories and concepts from disciplines related to interpretation "can rapidly enhance our ability to conduct meaningful theory-based research."

There is also a growing interest in how interpreters can promote optimal experiences. Attempts have been made by researchers in the interpretive field to use optimal experience theory to assess the effectiveness of interpretation efforts (Prentice, Witt and Hamer 1998). Beck and Cable (1998) suggest that promoting optimal experience for visitors should be the interpreter's objective. They believe that "when

visitors are engaged in optimal experience, in our places of cultural and natural wonder, they will be inclined to seek out further enjoyment, learning, and inspiration. [Therefore,] with an understanding of optimal experience theory, interpreters can maximize enjoyment, productivity, and effectiveness" (Beck and Cable 1998, 186). Although Beck and Cable (1998) recognize the importance of applying the optimal experience theory to interpretation, there is a lack of research related to interpretive experience. Therefore, visitors' subjective experiences to the interpretive material presented in the Web site, factors related to these experiences, and the consequence of these experiences are the focus of this research.

This research proposes that the optimal experience theory (Csikszentmihalyi 1975) can be used to understand and analyze visitors' experiences and the impact of a virtual tour Web site. Researchers have used this theory to study activities ranging from sports, games, music, hobbies, recreation, and human-computer interactions (Csikszentmihalyi 1975; Csikszentmihalyi and Csikszentmihalyi 1988; Mannell et.al. 1988; Csikszentmihalyi and LeFevre 1989; Trevino and Webster 1992; Ghani and Deshpande 1994; Hoffman and Novak 1996; Prentice, Witt and Hamer 1998). It emphasizes the role of context as well as individual differences.

What motivates the audience to spend time and browse virtual tour Web pages? The theory of optimal experience or flow has been considered a useful framework for studying the experience of individuals in human-computer interactions and for identifying the factors that influence that experience (Ghani 1991; Hoffman and Novak 1996). The advantage of using this theory is that it is operational. It can be adapted to numerous situations and be used to explain human-computer interactions in the context of

the Web (Ghani and Deshpande 1994; Chen, Wigand, and Nilan 1999). Hoffman and Novak (1996) suggested that the flow construct is essential to understanding navigation behavior in on-line environments such as the Web.

Definitions of Flow

Csikszentmihalyi's original definition of flow (1975, 36) is the "holistic sensation that people feel when they act with total involvement." There are many definitions of "flow." Some definitions describe the cause of flow. Others describe the experiences as a result of being in a "flow state." These definitions reflect various approaches to modeling the flow construct**.** For example, Csikszentmihalyi and Csikszentmihalyi's definition (1988) focuses on the congruence of a person's skill in a given activity and their perceptions of the challenge. "The flow experience begins only when challenges and skills are above a certain level*,* and are in balance" (Csikszentmihalyi and Csikszentmihalyi 1988, 260). Trevino and Webster (1992) define flow as the linear combination of four characteristics: control, attention, curiosity, and intrinsic interest. Hoffman and Novak (1996) propose that attention should be placed on the necessary condition for achieving flow. According to Hoffman and Novak (1996), flow is "the state occurring during network navigation which is 1) characterized by a seamless sequence of responses facilitated by machine interactivity, 2) intrinsically enjoyable, 3) accompanied by a loss of self-consciousness, and 4) self-reinforcing."

Characteristics of Flow

Csikszentmihalyi (1975, 1996) suggests that there are nine characteristics in describing the flow experience:

1. There are clear goals every step of the way.
2. There is immediate feedback to one's actions.
3. There is a balance between challenges and skills.
4. Actions and awareness are merged.
5. Distractions are excluded from consciousness.
6. There is no worry of failure.
7. Self-consciousness disappears.
8. The sense of time becomes distorted.
9. The activity becomes autotelic (from the Greek *auto* = *self* and *telos* = *goal*, purpose. An activity is considered to be autotelic if it requires "formal and extensive energy output on the part of the actor," yet provides "few if any conventional rewards." (Csikszentmihalyi 1975, 10)).

These characteristics have become the basis for constructing various flow models that I will discuss later.

Consequences of Flow

Flow has been found to be correlated to increased learning and changes in attitudes and behavior. Previous studies have demonstrated that flow is related to learning (Ghani 1991; Webster, Trevino, and Ryan 1993; Ghani and Deshpande 1994; Hoffman

and Novak 1996). In a flow state, the learning process is highly involved and enjoyable. Ghani (1991) found that flow was closely related to acceptance and user satisfaction with computer technology. Wester, Trevino, and Ryan (1993) believe that learning is a reasonable outcome of the flow state.

Ghani and Deshpande (Ghani 1991; Ghani and Deshpande 1994) suggest that flow is also significantly related to exploratory use behavior in human-computer interactions. Carroll and Rosson (1987) and Katz (1987) found that in this state, computer users perform more experimentation, browsing, and exploratory behaviors. This "active learning" facilitates learning. Thus, helping an audience achieve a state of flow should be a primary objective for virtual Web site developers.

Measurements of Flow

A reliable measurement of flow is necessary to test flow theory and assist in the development of a flow model. Webster, Trevino, and Ryan (1993) use four dimensions to define and measure the state of flow: control, focused attention, curiosity, and intrinsic motivation. Ghani and Deshpande (1994) use a self-report scale containing items that measured enjoyment and concentration. The problem with these methods is that they fail to distinguish between the causes of flow, the flow experience, and the consequence of flow.

Flow Models in the Literature

Segment Model

Flow channel segment models construct flow as the congruence of skills and challenges (e.g. Ellis, Voelkl, and Morris 1994; Nakamura 1988; Wells 1988). Ellis, Voelkl, and Morris (1994) provided a recent review of the development of the flow channel segment model and created graphic representations of these models. In an early study of flow, scholars consider flow to occur whenever there is a balance between people's perceived skills and challenge provided (Csikszentmihalyi 1975). The balance of skill and challenge determines the three channels of flow--flow, boredom, or anxiety. The three-channel flow model shows these relationships. If the challenge is too simple, the audience will get bored. On the other hand, if the challenge is too high, the audience will get frustrated (anxiety) and lose interest. Figure 2.1 shows these relationships.

Later studies have reformulated the model (Csikszentmihalyi and Csikszentmihalyi 1988), and a four-channel model was identified (Figure 2.2). According to Csikszentmihalyi (1988, 1990), a certain level of challenge can help to achieve optimal flow. In the four-channel flow model (Csikszentmihalyi and Csikszentmihalyi 1988; Ellis, Voelke and Morris 1994), when challenge and skill are perfectly matched, the participant might not experience flow. A low skill and low challenge experience results in apathy. Only when skill and challenge both reach a certain level, can a flow experience start. A high challenge and low skill experience will result in anxiety. High skill and low challenge will result in boredom. High challenge and high skills correspond to a high flow experience.

Figure 2.1. Three-channel flow model (Ellis, Voelke, and Morris, 1994).

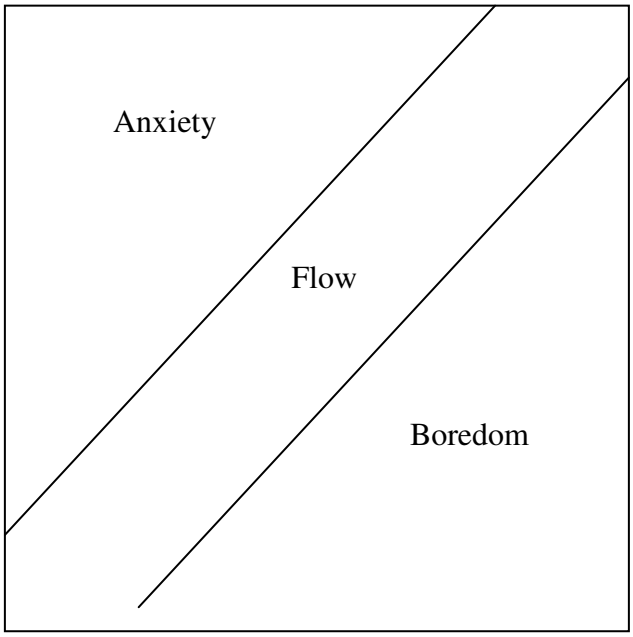
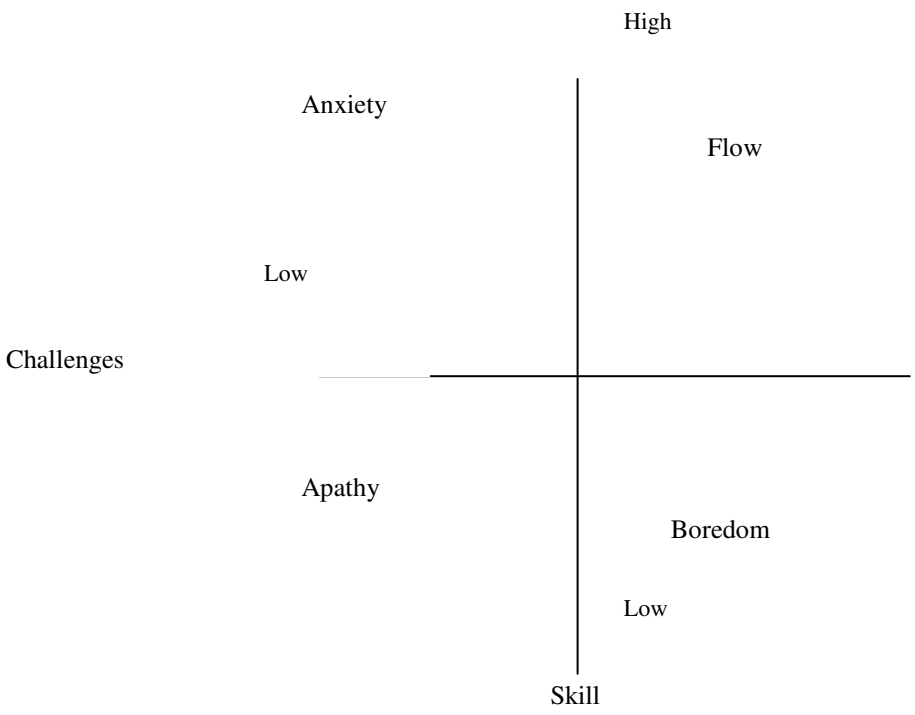


Figure 2.2. Four-channel flow model (Ellis, Voelke, and Morris 1994)



Based on the four-channel model, the eight-channel model (Figure 2.3) allows more challenge-skill ratios (Massimini and Carli 1988; Ellis, Voelke, and Morris 1994).

Causal Model

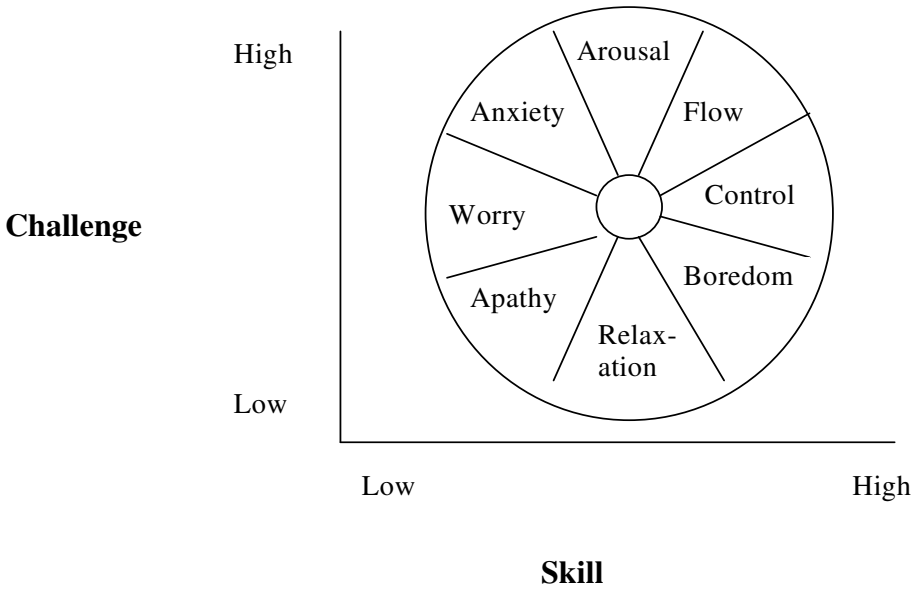
The causal model is another approach to study flow. Trevino and Webster (1992) propose a causal model in their study of human-computer interactions during email and voice mail interactions. Their study used four dimensions to describe characteristics of flow as a multidimensional construct characterized by the dimensions of (1) control, (2) attention focus, (3) curiosity, and (4) intrinsic interest. Their study concludes that the types of computer-mediated communication technology, a perceived technological characteristic (ease of use), and an individual characteristic (computer skill) contribute flow experience. Webster, Trevino, and Ryan (1993) found significant correlation between factors for intrinsic interest/curiosity and focused attention. Focused attention leads to involvement, which is one of the characteristics of flow.

Three Stages Model

On the basis of previous models, Hoffman and Novak (1996) proposed a conceptual flow model in a Computer Mediated Environment. Their model emphasizes the distinction of the flow state, the potential antecedents, and consequences of flow. The antecedents of flow include a perceived congruence of skills and challenges, focused attention, interactivity, and telepresence. The consequences of flow include increased learning, perceived behavior control, and exploratory and positive subjective experience.

Later, Chen, Wigand, and Nilan (1999) categorized Csikszentmihalyi ‘s (1996)

Figure 2.3. Eight-channel flow model (Ellis, Voelke, and Morris 1994)



nine dimensions of flow into three stages: antecedents, experiences, and effect. The antecedent stage includes the perception of goals, feedback, and matched skills and challenges. The flow experience stage is comprised of a merger between action and awareness, concentration, and a sense of potential control. The effect stage includes loss of self-consciousness, time distortion, and an experience that becomes autotelic (Csikszentmihalyi 1975).

There are difficulties in using any of the previous flow models to examine the on-line experience of visitors to a virtual tour Web site. There is a need to establish a framework to examine the various factors. These would include conditions and outcomes of the flow experience in the context of a virtual tour Web site for nature tourism interpretation.

Regarding problems with the existing flow models, first, there is no consistent way to define "flow." Flow models vary according to the context of research questions. The most challenging problem is the operational definitions of flow due to the discrepancies between various researchers' descriptions of flow dimensions. For example, focused attention and intrinsic interest are considered "antecedents" in Hoffman and Novak's model (1996); however, they are considered as dimensions to define the characteristics of flow in Trevino and Webster's model (1992). Although Trevino and Webster's (1992) model makes it relatively easy to measure flow it does not distinguish conditions and the state of being in flow. Hoffman and Novak's (1996) concept model does not provide ways to measure flow. Flow channel segmentation models are based on Csikszentmihalyi's definition of the congruence of skills and challenges. However, they

do not provide a framework for a comprehensive analysis of the causes and effects of flow experiences.

Second, although Hoffman and Novak's model is a pioneer use of flow theory on the Web, flow was not operationalized as an experience related to a particular Web site. Their research did not focus on a specific set of users or a Web site. Instead, they studied the general experience of users browsing the Web.

Third, in previous studies of human-computer interactions, skills and challenges are measured as feelings about computer skills and operating challenges perceived by users. This way of defining challenge and skill is not suitable for a medium like the Internet. Because the skill required for browsing Web pages is relatively simple, the challenge will disappear over time. Furthermore, for this research, a primary use of the Web is for seeking information. Challenges and skills for Web users should be related to the information base and visitors' knowledge about the information. Therefore, this research proposes the following flow model for maximizing audiences' experience while visiting a virtual tour Web site. Testing the hypothetical flow model is directly related to answering the three research questions.