

Understanding the flow experiences of Web users

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Declaration

I certify that this thesis is my own original work. It does not contain any material previously published or written by another person where due reference is not made in the text.

Steven Pace

Acknowledgments

Completing a doctorate has been a long-standing goal of mine, which could only have been achieved with the support of some generous people.

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Abstract

This thesis presents a grounded theory of the flow experiences of Web users engaged in information-seeking activities. The term *flow* refers to a state of consciousness that is sometimes experienced by individuals who are deeply involved in an enjoyable activity. The experience is characterised by some common elements: a balance between the challenges of an activity and the skills required to meet those challenges; clear goals and feedback; concentration on the task at hand; a sense of control; a merging of action and awareness; a loss of self-consciousness; a distorted sense of time; and the autotelic experience.

Researchers have recently proposed Csikszentmihalyi's flow theory as a useful framework for understanding the enjoyment experienced by Web users, but they have struggled to operationalise key constructs such as flow and challenge in their quantitative models. This study aimed to address that problem by providing a better understanding of the nature of flow as experienced by Web users engaged in information-seeking activities. The theory that was developed during this study encompasses the following topics:

- the role that curiosity and time urgency play in the formation of a Web user's information-seeking goals and subsequent navigation behaviour;
- the challenges that Web users face when seeking information, the skills they use in meeting those challenges, and the relationship that exists between challenges and skills;
- the important role that focused attention plays in the flow experiences of Web users, elements that help to focus a user's attention, and elements that are distracting; and
- various dimensions of the flow experiences of Web users, which include a joy of discovery, a reduced awareness of factors that are irrelevant to the task at hand, a distorted sense of time, a merging of action and awareness, a sense of control, mental alertness, and telepresence.

The grounded theory research method that was employed in this study is a primarily inductive investigative process in which the researcher formulates a theory about a phenomenon by systematically gathering and analysing relevant data. The purpose of this research method is building theory, not testing theory. The data that was gathered for this study primarily consisted of semi-structured in-depth interviews with informants of varying gender, age, educational attainments, occupations and Web experience who could recall experiencing flow while using the Web.

An important distinction between this study and other investigations into the flow experiences of Web users is the way it goes beyond sheer associations to propose

explanations for how and why certain events occur—explanations that are grounded in the data rather than deduced from the literature. This study is the first of its type on this subject, and as such, it provides a useful counterpoint to previous quantitative studies.

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Introduction

This thesis documents a qualitative investigation into the flow experiences of Web users, which was conducted at Central Queensland University and the Australian National University between April 1999 and July 2003. This chapter provides a general introduction to the study, discussing topics such as the phenomenon that was investigated, the purpose of the study, the research questions that guided the study, the research method that was employed, the significance of the study, and the limitations of the study. The chapter concludes with an outline of the remainder of the thesis.

As is common in qualitative studies, parts of this thesis will be written in the first person style, rather than the third person style that is typically used in quantitative studies. My reason for doing so is not simply because the first-person style is gaining acceptance in academic writing, but because of my epistemological assumption that it is impossible for an investigator to study an entity without influencing it or being influenced by it (Lee 2001). The third person style creates 'a sense of objectivity and distance between the researcher and that being researched', which is not entirely appropriate for parts of this thesis (Creswell 1994, p. 43).

Background to the research

Since the 1980s researchers in the field of human-computer interaction (HCI) have called for more studies of the causes and effects of enjoyment in computer usage (Carroll & Thomas 1988; Davis, Bagozzi & Warshaw 1992; Draper 1999; Gaines, Chen & Shaw 1997; Igbaria, Schiffman & Wieckowski 1994; Lindgaard 1999; Malone 1981; Monk et al. 2002). The term *enjoyment* in this context refers to 'the extent to which the activity of using the computer is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated' (Davis, Bagozzi & Warshaw 1992, p. 1113).

Carroll and Thomas (1988, p. 23) were among the first to argue that 'there is an important need to develop a research program in fun and motivation'. Struck by the paucity of work on enjoyment in user interfaces, they wrote:

Currently we have some understanding of fun based on games, but we have no understanding of how people feel about or relate to tools they use. We do not even have a framework for posing such questions.

Davis, Bagozzi and Warshaw (1992, p. 1126) also commented on the dearth of research into the motivating effects of enjoyment. Having observed a positive interaction between usefulness and enjoyment in their own work, they recommended that more investigation was required 'to clarify which variables operate through enjoyment and usefulness and which have direct influences on intentions or behavior'.

With the advent of the Web, new calls for studies of enjoyment emerged. Gaines, Chen and Shaw (1997, p. 994) identified 'likeability' (Shackel 1991) as a critical factor in user adoption of a technology like the Web, but noted that likeability was rarely studied because it seemed to be 'a subjective matter with no behavioral model that can only be tested through questionnaire techniques'. In a similar vein, Lindgaard (1999, p. 149) observed that 'existing usability evaluation techniques are inadequate for evaluating web sites because they focus exclusively on effectiveness and efficiency'. She argued that 'additional tools are needed to address issues such as likeability, user satisfaction and aesthetic appeal as these assume an important role in the web environment'. Even more recently, Monk et al. (2002, p. 924) concluded that 'we are far from having a coherent understanding of what enjoyment actually is and how it can be addressed by products and processes'.

This study was a response to calls for more research into enjoyment, particularly with regard to the experiences of Web users. Dissemination of the results of this study to the HCI community has commenced with an article in the *International Journal of Human-Computer Studies* (Pace in press).

Flow

In recent years Csikszentmihalyi's (1975, 1990, 1993, 1996, 1997) flow theory has been used in several studies of human-computer interaction as a framework for modelling enjoyment, user satisfaction, playfulness, engagement, absorption and other related states of involvement with computer software (Agarwal & Karahanna 2000; Chen, Wigand & Nilan 1998, 1999, 2000; Ghani & Deshpande 1994; Hoffman & Novak 1996; Huang 2003; Koufaris 2002; Nel et al. 1999; Novak, Hoffman & Yung 2000; Trevino & Webster 1992; Webster & Ho 1997; Webster & Martocchio 1992; Webster, Trevino & Ryan 1993; Woszczynski, Roth & Segars 2002).

Flow is a state of consciousness that is sometimes experienced by people who are deeply involved in an enjoyable activity. The experience is characterised by some common elements: a balance between the challenges of an activity and the skills required to meet those challenges; clear goals and feedback; concentration on the task at hand; a sense of control; a merging of action and awareness; a loss of self-consciousness; a distorted sense of time; and the autotelic experience (Csikszentmihalyi 1975, pp. 35–54; 1990, pp. 48–70; 1993, pp. 178–187; 1996, pp. 110–123). The term *autotelic* refers to an activity that is 'done not with the

expectation of some future benefit, but simply because the doing itself is the reward' (Csikszentmihalyi 1990, p. 67). Whenever people reflect on their flow experiences, they mention some and often all of these characteristics (Csikszentmihalyi 1990, p. 49).

Support for Csikszentmihalyi's characterisation of flow can be found in studies of many diverse activities, such as reading (McQuillan & Conde 1996), work (Allison & Duncan 1988) and sport (Jackson 1996), to mention a few. The activities that people engage in to experience flow vary enormously, but they describe how it feels in almost identical terms. The subject of flow is explained in more detail in Chapter 2.

Flow and the Web

The concept of flow was first applied to the experiences of Web users by Hoffman and Novak (1996) in an examination of online marketing activities. Other researchers had applied flow to human-computer interactions previously, but not in the context of Web usage (Ghani & Deshpande 1994; Malone 1981; Trevino & Webster 1992; Webster & Martocchio 1992; Webster, Trevino & Ryan 1993). Building on the results of those earlier studies, Hoffman and Novak (1996) developed a conceptual model that attempted to explain the relationship between flow and the behaviour of online consumers. Their model specified an explicit structure for direct and indirect influences on flow, as well as the relationships between model constructs and behavioural outcomes.

Hoffman and Novak's (1996) conceptual model laid the groundwork for formal empirical testing, which was later conducted by Novak, Hoffman and Yung (2000). Using data from a survey of more than 1 600 Web users, Novak, Hoffman and Yung (2000, p. 22) developed, refined and validated a structural equation model that brought together 'the components of what makes for a compelling online experience'.

Despite the complexity of Novak, Hoffman and Yung's model, the large size of their sample, and the sophistication of their analysis techniques, the study was criticised for the fundamental problem of failing to operationalise key concepts such as flow, challenge and skill in terms of specific Web activities. Commenting on a working paper produced in 1998, Chen, Wigand and Nilan (1999, p. 592) wrote:

Past operationalizations of flow have employed measures that ask subjects about 'challenges' they perceive and their 'skills' in meeting and overcoming the challenges. We think that these operationalizations are unlikely to be understood by subjects in all but the most mundane activities (e.g. playing a physical sport), thereby generating unreliable definitions. Further, because the Web is a multi-activity environment which is very complex, subjects' interpretations of 'challenges' and 'skills' are likely to be even more confused.

The concepts of challenge and skill tend to play an important role in flow investigations because a recognised precondition for the flow experience is that the challenges an individual perceives in a particular activity are equal to the skills he or

she uses in meeting those challenges (Csikszentmihalyi 1990, p. 52; 1997, pp. 30–31). Chen, Wigand and Nilan's (1999, p. 590) concern about Novak, Hoffman and Yung's handling of these concepts stemmed from the fact that the Web is a rich interactive environment that facilitates many different 'creative, communicative and collaborative activities'. Examples include searching and browsing for information, uploading and downloading files, reading and sending e-mail, reading and posting newsgroup messages, listening to audio clips, viewing animations and video clips, playing games, chatting with friends, conversing verbally via Internet telephony, creating Web pages and more. Since different activities present different challenges and call for different skills, Chen, Wigand and Nilan (1999, p. 590) argued that the Web should be viewed as a 'multi-activity medium', and that concepts such as flow, challenge and skill should be operationalised in terms of specific Web activities:

The meaning of 'challenges and skills' on the Web is necessarily situated in time and space, dependent on what it is that the user is doing and the goal(s) that s/he is pursuing.

In their own studies, Chen, Wigand and Nilan (1999) confirmed that many different kinds of Web activities can facilitate flow. Their survey of 304 Web users found that information retrieval was the most commonly reported flow-inducing activity (60.6%), followed by reading/replying/debating in newsgroups (9.2%), reading/writing e-mail (8.3%), creating Web pages (5.5%), playing games on the Web (4.6%), and chatting (3.7%). The researchers also confirmed that using terms such as *challenge* and *control* in the context of Web activities weakened the ability of survey respondents to reliably report on their flow experiences. Between 20 and 40 per cent of the respondents to their questionnaire expressed confusion when queried about the 'challenges' or 'sense of control' associated with Web use. In the concluding comments of their paper, Chen, Wigand and Nilan (1999, pp. 604–605) noted that:

... much future research needs to be done ... in the operationalization of some of the key concepts associated with flow ... before researchers can provide clearer insight into Web activities that enhance or facilitate the emergence of flow experiences.

Novak, Hoffman and Yung (2000, p. 22) expressed a similar view in their report, acknowledging that:

... quantitative modeling efforts of the flow construct ... have been hampered by considerable confusion regarding the exact conceptual definition of flow. Lacking precise definition, it has been difficult to measure flow empirically, let alone apply the concept in practice.

The difficulties these researchers have encountered in their studies of the flow experiences of Web users suggest that the topic is in need of further conceptual development. A better understanding of the concepts and relationships pertaining to flow in the Web environment could help to resolve uncertainties and contribute to more precise and complete explanations about the nature of the phenomenon. Furthermore, there are many aspects of this topic that are relatively unexplored. Novak, Hoffman and Yung (2000, p. 40) suggest that research efforts could be

fruitfully directed at 'distinctions between task-oriented and experiential navigation behavior', 'the role of consumer demographic variables', and 'specific elements of commercial website design that facilitate a compelling consumer experience'. Literature relating to the flow experiences of computer users is explored in more detail in Chapter 2.

Research questions

The aim of this study was to answer the question: What is the nature of flow, as experienced by Web users engaged in information-seeking activities? The study focused on information-seeking because, as Chen, Wigand and Nilan (2000) have demonstrated, it is the most dominant flow-inducing activity in the Web environment. This central research question had eight associated research questions:

- *Question 1:* What are the salient features and dynamics of the flow experiences of Web users?
- *Question 2:* Under what conditions are Web users likely to experience flow?
- *Question 3:* How do the flow experiences of Web users compare with the general dimensions of flow proposed by Csikszentmihalyi?
- *Question 4:* What makes information-seeking on the Web an activity that is conducive to experiencing flow?
- *Question 5:* What challenges do Web users perceive when seeking information and what skills do they employ in dealing with those challenges?
- *Question 6:* Does a Web user's skill level influence his or her propensity to experience flow, and if so how?
- *Question 7:* What characteristics of individual Web users influence their propensity to experience flow?
- *Question 8:* What characteristics of individual Web sites influence the flow experiences of Web users?

Research method

The research method that was selected for this study was grounded theory—a primarily inductive investigative process in which the researcher formulates a theory about a phenomenon by systematically gathering and analysing relevant data (Glaser 1992, p. 16; Glaser & Strauss 1967, p. 1; Strauss & Corbin 1998, p. 12). The purpose of this research method is building theory, not testing theory. Rather than begin the study with a preconceived theory that needs to be proven, the researcher begins with a general area of study and allows the theory to emerge from the data.

The data for this study primarily consisted of semi-structured in-depth interviews with informants who could recall experiencing flow while using the Web. These interviews had a flexible and dynamic style of questioning and discussion directed toward understanding the significance of flow experiences from the informant's perspective. Using a process known as theoretical sampling, informants were selected according to their potential for providing new insights or expanding and refining those already gained. All interviews were tape-recorded with the informants' permission, and later transcribed to provide accurate records for analysis.

As with much qualitative research, data collection and data analysis occurred simultaneously in this study. A theory was derived from the data using a constant comparative method of analysis with four stages: generating categories and their properties; integrating categories and their properties; delimiting the theory; and writing the theory.

The first stage, called open coding, involved identifying categories and properties in the data. A category is a conceptual element of a theory—an abstract representation of something the researcher identifies as being significant in the data. A property is a conceptual characteristic or attribute of a category. Categories and properties were generated by comparing incidents in the data and looking for patterns. As concepts emerged, they were compared with other incidents for verification, and with other concepts for establishing the best fit with the data. Theoretical memos were written about categories, properties and their relationships during coding. Qualitative analysis software named NVivo (formerly NUD*IST) was used to assist with coding and memo-writing.

The next stage, called theoretical coding, involved taking the concepts that emerged during open coding and reassembling them with propositions about their relationships. These emerging hypotheses formed a theoretical framework, which served as a guide to further data collection and analysis. As with the categories and properties, the integrated theory emerged from the data; it was not preconceived or forced upon the data.

As the theory developed, it crystallised around a core explanatory category that reflected the main theme of the study—flow. The identification of the core category led to selective coding—the process of delimiting coding to only those concepts that relate to the core category. Data collection and analysis became more focused, resulting in a theory with a smaller set of higher-level concepts.

Data collection and analysis ceased once the study achieved theoretical saturation—the point at which no additional data could be found that added to the categories being developed. All that remained then was to write up the emergent theory, drawing on the theoretical memos that had been written about each category during the study. The research method is explained in more detail in Chapter 3.

Significance of the study

Developing a better understanding of the flow experiences of Web users is important for at least two reasons. First, there is evidence to suggest that the behaviour of users toward new information technologies is shaped by their holistic experiences with the technology, and not just the usability or instrumentality of the technology. Carroll and Thomas (1988, p. 22) observed that enjoyable human-computer interactions have 'powerful influences on what people will even try to do and on how long they will persist'. Later research conducted by Davis, Bagozzi and Warshaw (1992, p. 1125) demonstrated that 'increasing the enjoyment of using a system helps to get a productive system accepted by users'. More recent research conducted by Agarwal and Karahanna (2000, p. 688) highlighted 'the importance of eschewing a strictly utilitarian perspective on the usage of information technologies', and prompted them to make this prediction:

As technology developments continue to focus on richer and more appealing interfaces, the importance of experiences that are intrinsically motivating, i.e., pleasurable and enjoyable in and of themselves, might dominate as predictors of usage intentions.

The second reason for pursuing a better understanding of the flow experiences of Web users is the special design challenge presented by the Web. Traditionally, the field of human-computer interaction has focused on making software applications easier to use, particularly work-related applications (Monk et al. 2002). As Jordan (2000, pp. 6–7) notes, 'usability-based approaches tend to look at products as *tools* with which *users* complete *tasks*'. However, the Web is more than a work tool. People use the Web for many different purposes, including recreation. At times, the distinction between tool and toy becomes blurred, as Lenker (2002, p. 24) explains:

It's important to understand that, although our computers are great "business tools," when we go online our computers play more than a business role ... Although we may have practical tasks to perform, there's a part of us that wants to transform these tasks into opportunities to have fun. We want to find, tap into, and pursue interests that are more than just practical, even if they are well—practical. When we talk about the "entertainment value" of an online resource, we're talking about the degree to which a Web enterprise makes routine operations rise above the level of the mundane—even if the *purpose* of the Web enterprise is not necessarily to entertain.

Monk et al. (2002, p. 924) observe that as more researchers have become involved in this topic of designing for enjoyment, 'it has become clear that our current understanding of user concerns, derived from the world of work, is simply not adequate to this new design challenge'.

Limitations of the study

As one considers the information in this thesis, it is important to remember that the grounded theory method is for building theory, not verifying it. Grounded concepts

are suggested, not proven. The resulting theory is an integrated set of propositions, not findings (Glaser 1978, p. 134; Glaser & Strauss 1967, p. 103). Verification of grounded theory is left to other research methods that are better suited to that purpose (Glaser 1992, p. 16). These ideas are discussed further in Chapter 3.

According to Glaser and Strauss (1967, pp. 32–33), the grounded theory method can be used to generate two basic kinds of theory: substantive and formal. Substantive theory is that which is developed for a substantive, or empirical area of inquiry, such as patient care, race relations or juvenile delinquency. Formal theory is that which is developed for a formal or conceptual area of inquiry such as stigma, deviant behaviour, or reward systems. Substantive theory can be generated by comparative analysis between or among groups within the same substantive area. The generation of formal theory requires comparative analysis to be made among different kinds of substantive cases that fall within the formal area of inquiry, without relating them to any one particular substantive area.

The theory that was developed during this study is a substantive theory, since it was grounded in research in one particular substantive area—the experiences of Web users. The informants who were selected to participate in the study varied in terms of their gender, age, educational attainments, occupations and Web experience, so the theory has quite broad applicability. However, the generality of the theory is constrained by the fact that it was generated from a single study conducted within a single geographical region in a single country. It is possible that comparing the experiences of informants from different regions or different countries could result in a modified theory. This possibility provides avenues for future research.

Organisation of the thesis

The body of this thesis is organised into eleven chapters:

- Chapter 1, Introduction, provides a general introduction to the study, discussing topics such as the phenomenon that was investigated, the purpose of the study, the research questions that guided the study, the research method that was employed, the significance of the study, and the limitations of the study.
- Chapter 2, Review of the literature, builds on the introduction to flow theory provided in Chapter 1 by discussing characteristic dimensions of the flow experience, and by reviewing relevant studies of flow in human-computer interactions, particularly in the Web environment.
- Chapter 3, Research method, describes the grounded theory research method that was employed during this study. Specific characteristics of the research design, data collection procedures and data analysis procedures are discussed.
- Chapter 4, Theory overview, goals and navigation behaviour, introduces the grounded theory that emerged from the data during this study, and discusses the

role that curiosity and time urgency play in the formation of a Web user's information-seeking goals and subsequent navigation behaviour.

- Chapter 5, Challenges and skills, continues the explanation of the theory with a discussion about the challenges that Web users face when seeking information, the skills they use in meeting those challenges, and the relationship that exists between challenges and skills.
- Chapter 6, Attention, continues the explanation of the theory with a discussion about the important role that focused attention plays in the flow experiences of Web users. Elements that help to focus a user's attention and elements that are distracting are also discussed.
- Chapter 7, Dimensions of flow, concludes the explanation of the theory with a discussion about the various dimensions of the flow experience that became evident through the comments of the informants.
- Chapter 8, Personal characteristics of Web users, discusses personal characteristics that influence an individual's propensity to experience flow while seeking information on the Web.
- Chapter 9, Evaluation, assesses the credibility of this study against several sets of evaluation criteria.
- Chapter 10, Discussion, compares the theory that was developed during this study with the general dimensions of flow proposed by Csikszentmihalyi (1975, pp. 35–54; 1990, pp. 48–70; 1993, pp. 178–187; 1996, pp. 110–123) and the structural model of the flow experiences of Web users developed by Novak, Hoffman and Yung (2000). This chapter also discusses the theory's implications for practitioners.
- Chapter 11, Conclusion, revisits the study's research questions and briefly summarises the major components of the theory that was developed.

Summary

Since the 1980s researchers in the field of human-computer interaction have called for more studies of the causes and effects of enjoyment in computer usage. Several studies have recently used Csikszentmihalyi's flow theory as a framework for understanding the enjoyment experienced by Web users.

Flow is a state of consciousness that is sometimes experienced by people who are deeply involved in an enjoyable activity. The experience is characterised by some common elements: a balance between the challenges of an activity and the skills required to meet those challenges; clear goals and feedback; concentration on the task at hand; a sense of control; a merging of action and awareness; a loss of self-consciousness; a distorted sense of time; and the autotelic experience. Support for

Csikszentmihalyi's characterisation of flow can be found in studies of many diverse activities, such as reading, work and sport, to mention a few.

Several studies have attempted to explain the relationship between flow and the behaviour of Web users using structural equation modelling techniques. However, even the most comprehensive of these studies has been criticised for the fundamental problem of failing to operationalise key concepts such as flow, challenge and skill in terms of specific Web activities. The difficulties that researchers have encountered in their studies of the flow experiences of Web users suggest that the topic is in need of further conceptual development. A better understanding of the concepts pertaining to flow in the Web environment could help to resolve uncertainties and contribute to more precise and complete explanations about the nature of the phenomenon.

The aim of this study was to answer the question: What is the nature of flow, as experienced by Web users engaged in information-seeking activities? The study focused on information-seeking because it is the most dominant flow-inducing activity in the Web environment.

The research method that was selected for this study was grounded theory—a primarily inductive investigative process in which the researcher formulates a theory about a phenomenon by systematically gathering and analysing relevant data. The purpose of this research method is building theory, not testing theory. Rather than begin the study with a preconceived theory that needs to be proven, the researcher begins with a general area of study and allows the theory to emerge from the data.

Developing a better understanding of the flow experiences of Web users is important for at least two reasons. First, there is evidence to suggest that the behaviour of users toward new information technologies is shaped by their holistic experiences with the technology, and not just the usability or instrumentality of the technology. Second, our current understanding of user concerns, derived from the world of work, is not adequate for dealing with the special design challenges presented by the Web.

Review of the literature

This chapter builds on the introduction to flow theory provided in Chapter 1 by discussing characteristic dimensions of the flow experience, and by reviewing relevant studies of flow in human-computer interactions, particularly in the Web environment.

Ordinarily, grounded theory researchers avoid the traditional practice of reviewing relevant literature at the outset of a study. The rationale for this approach is to keep the researcher open to the concepts and relationships that will emerge from the data, and to avoid derailments in the form of assumptions about what ought to be found in the data (Glaser 1978, p. 31; 1992, pp. 31–32; 1998, pp. 67–73; Glaser & Strauss 1967, pp. 33–34; Strauss & Corbin 1998, p. 49).

Circumstances prevented me from applying that recommendation in this study. Conducting a preliminary review of the literature was a formal requirement of my PhD research program. I had no reason to resist that requirement because I did not select grounded theory as my research method until after I had reviewed the relevant literature and developed a better understanding of the research problem. Chapter 3 explains the strategy that I used to preserve my openness to the data and to make my prior conceptions manifest before entering the field of study.

Flow

As mentioned in Chapter 1, flow is a state of consciousness that is sometimes experienced by people who are deeply involved in an enjoyable activity. According to Csikszentmihalyi (1990, p. 4), people in flow 'are so involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it'. A champion swimmer interviewed by Jackson (1996, p. 83) described the flow experience this way:

Where I've been happiest with my performance, and I've felt sort of one with the water, and my stroke, and everything ... I was really tuned into what I was doing. I knew *exactly* how I was going to swim the race, and I just knew I had it all under control ... I was just totally absorbed in my stroke, and I knew I was passing them all

but I didn't care. I mean it's not that I didn't care. I was going, 'Oh, this is cool!' And just swam and won, and I was totally in control of the situation. It was really cool.

The view of enjoyment that is presented here is quite different to pleasure. For example, the swimmer who was just quoted may have experienced physical pain during the race, but looked back on the event afterwards as something enjoyable and fulfilling. Seligman and Csikszentmihalyi (2000, p. 12) make the following distinction between the concepts of pleasure and enjoyment:

Pleasure is the good feeling that comes from satisfying homeostatic needs such as hunger, sex, and bodily comfort. Enjoyment, on the other hand, refers to the good feelings people experience when they break through the limits of homeostasis—when they do something that stretches them beyond what they were—in an athletic event, an artistic performance, a good deed, a stimulating conversation.

Csikszentmihalyi (1975) was first led into the study of flow by a desire to understand the nature of enjoyment and intrinsic motivation. With the help of his associates at the University of Chicago, he interviewed more than two hundred individuals who were presumed to be familiar with intrinsic rewards. The informants included basketball players, chess players, dancers, musical composers and rock climbers—people who devoted considerable time and effort to activities that provided no obvious rewards such as money or recognition.

The informants were questioned about the intrinsic rewards they derived from the particular activity in which they were engaged. A common theme that emerged from the responses was that the experience was autotelic, or rewarding in itself. With near unanimity, the informants indicated that their primary motivation to devote time and effort to a particular activity was the rare experience they felt while engaged in it, an experience that is not accessible in everyday life.

The accounts revealed that the autotelic experience generally does not occur during passive, receptive, relaxing times. Rather, it often involves painful, risky or difficult activities that stretch a person's mind or body 'to its limits in a voluntary effort to accomplish something difficult and worthwhile' (Csikszentmihalyi 1990, p. 3). The experience eventually came to be called *flow*, a term which had been used as a metaphor by some informants to describe the seemingly effortless, yet highly focused state of mind. It should be clear that the flow experience has little to do with the well-known figure of speech, 'go with the flow', which means to abandon oneself to a situation that feels good, natural and spontaneous (Csikszentmihalyi 1999). The flow experience is something that requires skills, focused attention and perseverance.

Not all flow activities elicit the same intensity of feelings as the examples provided in the preceding paragraphs. Many people experience flow while engaging in more mundane activities such as gardening, driving or talking with friends (Allison & Duncan 1988). Csikszentmihalyi (1975, p. 141) uses the term 'microflow' to describe trivial activities that appear to fit the flow model, but at a lower level of complexity than so-called 'deep flow' activities.

After learning how it felt to be in a situation that was intrinsically motivating, Csikszentmihalyi's research team went on to explore the characteristics of those activities that provided intrinsic rewards. Despite the obvious differences between activities such as chess and rock-climbing, 'a common set of structural characteristics was found to distinguish those patterns of action that produced flow from the rest of everyday life' (Csikszentmihalyi & Csikszentmihalyi 1988, p. 8). Whenever people reflected on their flow experiences, they mentioned some, and often all, of the following elements: a balance between the challenges of an activity and the skills required to meet those challenges; clear goals and feedback; concentration on the task at hand; a sense of control; a merging of action and awareness; a loss of self-consciousness; a distorted sense of time; and the autotelic experience (Csikszentmihalyi 1975, pp. 35–54; 1990, pp. 48–70; 1993, pp. 178–187; 1996, pp. 110–123). These dimensions of flow will be explained in more detail later in this chapter.

In the years following Csikszentmihalyi's initial study, researchers around the world have applied flow theory to a variety of activities and interviewed more than 10 000 individuals from many different walks of life (Csikszentmihalyi 1999). One of the findings that emerged from this research is that flow and 'the psychological conditions that make it possible seem to be the same the world over' (Csikszentmihalyi 1990, p. 49). Regardless of culture, stage of modernisation, social class, age, or gender, people describe flow experiences in much the same way. What they do to experience flow varies enormously, but they describe how it feels in almost identical terms.

States of consciousness

Having described flow as a 'state of consciousness', it seems appropriate to provide some explanation of the nature of consciousness, and some examples of sibling concepts or other states of consciousness.

Many researchers believe that consciousness is not sufficiently well understood to be precisely defined (Crick & Koch 1992), but for the purposes of this discussion we will use Lefton's (1997, p. 117) definition that consciousness is 'the general state of being aware of and responsive to events in the environment, including one's own mental processes'. Defined in this way, consciousness is a synonym for awareness. Bernstein et al. (2000, p. 290) suggest that consciousness is 'a property of many mental processes rather than a unique mental process unto itself'. For example, memories can be conscious, but consciousness is not memory. Similarly, perceptions can be conscious, but consciousness is not perception.

Consciousness is related to attention. Gray (1999, p. 302) defines attention as 'the process by which the mind chooses from among the various stimuli that strike the senses at any given moment, allowing only some to enter consciousness'. In other words, attention is a gateway to consciousness, controlling what is allowed to enter. Eysenck and Keane (2000, p. 119) use a different analogy. They liken consciousness

to the picture on a television screen, with attention being similar to choosing a particular channel.

The level of awareness or consciousness that an individual experiences at any given moment is not continuous or uniform. In fact, it varies considerably. There are many distinctive states of consciousness that affect the way an individual perceives and experiences the world.

People generally spend most of their time in a waking state of consciousness. Garcia-Ives, Marquez-Bridger & Perri (1999, pp. 97–99) identify the following characteristics of ordinary waking consciousness:

- it includes our current thoughts and feelings, memories from the past and expectations for the future;
- it includes sensory material that our bodies are constantly bombarded with from our external environment and internal mental processes;
- it is perceived to be real and associated with a familiar sense of time and place;
- it changes with shifts in the focus of our attention; and
- it varies from a high level of awareness in which a large amount of information is taken in, to a low level of awareness in which minimal information is taken in.

Any mental state that is noticeably different to ordinary waking consciousness is called an altered state of consciousness. Altered states of consciousness affect the way an individual experiences sensations, thoughts and feelings, and are generally accompanied by physiological changes. They can occur due to natural processes, the conscious control of thought processes, or with the assistance of outside agents (Bernstein et al. 2000, pp. 296–320; Garcia-Ives, Marquez-Bridger & Perri 1999, pp. 99–101; Lefton 1997, pp. 116–145). Several examples of altered states are described below.

- *Sleep* is a natural, non-waking state of consciousness characterised by general unresponsiveness to the environment and general physical immobility.
- *Night dreaming*, or simply dreaming, is a state of consciousness that usually occurs during a period known as rapid eye movement (REM) sleep. Dreams contain vivid story-like sequences of images. They are fantastic in the sense that space-time relationships are distorted, they are often emotionally charged and they have a delusional quality.
- *Lucid dreaming* occurs when a person becomes lucid and aware that he or she is dreaming while the dream is going on. Lucid dreamers are often able to control the content of their dreams.
- *Daydreaming* is a period of thinking or feeling while awake that is not constrained by the bounds of logic or reality.

- *Meditation* is a state of consciousness induced by a variety of techniques that typically involve concentration, restriction of incoming stimuli and deep relaxation.
- *Hypnosis* is a poorly understood state of consciousness brought about by procedures that may induce a trance. Hypnotised individuals are aware of their surroundings, but passively follow the instructions of the hypnotist.
- *The effects of psychoactive drugs* such as depressants, stimulants, opiates and psychedelics may include changes to one's behaviour, thought or emotions. Psychoactive drugs are chemical substances that affect consciousness by altering biochemical reactions in the nervous system.

Dimensions of flow

Csikszentmihalyi (1975, pp. 35–54; 1990, pp. 48–70; 1993, pp. 178–187; 1996, pp. 110–123) has observed that whenever people reflect on their flow experiences, they mention some, and often all, of the following characteristics: a balance between the challenges of an activity and the skills required to meet those challenges; clear goals and feedback; concentration on the task at hand; a sense of control; a merging of action and awareness; a loss of self-consciousness; a distorted sense of time; and the autotelic experience. These general dimensions of flow are discussed in this section.

Balance between challenges and skills

A universal precondition for the flow experience is that the challenges an individual faces in a particular activity are equal to the skills he or she uses in meeting those challenges (Csikszentmihalyi 1990, p.52; 1997, pp. 30–31). In this context the terms *skills* and *challenges* are not confined to physical activities. Intellectual pursuits such as reading, chess, mathematics, musical composition and computer programming often lead to flow experiences.

Flow theory suggests that if the challenges of an activity are too high relative to one's skills, one experiences anxiety. If challenges are too low, one experiences boredom. If challenges and skills are both low, one experiences apathy and the overall quality of the subjective experience is the lowest. If challenges and skills are both high, the likelihood of experiencing flow is maximised and the overall quality of the subjective experience is the highest (see Figure 2.1).

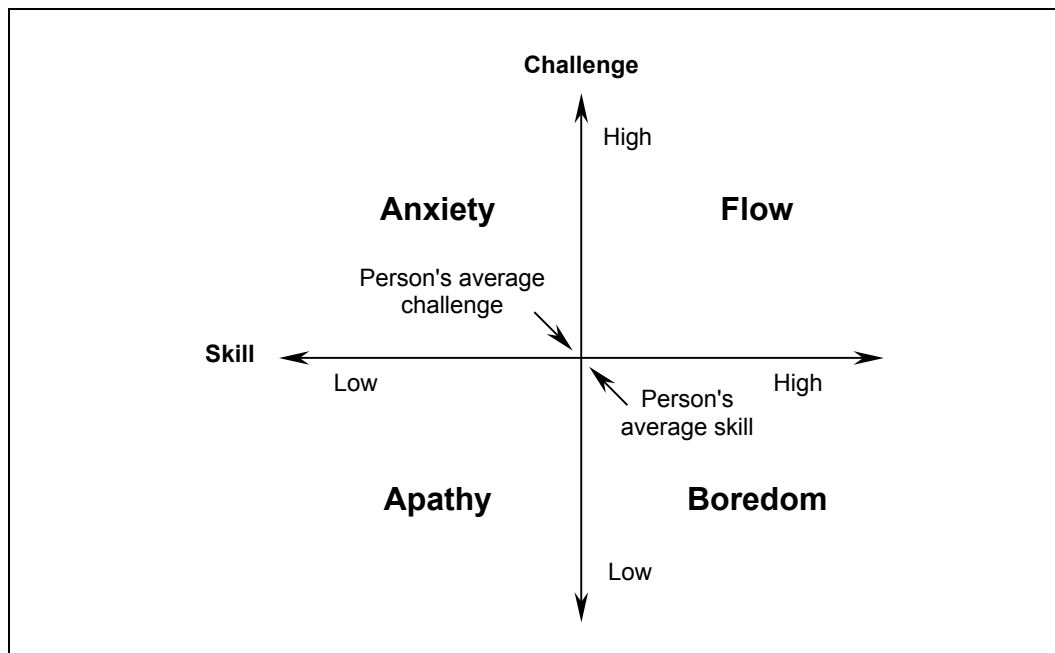


Figure 2.1. The four-channel flow model. Adapted from Jackson and Csikszentmihalyi (1999, p. 37)

To illustrate these ideas, consider a game of tennis. Playing tennis is most enjoyable when the two opponents are well matched. When opponents are mismatched, the weaker player feels anxious and the stronger player feels bored. The weaker player may try to restore balance to the game by learning new skills or by seeking a less challenging partner. The stronger player may try to restore balance to the game by handicapping herself or by seeking a more challenging partner.

Many researchers have observed this relationship between the quality of subjective experience and perceived levels of challenges and skills (Carli, Delle Fave & Massimini 1988; Clarke & Haworth 1994; Haworth & Evans 1995; Nakamura 1988; Wells 1988). Moneta and Csikszentmihalyi (1996), for example, used the Experience Sampling Method on a sample of 208 high-school students in Chicago to test their hypothesis that the quality of daily experience depends on the balance of challenges and skills in specific situations. The Experience Sampling Method required the students to wear a pager and to carry a booklet of self-report forms with them for a week. At eight randomly selected times each day the students were signalled, prompting them to immediately complete one of the forms. The self-report form asked the student to provide details about the activity in which he or she was currently engaged, and to rate the experience in terms of challenge, skill and other variables. Moneta and Csikszentmihalyi (1996) measured daily variations in four dimensions of experience (concentration, desire to do an activity, involvement and happiness) in four different social contexts (at school, with relatives, with friends, and in solitude). The four dimensions of experience were regressed on the predictors challenges, skills, and their absolute difference expressing the balance/imbalance of challenges and skills. Hierarchical linear modelling was conducted on a one-week sample of experiences. The findings confirmed the hypothesis that the balance of

challenges and skills has a positive and independent effect on the quality of experience.

Csikszentmihalyi's (1975, p. 49) original model of flow assumed that enjoyment occurred when challenges and skills were both low, as well as when they were both high. Empirical research conducted at the University of Milan later revealed that people do not experience flow when challenges and skills are both perceived to be lower than their accustomed levels (Massimini & Carli 1986). The current model predicts flow only when challenges and skills are in balance and above the level that is typical of the individual's day-to-day experiences (Csikszentmihalyi & Csikszentmihalyi 1988, p. 260).

Since this discovery, researchers have experimented with the number of channels or challenge-skill ratios used to categorise experiences in the flow model. Building on the basic assumptions of the four-channel model, Massimini and Carli (1988) proposed an eight-channel model with the following combinations:

- arousal (high challenges and moderate skills);
- flow (high challenges and high skills);
- control (moderate challenges and high skills);
- boredom (low challenges and high skills);
- relaxation (low challenges and moderate skills);
- apathy (low challenges and low skills);
- worry (moderate challenges and low skills); and
- anxiety (high challenges and low skills).

These eight channels are represented diagrammatically in Figure 2.2. The centre of the diagram represents the average level of an individual's weekly challenges and skills as measured by the Experience Sampling Method. It corresponds to the point of origin of the coordinate system shown in Figure 2.1. Clarke and Haworth (1994) treat this combination of moderate challenges and moderate skills as a ninth channel which they refer to as 'ease'. The eight-channel model receives mixed support in the literature, with most authors continuing to reference the four-channel model.

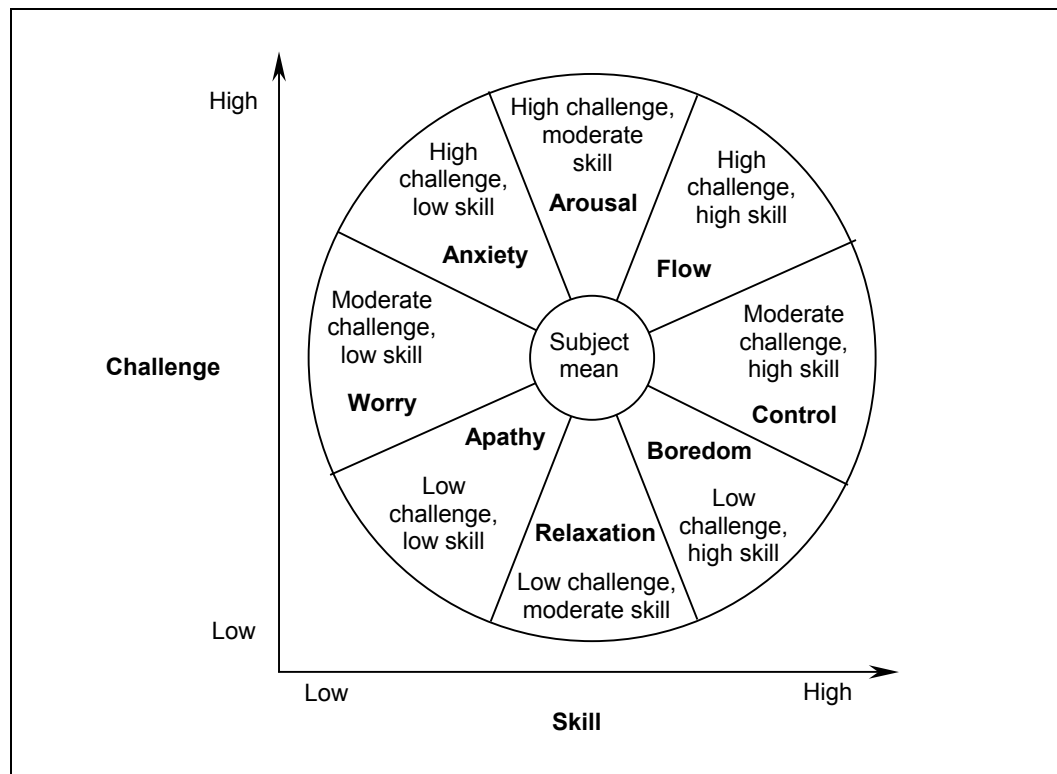


Figure 2.2. The eight-channel flow model. Adapted from Massimini and Carli (1988)

Clear goals and feedback

Most flow experiences are reported to occur within activities that are goal-directed and bounded by rules (Csikszentmihalyi 1990, p. 49). In everyday life, at home or on the job, people often engage in activities without being consciously aware of their purpose or of how well they are doing. In contrast, flow activities allow a person to focus on clear goals and to receive meaningful feedback.

Most games, sports, artistic performances and religious ceremonies have well-defined goals and rules that allow participants to act without questioning what should be done and how (Csikszentmihalyi 1993, p. 179). A musician knows exactly which note to play next, and can immediately hear whether she is performing well or not. A chess player aims to mate his opponent's king, and can calculate whether he has come closer to this objective with each move he makes.

Some jobs can also be very rewarding for the right type of person because of their goal-directed structure. A surgeon is aware of how an operation should proceed moment by moment, and can quickly tell whether a patient is doing well or not. A computer programmer knows what needs to be done at each step of a program's development, and gets progressive visual feedback along the way. Of course, the structure of a job alone does not determine whether a person performing that job finds enjoyment in it (Csikszentmihalyi 1990, p. 157). Job satisfaction partly depends on the individual's personality.

The goals of an activity and the feedback it provides are not always as clear as those in the preceding examples. Sometimes, as in the case of conversation, the goals and rules governing an activity are negotiated on the spot. In some creative activities, where goals are not clearly predefined, a person must develop a strong sense of what he or she intends to do. A poet, for example, may know that she wants to write a poem about motherhood, but apart from that, her goals may be quite vague until the work has progressed to a point where she can evaluate it. The poet must possess internal criteria for assessing the quality of each verse and the appropriateness of her choice of words. As Csikszentmihalyi (1990, p. 55) explains, 'unless a person learns to set goals and to recognize and gauge feedback in such activities, she will not enjoy them'.

Almost any goal, if sufficiently clear, can serve to focus attention long enough for one to achieve a flow experience (Csikszentmihalyi 1993, p. 180). A goal need not have any social or economic value; its value is simply that it gives us an opportunity to express our potential, learn about our limits and improve our abilities. For example, a marathon swimmer's goal to swim the English Channel is simply an excuse for swimming. There is really no other reason to attempt such a feat, particularly when there are so many faster, more comfortable ways of making the crossing. The same is true for many other flow activities.

In a similar vein, almost any kind of feedback can be enjoyable, provided it is logically related to a goal in which one has invested attention (Csikszentmihalyi 1990, p. 57). For example, the sight of a distant island may be quite meaningless to most people, but to a solo yachtsman such a landfall may provide satisfying confirmation of his navigation skills (Macbeth 1988). What makes feedback valuable is the symbolic information it contains about how close one is to achieving one's goals. Another point that can be drawn from the previous example is that feedback is not always immediate. Some flow activities take a long time to accomplish, but the components of goals and feedback are still important to them.

Concentration on the task at hand

The higher-than-average challenges associated with flow activities require a complete focusing of attention on the task at hand, or as Csikszentmihalyi (1975, p. 40) puts it, 'a centering of attention on a limited stimulus field'. An important by-product of this fact is that flow leaves no room in one's consciousness for irrelevant thoughts, worries or distractions (Csikszentmihalyi 1990, p. 58). People who experience flow frequently report that, while it lasts, they are able to forget about the unpleasant aspects of life. Consider the following comment from a young male basketball player who was interviewed for a study conducted by Csikszentmihalyi (1975, pp. 40–41):

The court—that's all that matters ... Sometimes on court I think of a problem, like fighting with my steady girl, and I think that's nothing compared to the game. You can think about a problem all day but as soon as you get in the game, the hell with it ... Kids my age, they think a lot ... but when you are playing basketball, that's all there is on your mind—just basketball ... everything seems to follow right along.

In everyday life, one's concentration is rarely so intense that all preoccupations disappear from consciousness, but that is precisely what happens in a flow experience. All of the troubling thoughts that normally occupy the mind are temporarily suspended while the pressing demands of the flow activity consume one's attention.

Sense of control

The flow experience is often described as involving a sense of control, or more precisely, an absence of any concerns about failure (Csikszentmihalyi 1990, p. 59). Comments such as 'Feel like I can do anything in that state', and 'You can't imagine anything going wrong', illustrate how a runner and a football player experienced this dimension of flow (Jackson & Marsh 1996). The feeling that these elite-level athletes described is not one of actual control, but potential control. There is a real possibility that the runner may stumble and fail to complete the race; the football player may lose possession of the ball at a critical point in the game. Regardless of these realities, when challenges and skills are in balance and all attention is focused on the flow activity, the possibility of failure doesn't enter the mind (Csikszentmihalyi 1996, p. 112).

This sense of control is also frequently reported in recreational activities that involve serious risks such as hang-gliding, rock-climbing and motorbike runs (Sato 1988). Csikszentmihalyi (1990, p. 60) theorises that the enjoyment people derive from these activities stems 'not from the danger itself, but from their ability to minimize it'. The feeling of controlling potentially dangerous forces can only be experienced when one has given up the usual safety nets and a doubtful outcome is at stake.

Merging of action and awareness

One of the most distinctive features of the flow experience is the effective merging of action and awareness. As Csikszentmihalyi (1990, p. 53) describes it, sometimes 'people become so involved in what they are doing that the activity becomes spontaneous, almost automatic; they stop being aware of themselves as separate from the actions they are performing'. A champion cyclist perceived this sense of oneness in his relationship with his bike during a competition (Jackson 1996, p. 82):

You're working with the bike. It doesn't seem like you're sitting on the bike, it feels like altogether, it's just one piece of machinery working together ... like you're a part of this machine that you were born with and it's how you move.

This merging of action and awareness is made possible by the focusing of attention that was described earlier in this chapter. In everyday life, our minds are often diverted from our activities by doubts and questions that constantly compete for our attention. In flow, however, our attention is so focused on what we are doing that the usual dualism between action and awareness disappears (Csikszentmihalyi 1996, pp. 111–112).

Loss of self-consciousness

As mentioned earlier in this chapter, a flow activity can occupy a person's attention to the point of excluding all other irrelevant thoughts. One important item that disappears from awareness during flow is the self—an individual's consciousness of his or her own being or identity (Csikszentmihalyi 1990, p. 62). To illustrate this loss of self-consciousness, consider the following comment from a rock climber who experienced flow while climbing (Csikszentmihalyi 1975, p. 43):

One tends to get immersed in what's going on around him, in the rock, in the moves that are involved ... search for handholds ... proper position of the body—so involved that he might lose the consciousness of his own identity and melt into the rock.

In everyday life, the self is never far from the focus of attention. We are regularly preoccupied with personal concerns such as our appearance, our possessions or our social reputation (Zimbardo & Weber 1994, p. 393). A person in flow, however, is too focused on the task at hand to worry about such things. This lack of self-awareness does not mean that people in flow simply 'tune out'. In fact the opposite is true. Being less self-aware means that one can devote more attention to the challenges of the activity. (Csikszentmihalyi 1993, p. 185–186) The climber, for example, can focus more intensely on the rock and the moves he has to make.

A seemingly paradoxical side-effect of losing one's sense of self in a flow experience is that it often emerges stronger after the event. Knowing that we have succeeded in meeting a difficult challenge can 'lead to a feeling that the boundaries of our being have been pushed forward' (Csikszentmihalyi 1990, p. 64). This sense of achievement is not felt during the flow experience, but afterward, when we have an opportunity to reflect on our new skills and fresh accomplishments.

Distorted sense of time

Another commonly reported dimension of the flow experience is a distorted sense of time. In most cases, time seems to pass faster than usual. Hours slip by as if they were minutes. One surgeon reported, 'Time goes very fast; but afterwards, if it was a difficult operation, it may feel as if I had been working one hundred hours' (Csikszentmihalyi 1993, p. 186).

In some exceptional cases, people in flow find themselves very sensitive to the passage of time. In most of these situations, keeping track of time is one of the skills needed to perform well in the activity. Runners, for example, sometimes need to pace themselves precisely during a competition (Csikszentmihalyi 1990, p. 66).

Autotelic experience

When an activity exhibits many of the characteristics described in the preceding sections, the experience becomes autotelic, or worth doing for its own sake.

According to Csikszentmihalyi (1990, p. 67), an autotelic experience is 'a self-contained activity, one that is done not with the expectation of some future benefit, but simply because the doing itself is the reward'. Because autotelic experiences are so satisfying, they create a strong desire to repeat the activity that produced the experience. Consider the following comment from a sixty-two-year-old woman who experienced flow while knitting (Delle Fave & Massimini 1988, pp. 198–199):

This sensation [referring to the flow experience] begins when I make a difficult stitch—if it is difficult I get great satisfaction when I see that it came out well. I can spend hours knitting. This way of feeling only happens if I get involved. Once it starts, what keeps it going is the activity itself.

Activities such as art, music and sport often lead to autotelic experiences. People do them, not to receive some extrinsic reward, but simply because they enjoy the experience. In contrast, many of the activities we perform every day are exotelic. We do them, not because we enjoy them, but because we have to do them or because we expect some future benefit from them (Csikszentmihalyi 1996, p. 113). Most activities are neither purely autotelic nor purely exotelic, but a combination of the two. For example, a concert pianist may receive the extrinsic reward of payment for his performance as well as the intrinsic reward of enjoying what he does.

Concepts related to flow

Over the past forty years researchers in psychology have developed several concepts that, like flow, may be categorised as optimal experiences. This section compares and contrasts two of those concepts: peak experience and peak performance.

Peak experience

According to Maslow (1971, p. 105), the term 'peak experience' is 'a generalization for the best moments of the human being, for the happiest moments of life, for experiences of ecstasy, rapture, bliss, of the greatest joy'. Peak experiences are similar to flow experiences in the sense that both may involve high levels of enjoyment. Peak experiences differ from flow experiences in that 'the former is "all or nothing" while the latter varies in intensity' (Walker, Hull & Roggenbuck 1998, p. 455).

The concept of peak experience is part of Maslow's (1970) influential theory of motivation, which suggests that human needs form a hierarchy (see Figure 2.3). Basic physiological needs such as hunger and thirst are at the bottom of the hierarchy. Self-actualisation needs at the top of the hierarchy constitute a final level of psychological development in which individuals strive to realise their fullest potential—to achieve everything they are capable of achieving. According to Maslow, needs at the lower end of the hierarchy dominate an individual's motivation as long as they are unsatisfied. As lower-level needs are satisfied, people strive for the next higher level. People who achieve self-actualisation are prone to peak experiences.

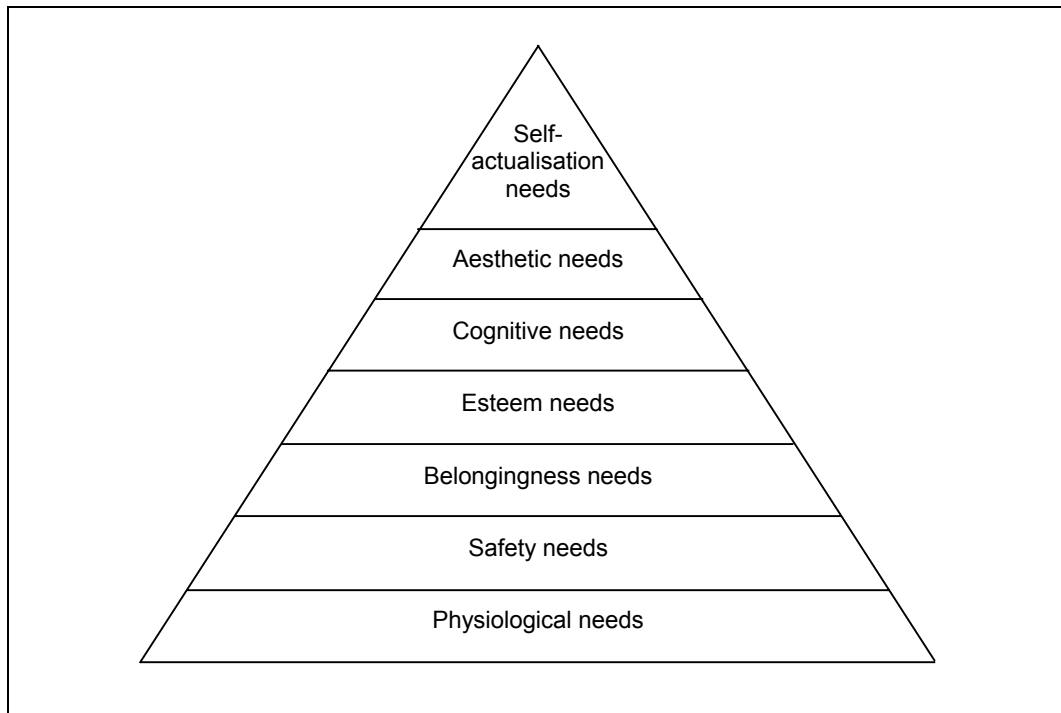


Figure 2.3. Maslow's (1970) hierarchy of needs.

Peak performance

Privette (1983, p. 1362) defines peak performance as 'superior use of human potential'. It refers to the full use of human power, whether that be physical strength in a crisis, creative expression through an artistic endeavour, intellectual mastery of a problem, or any other experience that significantly taps human potential.

Peak performance can be compared to both peak experience and flow in terms of the levels of enjoyment and performance that are involved (see Figure 2.4). Peak performance involves a high level of performance, but is not necessarily accompanied by enjoyment. Peak experience involves a high level of enjoyment, but does not necessarily involve performance. Flow involves both enjoyment and performance, but is not defined by their levels of intensity. A flow experience involves moderate to high levels of enjoyment and moderate to high levels of performance.

To illustrate the differences between these experiences, consider the following examples provided by Privette (1983). A great sporting achievement that involves a high level of enjoyment and a high level of performance could be an example of peak performance, peak experience and flow. A life-threatening event might trigger peak performance, but not peak experience and not flow. Listening to music could be a peak experience, but probably not peak performance or flow unless some kind of performance is involved. A moderately enjoyable, but not outstanding, sporting performance might be flow, but not peak experience or peak performance.

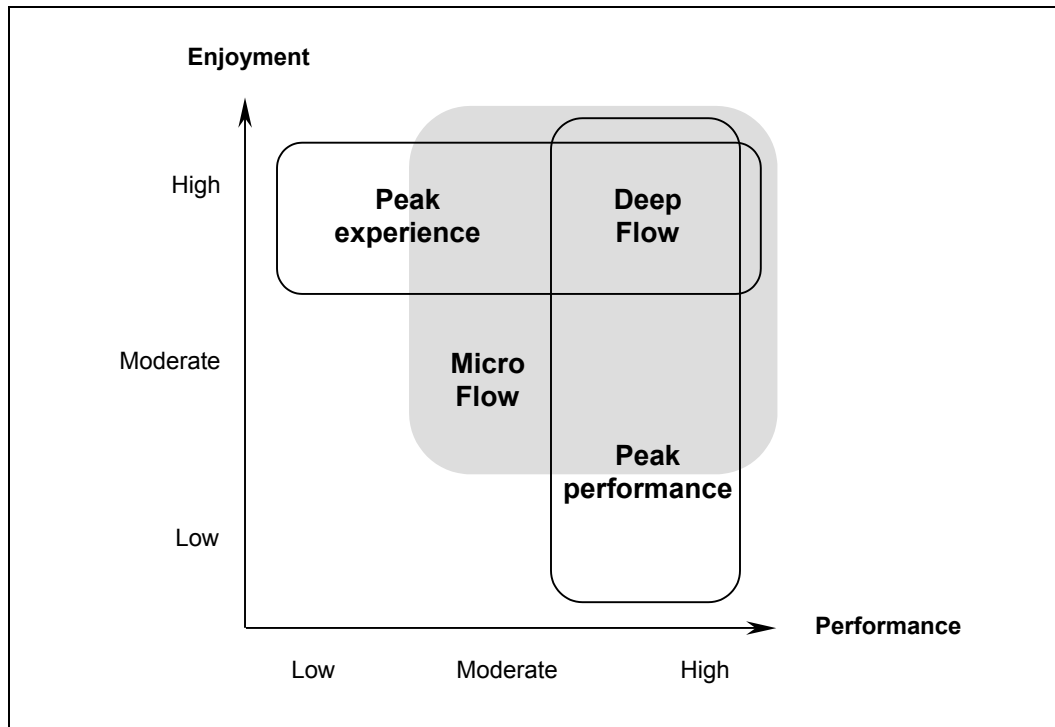


Figure 2.4. Peak experience, peak performance and flow. Adapted from Privette (1983, p. 1363).

Flow and human-computer interaction

Flow theory has been used as a framework for studying the experiences of individuals interacting with computers. This section reviews studies that have related flow to computer game play, playfulness, engagement, task scope and attitudes toward technology.

Flow and computer game play

Game developers acknowledge the importance of flow in providing satisfying game play. In a discussion about what HCI designers can learn from video game designers, Pausch et al. (1994, p. 178) summarise how game software facilitates flow:

The way each video game facilitates reaching that state is similar from one game to the next: Step one, present a goal; Step two, provide clear-cut feedback to the user as to their progress towards the goal; Step three, (and this is the step at which good video games excel) constantly adjust the game's challenges to a level slightly beyond the current abilities of the player. That's it—simple, but still a formidable design challenge.

Pursuing similar themes, Clanton (1998) and Neal (1990) list several dimensions of the flow experience among the essential ingredients of a good game: clearly defined

goals, progressively increasing levels of difficulty, a sense of control and visible feedback such as a scoring mechanism.

Malone (1981) attempted to find out what makes computer games engaging by conducting a series of empirical studies with children about their computer game preferences. He was particularly interested in learning how to design instructional software that captivates and intrigues the user.

In one of Malone's (1981) studies, forty-two boys and twenty-three girls from a private elementary school near Palo Alto, California, were interviewed about their computer game preferences. All of the students had played computer games in their weekly computer classes for at least two months, and some for more than two years. The teachers of the computer classes provided a list of twenty-five games which they thought were the most popular among the children. Each child was asked to rate the appeal of each game on a four-point scale. An analysis of variance was conducted on the resulting data with the order of presentation, the child's gender and the game as factors. The order in which the games were presented to the children had no significant influence on rating. The only significant effects detected were the child's gender and the gender by game interaction.

Contrary to expectations, there was no consensus among the children about which games were the most popular. No single game received more than seventeen per cent of the first place rankings. An analysis of the features that were common to only the popular games revealed that a clear goal, a scoring mechanism, audio effects and randomness were the most important determinants of a game's popularity.

In order to make stronger inferences Malone (1981) conducted a second study, this time focusing on a single game that challenged sensorimotor skills. Systematically varying features of the game revealed that a clear goal, a scoring mechanism, challenge, visual effects and fantasy were the most important determinants of the game's popularity.

In a third study Malone (1981) systematically varied the features of a game that challenged cognitive skills. The main finding from this experiment was that fantasies can be helpful in creating motivating instructional environments, but they must be carefully chosen to appeal to the target audience.

On the basis of these and other findings, Malone (1981) developed a theory of intrinsically motivating instruction that incorporates three sources of motivation: challenge, fantasy and curiosity.

- *Challenge.* Malone (1981, p. 356) noted that 'in order for an environment to be challenging, it must provide goals whose attainment is uncertain'. Good goals are personally meaningful, easily generated, and accompanied by some kind of performance feedback. Game characteristics that can make the attainment of a goal uncertain include variable difficulty level, multiple level goals, hidden information and randomness.

- *Fantasy*. Malone (1981, p. 360) defined a fantasy-inducing environment as one that evokes 'mental images of things not present to the senses or within the actual experience of the person involved'. Distinguishing between extrinsic fantasies that are loosely related to the skills used in the game, and intrinsic fantasies that are closely related to the skills used in the game, he claimed that 'in general, intrinsic fantasies are ... more interesting and ... more instructional than extrinsic fantasies' (Malone 1981, p. 361).
- *Curiosity*. An environment can evoke a learner's curiosity by providing an optimal level of informational complexity, which means that it is neither too complicated nor too simple with respect to the learner's existing knowledge. Malone (1981, p. 363) distinguished between sensory curiosity that involves attention-attracting changes in light, sound and other stimuli, and cognitive curiosity that is evoked by the prospect of modifying higher level cognitive structures. Sensory curiosity can be aroused by using audio and visual effects as decoration, as a means of enhancing fantasy, as a reward or as a representation system. Cognitive curiosity can be aroused by presenting just enough information to make learners believe their knowledge is incomplete or inconsistent.

Flow and playfulness

Closely related to the role of flow in human-computer interactions, is the playfulness construct. There is ample anecdotal and empirical evidence that people find an element of playfulness in their experiences with computers (Katz 1987). As Starbuck and Webster (1991, p. 72) note, 'because computers follow logical rules and produce very immediate outcomes, they create work environments that resemble many recreational games, and they foster exploratory learning and what-if fantasizing'.

Many researchers have sought to better understand playfulness in human-computer interactions, both as a trait and a state (Martocchio & Webster 1992; Starbuck & Webster 1991; Webster & Martocchio 1992, 1993; Webster, Trevino & Ryan 1993; Yager et al 1997). Traits are relatively stable characteristics of individuals that tend to be unaffected by situational factors. States, on the other hand, are subjective characteristics of experience that fluctuate over time and can be influenced by situational factors. Thus:

... the trait of microcomputer playfulness represents a relatively enduring tendency to interact playfully with microcomputers, while the state of microcomputer playfulness represents a temporary state of playfulness with microcomputers (brought on by such influences as characteristics of the software, social influences, and so on) (Webster and Martocchio 1992, p. 204).

Playfulness as a trait

Although playfulness is a pervasive element of everyday life, most of the existing research on playfulness has studied children rather than adults, has focused narrowly

on games rather than on playfulness in a wider sense, and has occurred in classroom settings rather than in organisations (Starbuck & Webster 1991). Recognising the need for studies of playfulness in human-computer interaction, Webster and Martocchio (1992) developed and validated a Computer Playfulness Scale that measures an individual's tendency to interact spontaneously, inventively, and imaginatively with computers.

Lieberman (1977, p. 25) defined the general trait of playfulness in terms of five distinct factors: physical spontaneity, manifest joy, sense of humour, social spontaneity and cognitive spontaneity. Of these five factors, Webster and Martocchio (1992) identified cognitive spontaneity as the most relevant playfulness factor in the context of human-computer interactions. In her descriptions of cognitive spontaneity, Lieberman (1977, pp. 86–90) used adjectives such as imaginative, creative, impulsive, and perceptive. Thus, Webster and Martocchio (1992, p. 204) concluded that:

... cognitive spontaneity is a type of intellectual playfulness: those higher in microcomputer playfulness tend to be more spontaneous, inventive, and imaginative in their microcomputer interactions.

For example, in the case of interacting with new software, playful individuals are likely to experiment with the options available and eventually master the program through their self-motivated interaction.

Webster and Martocchio (1992) constructed a Computer Playfulness Scale based on Lieberman's (1977) cognitive spontaneity construct. The fifteen-item scale asked individuals to indicate on a seven-point scale the degree to which certain adjectives characterised their behaviour while interacting with computers. After a pilot test involving ninety undergraduate students from a management information systems (MIS) course, new items were added to the instrument, resulting in a twenty-two-item scale containing the following adjectives: spontaneous, conscientious (R), unimaginative (R), experimenting, serious (R), bored (R), flexible, mechanical (R), creative, erratic, curious, intellectually stagnant (R), inquiring, routine (R), playful, investigative, constrained (R), unoriginal (R), scrutinizing, uninventive (R), inquisitive and questioning. Items labelled with an *R* were reverse-scored.

To assess the validity of the computer playfulness measure, the researchers developed a series of hypotheses describing the relationships of computer playfulness with other individual characteristics such as computer anxiety and computer competence, and with training outcomes such as positive mood and learning. The hypotheses constituted a nomological network for examining the construct validity of the computer playfulness measure in terms of its factor structure, internal consistency reliability, concurrent validity, discriminant validity, predictive validity, predictive efficacy, and test-retest reliability.

Data from three survey studies and two training studies involving more than 400 participants were used to examine the validity of the computer playfulness measure. All of the study participants were either students or employees from large American

universities. The results of the studies provided initial evidence for the construct validity of a computer playfulness measure made up of the following seven items: spontaneous, unimaginative (R), flexible, creative, playful, unoriginal (R) and uninventive (R).

As hypothesised, the computer playfulness measure related positively to computer attitudes, competence and efficacy, related negatively to computer anxiety, and did not relate to gender or age. The measure also related positively to training outcomes of involvement, positive mood, satisfaction and learning. The results suggested that computer playfulness may be a more efficient predictor of involvement, learning, positive mood and satisfaction than either computer attitudes or anxiety. On the basis of these findings, Webster and Martocchio (1992, p. 201) suggested that 'researchers should focus more attention on positive influences on human-computer interaction, such as microcomputer playfulness, rather than on negative influences, such as computer anxiety'.

Yager et al. (1997, p. 45) extended Webster and Martocchio's (1992) work by using a longitudinal study to 'establish the temporal stability and situational consistency of the playfulness construct'. In other words, their study tested the hypothesis that playfulness is a stable trait, as opposed to a dynamic one that changes over time or across situations.

The seven-item Computer Playfulness Scale was administered to seventy-seven undergraduate students enrolled in a computer-literacy course at a moderately large American university. The temporal stability of the playfulness trait was tested by administering the instrument four times over the course of the five-week summer session—once at the beginning of the course and again following the completion of three milestones in the course work. The situational consistency of the playfulness trait was tested by varying the type of software taught in the course. The three milestones were the completion of projects involving Microsoft Windows, Microsoft Word and Microsoft Excel.

The Computer Playfulness Scale was assessed for internal consistency, unidimensionality, and temporal and situational stability. The results of the study supported the hypothesis that playfulness is a stable trait.

Playfulness as a state

Webster and Martocchio's (1992) treatment of playfulness as a trait did not imply that an individual cannot feel varying degrees of playfulness at different times. In fact, they argued that the construct of playfulness should be studied as a state in human-computer interactions.

Webster, Trevino and Ryan (1993, p. 412) defined the state of computer playfulness as 'an aspect of users' subjective experiences during computer interactions that is characterized by perceptions of pleasure and involvement'. They drew upon Csikszentmihalyi's (1975, 1990) flow theory to provide a theoretical basis for

measuring the state of playfulness in human-computer interactions. Based on their understanding of the literature, the researchers proposed that the flow construct is comprised of four interrelated dimensions: control, attention focus, curiosity and intrinsic interest. They further hypothesized that flow would be significantly correlated with perceptions of a program's flexibility and modifiability, experimentation and expectations of future computer use.

A study was designed to investigate these research expectations. One-hundred and thirty-three MBA students from a large American university were surveyed at the end of a one-day spreadsheet course. Variables measured by the questionnaire included flow, flexibility, modifiability, experimentation and expectations of future computer use. The hypotheses were tested using confirmatory factor analysis (LISREL). The LISREL results suggested that within human-computer interactions flow is comprised of three dimensions, not four as originally proposed. The three dimensions were control, attention focus and a combination of curiosity and intrinsic interest which Webster, Trevino and Ryan (1993, p. 420) labelled 'cognitive enjoyment'. All correlational hypotheses were supported by the results and the measure of flow was found to be reliable.

To generalise these findings, a second study was conducted with additional hypotheses concerning work outcomes. The researchers proposed that flow would be significantly correlated with actual computer use, perceptions of communication quantity, and perceptions of communication effectiveness. Forty-three employees in the accounting department of a large computing organisation were surveyed about their use of e-mail. Variables measured by the questionnaire included flow, flexibility, modifiability, experimentation, expectations of future computer use, actual computer use, perceptions of communication quantity, and perceptions of communication effectiveness. Pearson correlations were calculated for the relationship between flow and each of these variables. All correlations were significant and in the proposed direction, providing additional support for all hypotheses.

Webster, Trevino and Ryan (1993, p. 421) acknowledged some of the limitations of their studies:

The data are cross-sectional, perceptual (with the exception of the number of unread electronic mail messages), and subject to common method variance. Future research would benefit from longitudinal research designs and the inclusion of more objective outcome data. Further, because of a limited sample size in Study 2, we were unable to utilize analytic techniques that could account for the correlations among the dependent variables in that study.

Flow and engagement

Flow theory has been used as a framework for studying engagement, a construct that is conceptually similar to the state of playfulness. Laurel (1993, p. 113) describes engagement as 'the state of mind that we must attain in order to enjoy a representation

of an action'. Likening it to the theatrical notion of the 'willing suspension of disbelief', she writes:

... in order to enjoy a play, we must temporarily suspend (or attenuate) our knowledge that it is "pretend". We do this "willingly" in order to experience other emotional responses as a result of viewing the action ... engagement entails a kind of playfulness—the ability to fool around, to spin out "what if" scenarios. Such "playful" behavior is easy to see in the way that people use spreadsheets and word processors (Laurel 1993, pp. 113–114).

Webster and Ho (1997) observed considerable overlap between the constructs of engagement and playfulness while exploring characteristics of instructional multimedia presentations that influence the engagement of learners. The researchers proposed that the two constructs share the dimensions of attention focus, curiosity and intrinsic interest, but differ with respect to perceived control. They suggested that an individual may experience passive engagement in an activity such as watching television, but cannot experience passive playfulness or passive flow. Drawing on theories of playfulness and flow, Webster and Ho (1997, p. 66) hypothesised that 'multimedia designed to provide more challenge, feedback, presenter control, and variety will engage learners more than multimedia designed to provide fewer of these features'.

A pilot study and two main studies were conducted to test these hypotheses. In each study, undergraduate students attending a lecture in organisational behaviour were exposed to two multimedia presentations, one of which was designed to be more engaging than the other. The first presentation, which addressed organisational socialisation, was developed with Macromedia Authorware, and was delivered during the first half of the lecture. The second presentation, which addressed organisational culture, was developed with Microsoft PowerPoint, and was delivered during the second half of the lecture.

Both presentations were delivered by the same lecturer and were designed to be as similar as possible, except with regard to challenge, feedback, control and variety. These proposed influences on engagement were intentionally heightened in the first presentation. Challenge was increased by involving the audience in interactive questionnaires. Feedback was increased by providing visible responses to questionnaire input. Presenter control was increased by providing buttons for controlling navigation and selecting options within a screen. Variety was increased by incorporating music, sound effects and animations into the presentation. Following each presentation, the students completed a questionnaire that measured the proposed influences on engagement (challenge, feedback, control and variety) and the proposed dimensions of engagement (attention focus, curiosity and intrinsic interest).

Ninety-five students participated in the pilot study, 202 students participated in the first main study, and 118 students participated in the second main study. Since each student completed the questionnaire twice—once for each presentation—repeated-measures analyses were performed on the data. The hypotheses relating to the influence of challenge, feedback, presenter control and variety on engagement were

supported. Challenge related most strongly to engagement. In addition, the items used to measure engagement were factor-analysed to determine whether engagement was similar to the state of playfulness. One clean factor emerged, supporting the similarity of the two constructs.

Webster and Ho (1997, pp. 72–73) acknowledged some of the limitations of their studies:

Several limitations exist with the present research, and provide other directions for future studies. First, we did not include a control group of students listening to a presentation made with the use of a single medium, such as the overhead projector or the blackboard ... Second, we compared software in which challenge, feedback, control, and variety were all manipulated at the same time ... Third, for reasons of brevity, most of our measures contained two items, and future research should utilize more items to increase reliability. Fourth, we captured all measures at the same time on the same questionnaire, resulting in limited exposure to the software and common method variance ... Finally, we only examined the effects of multimedia features on engagement ...

Flow and task scope

What factors motivate individuals to expend time and effort learning and adjusting to new technology? This is the question that prompted Ghani and Deshpande (1994) to investigate the influence of flow and task scope on the behaviour of computer users. The researchers defined flow as having two key characteristics: total concentration on an activity and the enjoyment derived from an activity. The term 'task scope' refers to a job's motivating potential, as determined by characteristics such as variety, identity, autonomy and feedback. A high-scope job involves the use of a greater variety of skills and allows the individual greater autonomy in determining how the work will be carried out.

One hundred and forty-nine professionals from a variety of manufacturing, service and government organisations were surveyed by questionnaire about typical work-related computer sessions. The average respondent was thirty-six years old, used a computer at work for twenty hours per week, and had seven years of computing experience. Fifty-nine per cent of the respondents were male.

The questionnaire measured flow-related variables and job characteristics such as enjoyment, concentration, perceived control, exploratory behaviour, perceived challenge, task variety, identity, autonomy, feedback, and extent of computer use. Task scope was measured as the average of the variety, identity, autonomy and feedback scores. Flow was measured as a combination of the concentration and enjoyment scores.

A causal model was developed and tested using linear structural relationship modelling (LISREL). Perceived control and challenge were identified as key factors

determining the flow experience. Flow was linked to exploratory behaviour, which in turn was linked to the extent of computer use.

Task scope was found to have a moderating effect on the relative importance of perceived control and challenge in relation to the flow experience. Perceived control was more important for individuals with a high-scope job, while challenge played a greater role for individuals with a low-scope job. Referring to theories of motivation, Ghani and Deshpande (1994) suggested that individuals with a high-scope job are less likely to seek challenges through computer use because they are already involved in work that has high motivating potential. In contrast, individuals with a low-scope job may be inclined to react positively to challenges in computer use because their work has low motivating potential.

Ghani and Deshpande (1994, p. 388) acknowledged some of the limitations of their study:

These findings must of course be interpreted with caution. First, the parameter estimates obtained can be interpreted only in the context of the variables included in the model. Exploratory use was measured with a self-rating instrument. The model needs to be tested with more objective measures. Second, although it is permissible to test causal models by using cross-sectional data, longitudinal designs provide a stronger basis for inferences. Finally, the model clearly does not include all the relevant variables.

Flow and attitudes toward technology

In the early 1990s research on the capabilities, perception and use of computer-mediated communication (CMC) technologies such as e-mail and voice mail was limited. Trevino and Webster (1992) attempted to address this deficiency by investigating employee attitudes toward these technologies and their impacts on communication-related work outcomes. A key variable in their study was the flow construct, which was used to characterise perceived interactions with CMC technologies as more or less playful and exploratory. Based on their understanding of the literature, the researchers defined four dimensions of flow: control, attention focus, curiosity and intrinsic interest.

Trevino and Webster (1992) hypothesised that the flow experiences of CMC technology users would be influenced by the type of CMC technology (e-mail or voice mail), ease of use, and computer skill. They also proposed that the following variables would directly influence employee evaluations and perceived impacts of CMC technologies: flow, type of CMC technology, ease of use, management support, and use by communication partners. Figure 2.5 illustrates the theoretical model of e-mail and voice mail evaluation and impact.

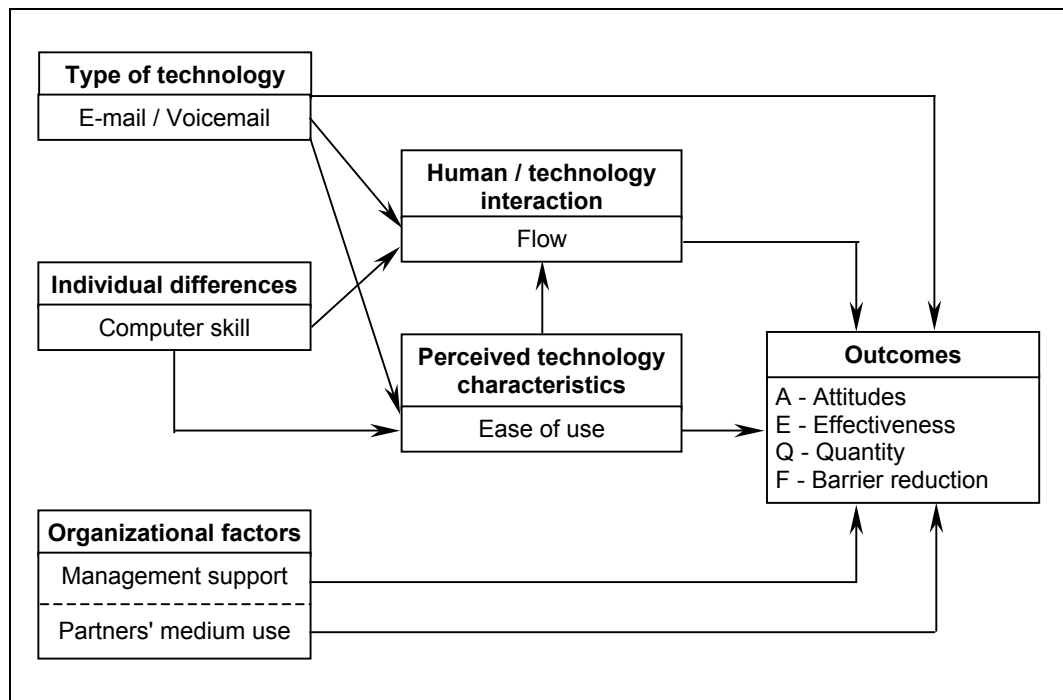


Figure 2.5. Model of e-mail and voice mail evaluation and impact (Trevino & Webster 1992)

Questionnaires were distributed to 287 employees selected randomly from a total of 800 employees at an American health care firm that had recently adopted both e-mail and voice mail. Half of the respondents were asked questions about e-mail usage and attitudes; the other half were asked similar questions about voice mail usage and attitudes. One hundred and fifty-four completed questionnaires (seventy-five regarding e-mail and seventy-nine regarding voice mail) were returned. The model shown in Figure 2.5 was tested and refined using structural equation modelling (LISREL).

The LISREL results provided mixed support for the hypotheses. Flow was positively influenced by CMC technology type and ease of use, but negatively influenced by computer skill. Trevino and Webster (1992) suggested that the respondents might not have found CMC technologies to be particularly challenging, given their high levels of computer skill. E-mail interactions were perceived to be higher in flow than voice mail interactions. Neither technology type nor computer skill related to ease of use.

Flow was positively associated with three of the outcome variables: attitudes toward the technology, perceptions of communication effectiveness and quantity of communication. However, flow had a negative association with the fourth outcome variable: reduction of communication barriers. Trevino and Webster (1992) suggested this latter finding might be due to the influence of voice mail, which is often used as just an answering machine despite its other capabilities. In addition to flow, type of technology, ease of use, management support and use by communication partners were directly associated with the outcome variables.

Trevino and Webster (1992, p. 565) acknowledged some of the limitations of their study:

The data are cross-sectional, perceptual, subject to common method variance, and collected in only one organization. Further, management's restrictions on survey length forced us to use some single item measures and to reduce the number of items for some measures (resulting in lower reliabilities). The perceptual nature of the data raises questions about the relationship between these perceptions and actual behavior.

Flow and the Web

Flow plays an important role in the experiences of Web users. Internet marketers Hoffman and Novak (1996, p. 58) embraced flow as 'the glue holding the consumer' in the Web environment. Basch (1996, p. 60) described flow as 'what keeps us pointing and clicking long after we've found, or forgotten, what we went online for in the first place'. This section reviews several studies of flow in the Web environment.

Conceptual model of flow in the Web environment

The Web has become an important environment for marketing and commercial activities. Hoffman and Novak (1997, p. 44) suggested that flow theory is 'central to the marketing question of how to develop the Web into a worthwhile consumer experience'. The researchers defined flow in the Web environment as:

... 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 (Hoffman & Novak 1996, p. 57).

In an attempt to understand the relationship between flow and the behaviour of online consumers, Hoffman and Novak (1996) developed a conceptual model of flow in hypermedia computer-mediated environments (CME) such as the Web (see Figure 2.6). Their model specified an explicit structure for direct and indirect influences on flow, as well as the relationships between model constructs and behavioural outcomes.

Drawing on studies such as those discussed earlier in this chapter, Hoffman and Novak (1996, pp. 57–58) argued that the flow experience requires a set of antecedents to occur and results in a set of consequences:

Two primary antecedents must be present in sufficiently motivated users of a hypermedia CME for the flow experience to occur. Consumers must focus their attention on the interaction, narrowing their focus of awareness so that irrelevant perceptions and thoughts are filtered out, and they must perceive a balance between their skills and the challenges of the interaction.

The key consequences of the flow experience for consumers are increased learning, exploratory and participatory behaviours, positive subjective experiences, and a perceived sense of control over their interactions in the hypermedia CME.

In addition to these primary antecedents and consequences, Hoffman and Novak (1996) proposed the influence of two secondary antecedents: telepresence and interactivity. Steuer (1992, p. 76) defined telepresence as 'the experience of presence in an environment by means of a communication medium'. The environment may be a real environment such as a distant space viewed through a video camera, or a non-existent environment such as an animated world in a video game. Steuer (1992) hypothesised that telepresence is a function of both the technology representing a mediated environment and the individual perceiving a mediated environment (see Figure 2.7). Since presence resides in an individual's consciousness, the representational powers of the technology will have similar but not identical effects across a range of individuals.

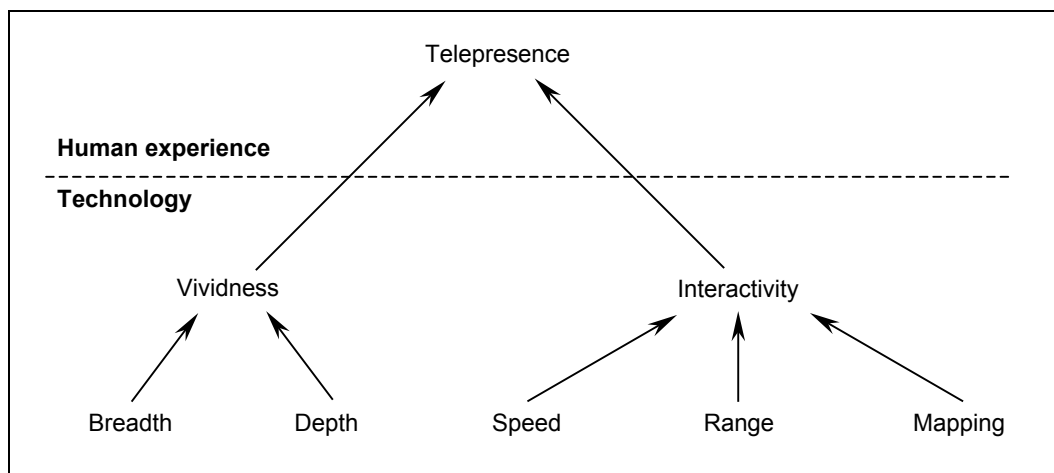


Figure 2.7. Technological variables influencing telepresence (Steuer 1992)

Steuer (1992) also identified two key technological variables that help to induce a sense of telepresence: vividness and interactivity. Vividness is the sensory richness of a mediated environment. It depends on two factors: sensory breadth, which is the number of sensory dimensions presented simultaneously; and sensory depth, which is the resolution within each of these perceptual channels. Interactivity is the extent to

which users can modify the form and content of a mediated environment in real time. It depends on three factors: speed, which is the rate at which the environment responds to input; range, which is the amount of change that can be effected on the environment; and mapping, which is the way in which human actions are connected to actions within the environment.

Structural model of flow in the Web environment

Hoffman and Novak's (1996) conceptual model of flow laid the groundwork for formal empirical testing, which was later conducted by Novak, Hoffman and Yung (2000). Using data from a large-sample Web-based survey, Novak, Hoffman and Yung (2000, p. 22) developed, refined and validated a structural equation model that brought together 'the components of what makes for a compelling online experience'. The model had thirteen constructs (see Table 2.1) which were operationalised using either nine-point rating scales or semantic differential scales. Indicators for measuring the constructs were developed with the aid of four small-scale pretests and two large-scale pilot tests. Existing measures such as Webster and Martocchio's (1992) Computer Playfulness Scale were incorporated into the survey instrument where appropriate.

In addition to the thirteen constructs, the study employed three Web usage variables which specified when the respondent first started using the Web (StartWeb), how much time the respondent spent using the Web each day (TimeUse), and how much time the respondent expected to spend using the Web in the future (ExpectUse).

Table 2.1. Constructs used in Novak, Hoffman and Yung's (2000) flow survey

Construct	Constitutive or operational definition
Arousal	... corresponds to high challenge and moderate skill. ... serves as a theoretical correlate of challenge.
Challenge	... the consumer's opportunities for action on the Web.
Control	... corresponds to high skill and moderate challenge comes from both the Web user's perception of her ability to successfully navigate through the Web environment and her perception of how the Web responds to her inputs.
Exploratory behaviour	The eight-item exploratory behavior scale is modified from Baumgartner and Steenkamp (1996)'s 20-item exploratory buying behavior tendencies scale.
Flow	... a cognitive state experienced during online navigation that is determined by (1) high levels of skill and control; (2) high levels of challenge and arousal; and (3) focused attention; and (4) is enhanced by interactivity and telepresence ...
Focused attention	... a centering of attention on a limited stimulus field ... the computer ...
Interactivity (speed)	... we consider only the speed of interaction ... Thus, our operationalization of interactivity is somewhat limited.
Involvement (importance)	... enduring involvement ... operationalized here as importance, is formed by the presence of situational and/or intrinsic self-relevance ...
Playfulness	... the seven-item playfulness scale is from Webster and Martocchio (1992) ...
Positive affect	... positive subjective experiences ...
Skill	... the Web consumer's capacity for action during the online navigation process ...
Telepresence	... the mediated perception of the environment ... the perception that the virtual environment with which one is interacting is more real or dominant than the actual physical environment.
Time distortion	... the perception of time passing rapidly when engaged in an activity.

Novak, Hoffman and Yung (2000) formulated hypotheses about relationships between the model constructs, including both direct and indirect influences on flow. The hypotheses were not stated in a causal manner because the direction of causality could not be determined from the survey data.

- H1: Greater skill at using the Web and greater perceived control during the Web interaction correspond to greater flow while using the Web.
- H2: Greater challenge and arousal correspond to greater flow.
- H3: Greater telepresence and time distortion correspond to greater flow.
- H4: Greater focused attention corresponds to greater flow, telepresence and time distortion.

- H5: Greater importance corresponds to greater focused attention.
- H6: Greater speed of interaction corresponds to greater focused attention, telepresence and time distortion, and flow.
- H7: The longer the respondent has been using the Web, the greater the skill and control.
- H8: Greater flow corresponds to greater exploratory behaviour
- H9: Greater flow corresponds to greater positive affect
- H10: Flow, and closely related constructs such as telepresence, time distortion, and exploratory behaviour, will be greater for respondents who use the Web for experiential uses, such as online chat, and entertainment, than for task-oriented uses such as work, searching for specific reference information, or online job listings.
- H11: Consumers who more recently started using the Web are more likely to use it for experiential activities; those who have been using the Web for a long time are more likely to use it for task-oriented activities.
- H12: Flow, and closely related constructs such as telepresence, time distortion, and exploratory behaviour, have a negative relationship with the length of time the respondent has used the Web.

The survey instrument was administered as an online form along with nine other surveys that comprised the Ninth World Wide Web User Survey conducted by the Graphic, Visualization, and Usability Center (GVU) at the Georgia Institute of Technology (<http://www.gvu.gatech.edu>). The GVU survey was not representative of the general population of Web users since it employed non-probabilistic sampling and self-selection. GVU survey samples tend to contain more long-term, sophisticated Web users than the general population.

At the end of the five-week survey period, 1 962 completed flow surveys were collected. The 1 654 respondents who completed both the flow survey and GVU's Web and Internet Usage Survey constituted the final sample. As part of a cross-validation procedure for assessing model fit, the 1 654 respondents were randomly split into a calibration sample of 1 154 respondents and a validation sample of 500 respondents.

Novak, Hoffman and Yung (2000, pp. 31–32) adopted a two-stage approach to model construction and testing:

First, we "purified" the measurement model by eliminating measured variables and latent factors that were not well fit by an initial confirmatory factor analysis (CFA) model. Second, we fit a theoretical base model, and a series of revised models to the measured variables retained in the first step.

Latent factors for playfulness and positive affect were eliminated along with several measured variables in the process of purifying the measurement model. The revised model shown in Figure 2.8 provided mixed support for the hypotheses. The relationships between flow and the constructs skill (H1), challenge (H2) and telepresence (H3) were positive and significant, supporting the first three hypotheses. No support was found for the hypothesis that greater focused attention corresponds to greater flow (H4). However, focused attention did correspond to greater telepresence and time distortion (H4), thereby influencing flow indirectly through these variables. Greater importance was positively associated with greater focused attention (H5). Greater speed of interaction corresponded to greater flow (H6), but did not correspond to greater focused attention, telepresence or time distortion. As expected, the longer respondents had been using the Web, the greater their levels of skill and control were (H7). It was unclear whether exploratory behaviour was directly associated with flow or an outcome of telepresence (H8). Finally, the hypothesis that greater flow corresponds to greater positive affect (H9) clearly wasn't supported, since positive affect was dropped from the model in the measurement purification process.

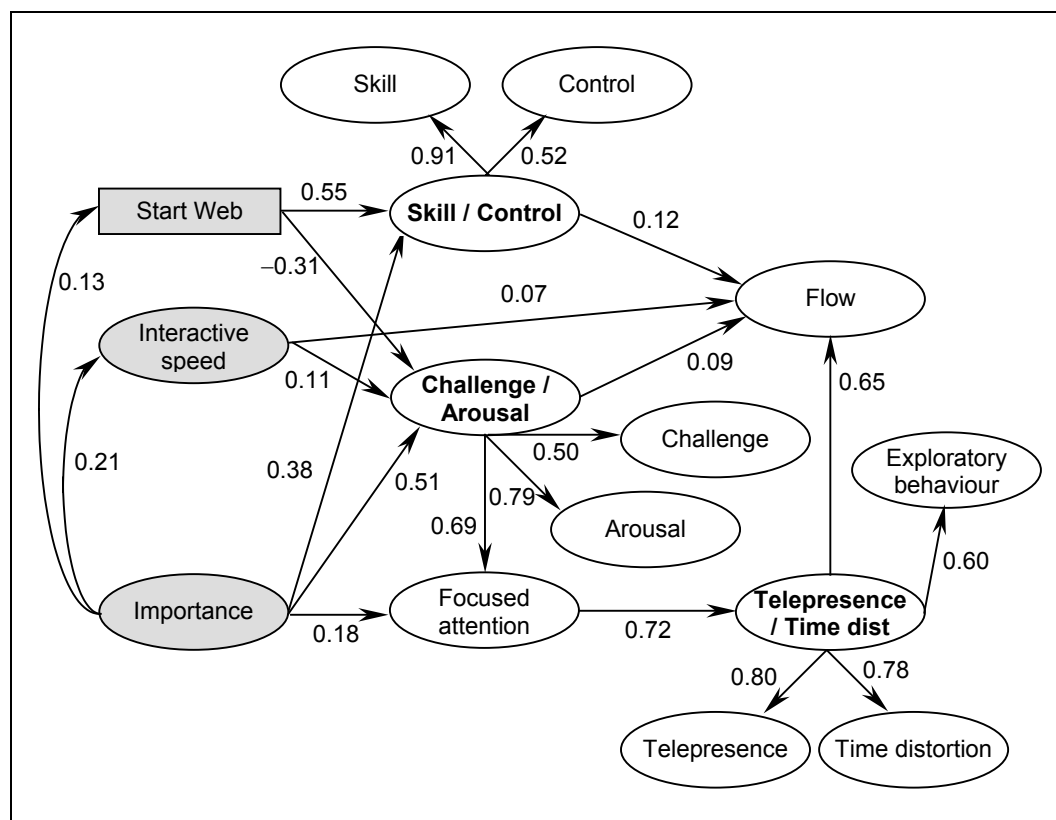


Figure 2.8. Novak, Hoffman and Yung's (2000) revised structural model of flow in the Web environment

Constructs derived from the structural model were used to predict outcome variables corresponding to consumer behaviour and Web usage. As hypothesised, flow was

positively correlated with fun, recreational and experiential uses of the Web (H10), but negatively associated with task-oriented activities such as work and searching for product information (H10). Novak, Hoffman & Yung (2000, p. 40) provided the following explanation for this result:

These results suggest that online shopping and task-oriented activities involving product search do not yet offer the requisite levels of challenge and arousal, nor do they induce the sense of telepresence and time distortion necessary to create a truly compelling online customer experience.

The study supported the hypothesis that consumers who have used the Web for the shortest period of time are more likely to use it for experiential activities, while experienced users are more likely to use the Web for task-oriented activities (H11). Although flow appeared to decrease with years of Web usage (H12), the study found that a sizeable proportion of very experienced respondents (three or more years of Web use) continued to experience flow and related constructs.

Novak, Hoffman and Yung's (2000) study was one of the most comprehensive attempts to quantitatively model flow ever undertaken, but it still had its critics. Commenting on a working paper produced in 1998, Chen, Wigand and Nilan (1999) drew attention to some of the study's limitations:

We have several concerns with this study. First, the concept of flow was not operationalized as a situated experience. Instead, they studied Web users' flow experience as a general experience of Web users. The respondents in their study could report any Web use experience they had before. Second, they did not operationalize the concepts of perceived challenges and skills as dynamic counterparts to each other. Instead, static views were used to define skills as the ability to use the Web and browsers, and challenges as the feelings of challenge felt by Web users. Third, measuring the same individual repeatedly at different times would provide the optimal approach to studying experience characterized by perceived conditions. The quality of the data and the amount of insight provided by a single questionnaire may not provide enough data for researchers to explore subjects' inner world over time, as Novak et al.'s (1998) study used a one-shot survey.

Measuring flow with ESM software

Chen, Wigand and Nilan (1998) explored the relationship between the flow state and its characteristic dimensions in the Web environment using a software application that mimicked the Experience Sampling Method (ESM). One hundred students at an American university agreed to have the ESM software run on their computers while they used the Web. Every five to seven minutes the ESM software interrupted the participants' Web activities by displaying a questionnaire on their computer screen.

The questionnaire asked each participant questions about his or her subjective state at the time of interruption. It included both open-ended questions and eleven-point Likert scales for rating constructs such as challenge, skill, clear goals, enjoyment and attention. Once the questionnaire had appeared three times, the participants could

press a button to end their participation in the study and send the data to the researchers electronically.

Chen, Wigand and Nilan (1998) assumed that participants were in the flow state if their challenge and skill ratings were both above five and the difference between the ratings was less than two. On this basis, twenty-five per cent of the questionnaires were judged as representing the flow state. Differences between the various dimensions of flow were analysed using two-tailed t-tests, and associations between the dimensions were measured with the Pearson correlation coefficient.

The data analysis revealed strong correlation between the constructs of skill, clear goals, enjoyment and attention. However, other findings contradicted fundamental elements of flow theory. For example, challenge correlated negatively with skill, clear goals, enjoyment and attention. In addition, users who did not experience flow were more likely to have a clear goal, pay attention to their activities and find enjoyment in their activities than users who did experience flow. One likely reason for the contradictory results is the ESM software's lack of suitability as an in situ self-report mechanism for Web users. In a separate paper dealing with the same study, Chen and Nilan (1998) reported on some of the negative feedback they received from the participants:

First, some subjects complained that the questionnaire popping up was very annoying and too intrusive ... Second, we also received some negative feedback about the length of the questionnaire and the time they needed to spend on answering questions. Third, from a pilot test before this exploratory study, we found out that in general Web users do not have enough patience to read a long explanatory text.

The Web as a multi-activity environment

As mentioned earlier in this chapter, Novak, Hoffman and Yung's (2000) structural equation model of flow was criticised by Chen, Wigand and Nilan (1999) for failing to operationalise key concepts such as flow, challenge and skill in terms of specific Web activities. Commenting on a working paper produced in 1998, Chen, Wigand and Nilan (1999, p. 592) wrote:

Past operationalizations of flow have employed measures that ask subjects about 'challenges' they perceive and their 'skills' in meeting and overcoming the challenges. We think that these operationalizations are unlikely to be understood by subjects in all but the most mundane activities (e.g. playing a physical sport), thereby generating unreliable definitions. Further, because the Web is a multi-activity environment which is very complex, subjects' interpretations of 'challenges' and 'skills' are likely to be even more confused.

To illustrate Chen, Wigand and Nilan's concern, the survey items that Novak, Hoffman and Yung (2000) used to measure the challenge construct are presented below. Their survey instrument asked participants to respond to each of these statements on nine-point rating scales.

- C1: Using the Web challenges me.
- C2: Using the Web challenges me to perform to the best of my ability.
- C3: Using the Web provides a good test of my skills.
- C4: I find that using the Web stretches my capabilities to my limits.
- C5: How much does the Web challenge you, compared to other things you do on the computer?
- C6: How much does the Web challenge you, compared to the sport or game you are best at?

Chen, Wigand and Nilan's (1999, p. 590) concern about these kinds of questions stemmed from the fact that the Web is a rich interactive environment that facilitates many different 'creative, communicative and collaborative activities'. Examples include searching and browsing for information, uploading and downloading files, reading and sending e-mail, reading and posting newsgroup messages, listening to audio clips, viewing animations and video clips, playing games, chatting with friends, conversing verbally via Internet telephony, creating Web pages and more. Since different activities present different challenges and call for different skills, Chen, Wigand and Nilan (1999, p. 590) argued that the Web should be viewed as a 'multi-activity medium', and that concepts such as flow, challenge and skill should be operationalised in terms of specific Web activities:

The meaning of 'challenges and skills' on the Web is necessarily situated in time and space, dependent on what it is that the user is doing and the goal(s) that s/he is pursuing.

Taking their concerns further, Chen, Wigand and Nilan (1999, 2000) undertook a descriptive survey and content analysis with the aim of answering the following questions:

- What kinds of Web activities contribute to the occurrence of flow in the Web environment?
- What kinds of descriptions of flow experiences do Web users report?
- How do Web users interpret the constructs of 'challenges' and 'sense of control' in the Web environment? If they understand the terms 'challenges' and 'sense of control,' what are their justifications?
- Do Web users feel enjoyment through Web activities? What sources of enjoyment they report?

The researchers developed an open-ended survey instrument that allowed Web users to describe their flow experiences in their own terms. The questions addressed perceptions of flow, time distortion, enjoyment, challenge and control. The

questionnaire did not address perceptions of skill because the researchers believed that once they understood the challenges Web users face they would be able to determine the skills needed to meet those challenges. All questions were framed in terms of the respondents' most recent flow experience 'in order to elicit specific data situated and bounded in a specific time and space' (Chen, Wigand & Nilan 1999, p. 595).

Personal invitations to participate in the survey were e-mailed to 1 200 individuals who frequently contributed to active newsgroups. In addition, open invitations to participate in the survey were posted to twenty Web-related mailing lists. Three hundred and four Web users responded to the invitations, submitting their completed questionnaires by e-mail or via a specially prepared online form. Content analysis techniques were applied to the descriptive responses with the aim of identifying and categorising factors associated with the occurrence of flow.

The results revealed that 39.8% of the respondents had experienced flow at least once while using the Web. The most frequently reported flow symptoms were very similar to those described in Csikszentmihalyi's (1975, 1990) work: feelings of inspired involvement (37.5%), a loss of self-consciousness (20.8%), excitement or enjoyment (16.7%), and timelessness (10.4%). Confirming that the Web is a multi-activity medium, several kinds of Web activities were associated with the flow state. As Table 2.2 shows, information retrieval was by far the most dominant flow activity (60.6%).

Table 2.2. Activities associated with flow during Web use (Chen, Wigand & Nilan 1999, p. 597)

Flow activity	Frequency (n=109)	Percentage
Research; information retrieval	66	60.6
Reading/replying/debating in newsgroups	10	9.2
Reading/replying e-mail	9	8.3
Creating Web pages	6	5.5
Playing games on the Web	5	4.6
Chatting	4	3.7
Others	9	8.2

Around half of the respondents (52.9%) responded affirmatively when asked if they had perceived challenges while using the Web. A significant number (38%) expressed confusion over the term 'challenge', confirming the researchers' suspicion that using the term directly in a question would weaken the respondents' ability to reliably report on their flow experiences. Information retrieval was once again the most frequently reported activity (74.6%) associated with challenges in the Web environment.

The results were very similar for the question regarding control. Around half of the respondents (48%) responded affirmatively when asked if they had perceived a sense

of control while using the Web. One-quarter of the respondents (24.6%) indicated that they didn't understand the term 'control' in the context of that question. Many respondents failed to specify a reason for their sense of control while using the Web, simply stating that they always felt in control online (38.1%). Those who could identify a specific source of control mentioned successful navigation (29.5%), having confidence in how to search (13.7%) and finding information (10.8%) as the most common causes.

Most respondents (81%) reported that they had experienced enjoyment while using the Web. Information retrieval was once again the most frequently reported activity (74%) associated with enjoyment in the Web environment. Commonly mentioned sources of enjoyment included finding information (24.4%), reading (17.5%) and learning (13.7%).

Cognitive absorption

Agarwal and Karahanna (2000) developed a conceptual construct named cognitive absorption that bears many similarities to flow. Cognitive absorption is defined as 'a state of deep involvement with software' that is exhibited through five dimensions: temporal dissociation, focused attention, heightened enjoyment, control and curiosity (Agarwal & Karahanna 2000, p. 673). The dimensions of control, curiosity and focused attention were taken from Webster, Trevino and Ryan's (1993) definition of the flow construct, which was discussed earlier in this chapter. The dimension of heightened enjoyment represents a synthesis of Webster, Trevino and Ryan's (1993) intrinsic interest dimension of flow and Davis, Bagozzi and Warshaw's (1992) definition of perceived enjoyment. The dimension of temporal dissociation was taken from Csikszentmihalyi's (1990) description of the flow experience.

Agarwal and Karahanna (2000, p. 674) constructed a conceptual model, which hypothesized that 'cognitive absorption is an underlying determinant of the perceived usefulness and perceived ease of use of an information technology, which, in turn, influence behavioural intentions to use the technology' (see Figure 2.9).

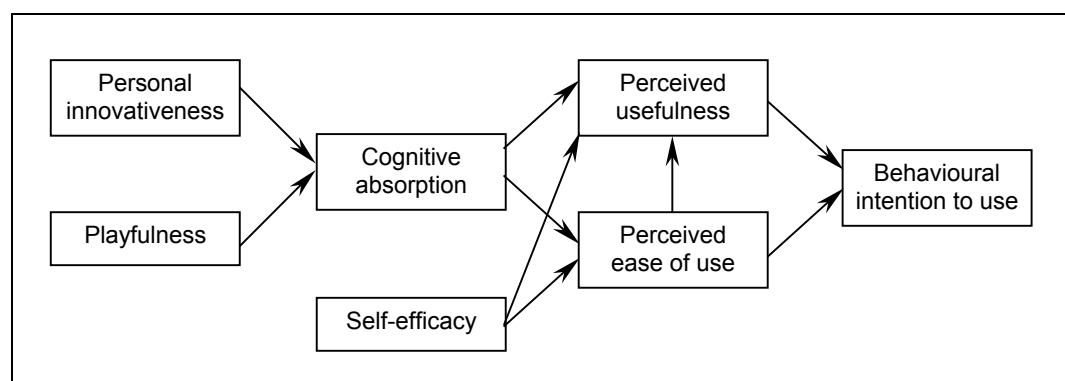


Figure 2.9. Agarwal and Karahanna's (2000, p. 674) conceptual model of cognitive absorption

The hypothesised relationships were tested against data collected from a survey of 288 students at a large American university. All of the variables represented in the model were measured using multi-item scales, with the Web selected as the target information technology. A structural equation modelling technique (PLS) was used to establish the nomological validity of the cognitive absorption construct.

The results provided mixed support for the hypotheses. The relationship between perceived usefulness and behavioural intention to use a technology was positive and significant, as was the relationship between perceived ease of use and behavioural intention to use a technology. The hypothesis that perceived ease of use has a positive effect on perceived usefulness was not supported. The hypotheses that cognitive absorption has a positive effect on perceived ease of use and perceived usefulness were both supported. The hypotheses that computer playfulness and personal innovativeness have a positive effect on cognitive absorption were also supported.

Agarwal and Karahanna (2000, p. 687) concluded that their results affirmed the value of the cognitive absorption construct 'in extending our understanding of technology users'. However, given that the five dimensions of cognitive absorption were all derived from flow theory, one has to wonder whether the introduction of this 'new construct' really aids our understanding of user behaviour or simply muddies the water.

Flow and online shopping

Koufaris (2002) used flow theory to investigate how emotional and cognitive responses to shopping on the Web influence the behaviour of online consumers, particularly their intention to return to an online store and their likelihood of making unplanned purchases. Koufaris (2002, pp. 207–208) did not use any pre-existing models of the flow experience in his study, but acknowledged the relevance of specific dimensions of flow:

While a valuable construct, we believe that flow is too broad and ill defined because of the numerous ways it has been operationalized, tested, and applied. We do, however, see value in some of the emotional and cognitive components used in flow research, namely, intrinsic enjoyment, perceived control, and concentration/attention focus.

Koufaris (2002) constructed a conceptual model of online consumer behaviour based on his understanding of the literature (see Figure 2.10). The model incorporated elements of flow theory such as enjoyment, attention focus, concentration, challenge and skill; elements of Davis's (1989) Technology Acceptance Model such as perceived usefulness and perceived ease of use; and other determinants of emotional and cognitive responses such as product involvement (Zaichkowsky 1985) and value-added search mechanisms.

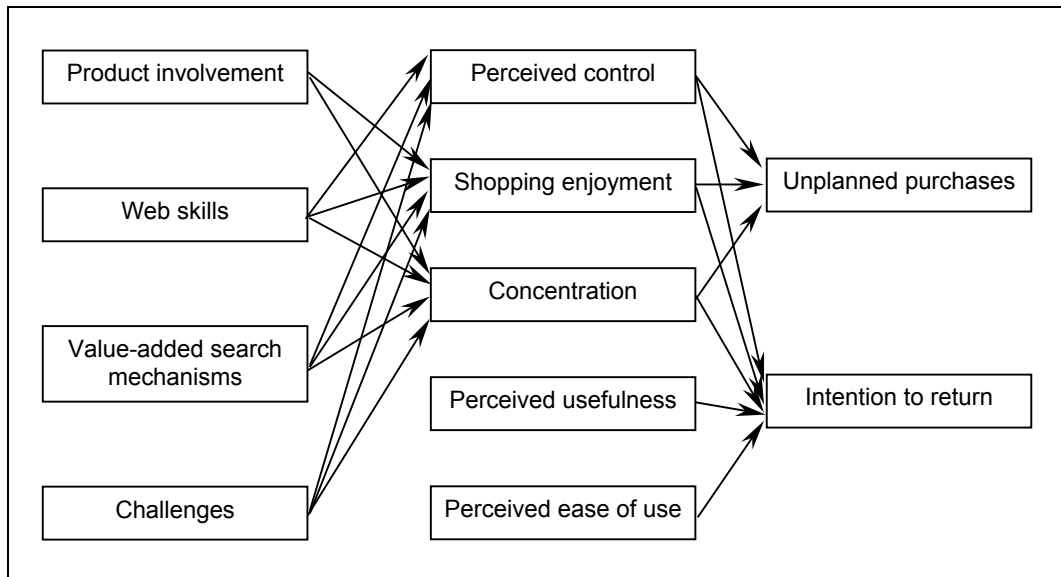


Figure 2.10. Koufaris's (2002, p. 213) conceptual model of online consumer behaviour.

To test the model, an online questionnaire was administered to 280 simulated customers of the online bookstore Booksamillion.com. Study participants were recruited from the database of an online market research firm, given a ten-dollar gift certificate for Booksamillion.com and asked to visit the site. Participants were then asked to complete an online questionnaire for an additional \$10 in cash and a chance to win \$1 000. Unlike the instrument used by Novak, Hoffman and Yung (2000), this questionnaire asked the participants about their experience during that specific store visit. Koufaris (2002, p. 213) admits that 'the fact that subjects did not visit the Web site on their own volition is definitely a limitation of the study'.

The results provided mixed support for the hypotheses. Intention to return to the online store was positively related to shopping enjoyment and perceived usefulness, but not perceived control, concentration or perceived ease of use. None of the hypotheses involving unplanned purchases were supported. Product involvement was positively related to both shopping enjoyment and concentration. Perceived skills were positively related to shopping enjoyment and concentration, but not perceived control. The use of value-added search mechanisms was positively related to shopping enjoyment, but not perceived control or concentration. Finally, challenge was positively related to shopping enjoyment and concentration, but not perceived control.

Koufaris (2002) concluded that both shopping enjoyment and perceived usefulness of an online store are important predictors of a customer's intention to return. Since no relationships involving unplanned purchases were verified, he suggested that future research should re-examine those relationships and explore other possible predictors. Koufaris (2002) also suggested that since enjoyment was the only flow variable to feature in the supported hypotheses, researchers should be cautious about using flow in studies of online consumer behaviour.

Concept matrix and discussion

Table 2.3 attempts to summarise the constructs, dimensions, antecedents, consequences and other correlates that featured in the studies discussed in this chapter. Webster and Watson (2002) recommend creating such a 'concept matrix' when preparing a literature review to help make sense of the accumulated knowledge and to identify knowledge gaps.

The first cell in each row of the table identifies a particular study. The second cell specifies the construct at the focus of the study—either flow or a related concept. The third, fourth and fifth cells list any dimensions, antecedents and consequences of the construct that were identified by the study. The sixth cell lists any correlates of the construct that were identified by the study, but not classified as either antecedents or consequences.

An examination of Table 2.3 reveals considerable discord among the findings of the reviewed studies. Some studies treated flow as a multi-dimensional construct (Ghani & Deshpande 1994; Trevino & Webster 1992; Webster, Trevino & Ryan 1993), while others treated it as a uni-dimensional construct (Hoffman & Novak 1996; Novak, Hoffman & Yung 2000). Dimensions, antecedents, consequences and correlates of flow varied from one study to the next. There are only two noticeable patterns in the table: (1) focused attention and enjoyment are frequently identified as dimensions of flow; and (2) challenge and skill are frequently identified as antecedents of flow. There is little agreement on the other concepts in the table—even those that featured in multiple studies. Control, for example, is listed as a dimension, an antecedent and a consequence of flow.

Flow's uncertain definition has prompted some information systems researchers to avoid using the construct altogether, preferring instead to invent new constructs (Agarwal & Karahanna 2000), or to build conceptual models incorporating previously proposed dimensions of flow (Koufaris 2002). These varied conceptualisations of flow suggest that the topic is in need of further conceptual development. A better understanding of the concepts pertaining to flow in the Web environment could help to resolve uncertainties and contribute to more precise and complete explanations about the nature of the phenomenon.

It is noteworthy that all of the reviewed studies employed quantitative research methods, particularly surveys and structural equation modelling techniques. Even Chen, Wigand and Nilan's (1999, 2000) study, which used an open-ended survey instrument to explore the flow experiences of Web users, was essentially a quantitative study involving content analysis techniques. It is surprising that none of the studies employed qualitative research methods, which are particularly well suited to building theory about phenomena that are poorly understood.

Table 2.3. Summary of selected studies of flow and related constructs

Study	Construct	Dimensions	Antecedents	Consequences	Correlates
Malone (1981)	Intrinsically motivating instruction		Challenge; Fantasy; Curiosity		
Webster & Martocchio (1992)	Computer playfulness				Involvement; Positive mood; Satisfaction; Learning
Webster, Trevino & Ryan (1993)	Flow	Control; Focused attention; Cognitive enjoyment (combination of curiosity and intrinsic interest)			Perceptions of flexibility and modifiability of software; Experimentation; Expectations of future voluntary computer interactions; Actual technology use; Perceived communication quantity and effectiveness
Webster & Ho (1997)	Engagement	Focused attention; Curiosity; Intrinsic interest	Challenge; Feedback; Presenter control; Variety		
Ghani & Deshpande (1994)	Flow	Focused attention; Enjoyment	Control; Challenge	Exploratory behaviour	

(Continued)

Table 2.3. (continued)

Trevino & Webster (1992)	Flow	Control; Focused attention; Curiosity; Intrinsic interest	Technology type; Ease of use; Computer skill (negative correlation)	Attitudes toward technology; Perceptions of communication effectiveness; Quantity of communication; Reduction of communication barriers (negative correlation)	
Hoffman & Novak (1996)	Flow		Focused attention; Balance between challenges and skills; Interactivity; Telepresence	Increased learning; Exploratory behaviour; Positive subjective experiences; Control	
Novak, Hoffman & Yung (2000)	Flow		Skill/control; Challenge/arousal; Telepresence/time distortion; Speed of interaction		
Chen, Wigand & Nilan (1999, 2000)	Flow	Involvement; Loss of self-consciousness; Enjoyment; Time distortion			
Agarwal & Karahanna (2000)	Cognitive absorption	Temporal dissociation; Focused attention; Enjoyment; Control; Curiosity	Playfulness; Personal innovativeness	Perceived usefulness; Perceived ease of use	

Summary

This chapter discussed characteristic dimensions of the flow experience and reviewed relevant studies of flow in human-computer interactions, particularly in the Web environment. Characteristic dimensions of the flow experience include: a balance between the challenges of an activity and the skills required to meet those challenges; clear goals and feedback; concentration on the task at hand; a sense of control; a merging of action and awareness; a loss of self-consciousness; a distorted sense of time; and the autotelic experience.

Flow is one of many distinctive states of consciousness that affect the way an individual perceives and experiences the world. Consciousness is the general state of being aware of and responsive to events in the environment, including one's own mental processes. Consciousness is related to attention, which is the process by which the mind chooses from among the various stimuli that strike the senses at any given moment, allowing only some to enter consciousness.

People generally spend most of their time in a waking state of consciousness. Any mental state that is noticeably different to ordinary waking consciousness is called an altered state of consciousness. Examples of altered states of consciousness include sleep, night dreaming, lucid dreaming, daydreaming, meditation, hypnosis, and the influence of psychoactive drugs.

Over the past forty years researchers in psychology have developed several concepts that, like flow, may be categorised as optimal experiences. Examples include peak performance, which is 'superior use of human potential' (Privette 1983, p. 1362), and peak experience, which is a generalisation for 'the happiest moments of life' (Maslow 1971, p. 105). Peak performance involves a high level of performance, but is not necessarily accompanied by enjoyment. Peak experience involves a high level of enjoyment, but does not necessarily involve performance. Flow involves both enjoyment and performance, but is not defined by their levels of intensity. A flow experience involves moderate to high levels of enjoyment and moderate to high levels of performance.

Flow has been identified as an important element in studies of computer game play, playfulness, engagement and other concepts related to human-computer interaction. One of the first researchers to apply flow theory to human-computer interactions was Malone (1981), who developed a theory of intrinsically motivating instruction incorporating three sources of motivation: challenge, fantasy and curiosity.

Webster and Martocchio (1992) used flow theory in the development of a Computer Playfulness Scale that measures an individual's tendency to interact spontaneously, inventively, and imaginatively with computers. Yager et al. (1997) established that computer playfulness is a stable trait, as opposed to a dynamic one that changes over time or across situations.

Computer playfulness can be viewed as not just a trait or enduring tendency, but as a temporary state. Webster, Trevino and Ryan (1993) defined the state of computer playfulness in terms of flow theory, and proposed that the flow construct is comprised of three interrelated dimensions: control, attention focus and a combination of curiosity and intrinsic interest which they labelled cognitive enjoyment.

Flow theory has been used as a framework for studying engagement, a construct that Laurel (1993, p. 113) describes as 'the state of mind that we must attain in order to enjoy a representation of an action'. Webster and Ho (1997) observed considerable overlap between the constructs of engagement and playfulness while exploring characteristics of instructional multimedia presentations that influence the engagement of learners. Webster and Ho proposed that the two constructs share the dimensions of attention focus, curiosity and intrinsic interest, but differ with respect to perceived control.

Flow plays an important role in the experiences of Web users. Hoffman and Novak (1996) developed a conceptual model of flow in the Web environment in an attempt to understand the relationship between flow and the behaviour of online consumers. Their model specified an explicit structure for direct and indirect influences on flow, as well as the relationships between model constructs and behavioural outcomes.

Hoffman and Novak's conceptual model of flow laid the groundwork for formal empirical testing, which was later conducted by Novak, Hoffman and Yung (2000). Using data from a large-sample Web-based survey, Novak, Hoffman and Yung (2000, p. 22) developed, refined and validated a structural equation model that brought together 'the components of what makes for a compelling online experience'. Despite the complexity of the model, the large size of the sample, and the sophistication of the analysis techniques, the study was criticised by Chen, Wigand and Nilan (1999) for failing to operationalise key concepts such as flow, challenge and skill in terms of specific Web activities.

Acting on their concerns, Chen, Wigand and Nilan (1999, 2000) undertook a descriptive survey and content analysis, which revealed that many different kinds of Web activities can facilitate the occurrence of flow. The most commonly reported flow-inducing activity was information retrieval, followed by reading/replying/debating in newsgroups, reading/writing e-mail, creating Web pages, playing games on the Web, and chatting. This study also confirmed that using terms such as 'challenge' and 'control' in the context of Web activities weakens the ability of survey respondents to reliably report on their flow experiences.

Recent studies involving flow and the behaviour of Web users have not used Novak, Hoffman and Yung's (2000) model (Agarwal & Karahanna 2000; Koufaris 2002). Instead, they have developed and tested new models that incorporate various dimensions of flow within complex networks of relationships.

A comparison of the findings of the reviewed studies revealed considerable discord. Some studies treated flow as a multi-dimensional construct, while others treated it as

a uni-dimensional construct. Dimensions, antecedents, consequences and correlates of flow varied from one study to the next. These varied conceptualisations of flow suggest that the topic is in need of further conceptual development. It is noteworthy that all of the reviewed studies employed quantitative research methods, particularly surveys and structural equation modelling techniques. It is surprising that none of the studies employed qualitative research methods, which are particularly well suited to building theory about phenomena that are poorly understood.

Research method

This chapter explains and justifies both the qualitative research paradigm and the grounded theory research method that were selected for this study. Specific aspects of the research method that are discussed include data collection procedures such as in-depth interviewing and theoretical sampling, and data analysis procedures such as open coding, theoretical coding, selective coding and memo-writing.

These topics are discussed in considerable detail because the grounded theory method is not widely used in information systems research, and may thus be unfamiliar to the reader. Lehmann (2001, p. 72) reports that of the 7372 papers published in top-ranking information systems journals between 1985 and 2000, only 3 listed 'grounded theory' as a key word. A notable part of this study's contribution to the field of information systems is the example it provides for others who wish to develop grounded theory. Trauth (2001, p. 2) suggests that there is certainly a need for such examples:

Throughout all these phases of my research career what I most often sought were examples to help show me the way. I wanted to see how others were engaging with research issues that were similar to mine, whether they were about the choice of appropriate method, the particulars of data collection and analysis associated with a given method, or finding appropriate evaluative criteria once the method was chosen. Unfortunately, I was often frustrated in my attempts to do so.

Rationale for the research paradigm

This study was designed to be consistent with the assumptions of qualitative research and, more specifically, the assumptions of the postpositivist research paradigm, as defined by Guba and Lincoln (1994) and Lincoln and Guba (2000). This section discusses the nature of that paradigm, the reason for its selection and the implications for the kind of theory that was developed.

Qualitative research

Qualitative research has its roots in the disciplines of sociology and anthropology (Denzin & Lincoln 2000)—fields which Gaines and Shaw (2000, p. 373) have encouraged human-computer interaction (HCI) researchers to investigate with the intention of extending 'the discipline of HCI to encompass the full range of human-computer interaction phenomena that characterize the Internet and World Wide Web'. Creswell (1994, pp. 1–2) defines qualitative research as:

... an inquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting.

Qualitative research can be distinguished from quantitative research in terms of several basic characteristics of the research design. The following list of commonly cited characteristics of qualitative research has been synthesised from the comments of various scholars (Creswell 1994; Denzin & Lincoln 2000; Guba & Lincoln 1994; Merriam 1998; Miles & Huberman 1994).

- Qualitative research is primarily concerned with *process*—how social experience is created and given meaning—rather than just outcomes.
- Qualitative researchers are interested in the *perceptions* of their informants—the interpretations and meanings that people attach to their experiences. Qualitative researchers typically try to get close to their informant's perspective through interviews and observations rather than rely on more remote, inferential techniques.
- In qualitative research, the *primary instrument* for data collection and analysis is the researcher, not some inanimate mechanism such as a questionnaire or interview protocol.
- Qualitative research involves *fieldwork*—observing or recording human behaviour and events in natural settings.
- Qualitative research is *descriptive* in the sense that data are reported in words or pictures rather than numbers. Qualitative researchers rarely report their findings in terms of the statistical measures and methods to which quantitative researchers are drawn.
- Qualitative research uses primarily *inductive reasoning* rather than deductive reasoning. Theories and hypotheses emerge from the data; they are not established a priori.
- Qualitative research is not evaluated according to the same criteria as quantitative research. Terms such as *credibility*, *transferability*, *dependability* and *confirmability* are often substituted for the traditional quantitative criteria of internal validity, external validity, reliability and objectivity.

Resistance to qualitative research

Ever since its inception, qualitative research has been treated with hostility in certain academic disciplines. Even within the field of information systems, qualitative research has only recently gained acceptance (Lee 2001; Markus & Lee 1999). Denzin and Lincoln (2000, p. 7) describe some of the challenges to qualitative research:

Qualitative researchers are called journalists, or soft scientists. Their work is termed unscientific, or only exploratory, or subjective. It is called criticism and not theory, or it is interpreted politically, as a disguised version of Marxism or secular humanism ...

What is the reason for this academic and disciplinary resistance to qualitative research? Historically, there has been a heavy emphasis on quantification in science. Experimental sciences such as physics and chemistry, which are particularly amenable to quantification, are generally known as 'hard'. Less quantifiable areas such as the social sciences are referred to as 'soft' to signal their supposed imprecision and lack of dependability (Guba & Lincoln 1994). The experimental sciences are widely viewed as 'the crowning achievements of Western civilization, and in their practices it is assumed that "truth" can transcend opinion and personal biases' (Denzin & Lincoln 2000, p. 8). Qualitative research has been viewed as an attack on this tradition and, by extension, an attack on reason and truth.

Qualitative research has traditionally been a staple of many fields within the social sciences, but during the past two decades there has been a significant shift toward qualitative research methods in many other disciplines such as business, health and education (Miles & Huberman 1994, p. 1). Even within the field of information systems, qualitative researchers now have substantial representation on the editorial boards of major journals (Markus & Lee 1999), and best paper awards in journals and conferences have been given for qualitative research papers such as Orlikowski's (1993) pioneering grounded theory study. Qualitative research has emerged as a 'valid and important approach to information systems research' (Klein & Myers 1999, p. 87).

Choosing qualitative research

Trauth (2001) discusses five factors that may influence a researcher's decision to choose qualitative methods for information systems research: the research problem; the researcher's theoretical lens; the degree of uncertainty surrounding the phenomenon; the researcher's skills; and academic politics.

- *The research problem.* Many scholars claim that the nature of the research problem should be the most significant influence on the choice of research method (Strauss & Corbin 1998, p. 11; Yin 1994, p. 7). They reason that what one wants to learn should determine how one goes about learning it.
- *The researcher's theoretical lens.* Also known as a *research paradigm*, the researcher's theoretical lens is a 'basic belief system or worldview that guides the

investigator, not only in choices of method but in ontologically and epistemologically fundamental ways' (Guba & Lincoln 1994, p. 105). Research paradigms and related concepts such as ontology and epistemology will be discussed in more detail later in this chapter.

- *The degree of uncertainty surrounding the phenomenon.* The less that is known about a phenomenon, the more difficult it is to measure and study using quantitative methods.
- *The researcher's skills.* An individual's lack of skill, knowledge and experience with qualitative methods will likely discourage him or her from using those methods. The level of training in qualitative methods that is available through the institution at which one works is a related factor.
- *Academic politics.* The norms and values of the information systems field, the institution at which one works, the country in which that institution is located, and the status one holds in the profession can all influence the choice of research method.

As an early- to mid-career academic, trained in quantitative methods, most of the factors described above worked against my decision to choose qualitative methods for this study. Indeed, in the early stages of my study, I spent a considerable amount of time framing my research problem in a quantitative manner and investigating the possibility of using surveys, structural equation models and other quantitative research methods.

The factors that primarily influenced my decision to use qualitative methods were the nature of my research problem and the degree of uncertainty surrounding the phenomenon under investigation. These two factors effectively shook me out of my quantitative comfort zone and forced me to learn about other research paradigms and methods in an effort to find the most appropriate way of investigating the problem at hand. Morse (1991, p. 120) lists the following characteristics of a qualitative research problem:

Characteristics of a qualitative research problem are: (a) the concept is "immature" due to a conspicuous lack of theory and previous research; (b) a notion that the available theory may be inaccurate, inappropriate, incorrect, or biased; (c) a need exists to explore and describe the phenomena and to develop theory; or (d) the nature of the phenomenon may not be suited to quantitative measures.

Many of these characteristics are evident in the research problem that was described in Chapter 1 of this thesis. Qualitative research methods appeared to be the most promising way of investigating this problem. Qualitative methods can be used to 'explore substantive areas about which little is known', and to obtain 'details about phenomena such as feelings, thought processes, and emotions that are difficult to extract or learn about through more conventional research methods' (Strauss & Corbin 1998, p. 11).

Research paradigms

All research is guided by a basic set of beliefs about the world and how it should be understood and studied. This basic set of beliefs has been termed a *paradigm* (Guba 1990; Kuhn 1970). Paradigms are human constructions and can never be established in terms of their ultimate truthfulness. They are not open to proof in any conventional sense.

The basic beliefs that define a paradigm can be summarised by the responses that proponents of that paradigm give to three fundamental, interconnected questions (Guba & Lincoln 1994, p. 108):

- *Ontology*. What is the form and nature of reality, and therefore, what can be known about it?
- *Epistemology*. What is the relationship between the researcher and what can be known?
- *Methodology*. How can the researcher gain knowledge about whatever he or she believes can be known?

Lincoln and Guba's classification

Lincoln and Guba (2000) describe five major paradigms that structure and organise qualitative research: positivism, postpositivism, critical theory, constructivism and participatory action. Table 3.1 presents the responses that Lincoln and Guba (2000) believe proponents of each paradigm would make to the three defining questions outlined above. The table consists of three rows corresponding to the ontological, epistemological and methodological questions, and five columns corresponding to the five major paradigms.

Table 3.1. Basic beliefs of alternative paradigms (Lincoln & Guba 2000, p. 168).

Issue	Positivism	Postpositivism	Critical Theory et al.	Constructivism	Participatory
Ontology	naive realism—"real" reality but apprehendable	critical realism—"real" reality but only imperfectly and probabilistically apprehendable	historical realism—virtual reality shaped by social, political, cultural, economic, ethnic, and gender values crystallized over time	relativism—local and specific constructed realities	participative reality—subjective-objective reality, cocreated by mind and given cosmos
Epistemology	dualist/objectivist; findings true	modified dualist/objectivist; critical tradition/community; findings probably true	transactional/subjectivist; value-mediated findings	transactional/subjectivist; created findings	critical subjectivity in participatory transaction with cosmos; extended epistemology of experiential, propositional, and practical knowing; cocreated findings
Methodology	experimental/manipulative; verification of hypotheses; chiefly quantitative methods	modified experimental/manipulative; critical multiplism; falsification of hypotheses; may include qualitative methods	dialogic/dialectic	hermeneutic/dialectic	political participation in collaborative action inquiry; primacy of the practical; use of language grounded in shared experiential context

This study was designed to be primarily consistent with the assumptions of the postpositivist paradigm, as defined by Guba and Lincoln (1994) and Lincoln and Guba (2000). I say *primarily* because, although Table 3.1 presents the five paradigms as philosophically distinct, in the practice of research these distinctions are not so clear-cut. Miles and Huberman (1994, pp. 4–5) observe:

At the working level, it seems hard to find researchers encamped in one fixed place along a stereotyped continuum between "relativism" and "postpositivism" ... In epistemological debates it is tempting to operate at the poles. But in the actual practice of empirical research, we believe that all of us—realists, interpretivists, critical theorists—are closer to the center, with multiple overlaps.

Postpositivism takes the following positions with respect to the defining questions of ontology, epistemology and methodology (Guba & Lincoln 1994; Lincoln & Guba 2000):

- *Ontology*. Postpositivists assume that reality exists, but that it cannot be perfectly apprehended because of human limitations and the intractable nature of phenomena. Claims about reality must be subjected to the widest possible critical examination so that reality can be apprehended as closely as possible.
- *Epistemology*. Postpositivists assume that it is impossible for an investigator to study an entity without influencing it or being influenced by it (dualism). Objectivity is a sought-after ideal. Critical traditions (such as how research findings fit with pre-existing knowledge) and the critical community (such as editors, referees and professional peers) are highly regarded as external guardians of objectivity. Replicated findings are taken as probably true, but are always subject to falsification.
- *Methodology*. Postpositivists use mainly qualitative research methods with the aim of redressing some of the perceived problems of positivism. Strategies include conducting research in natural settings, collecting situational information, reintroducing discovery as an element of inquiry, focusing on the meanings that people ascribe to their actions, developing grounded theory, and using critical multiplism (a form of triangulation) as a way of falsifying hypotheses.

My aim in presenting this description of postpositivism is not to convince the reader of its reasonableness or superiority, but rather to be explicit about my biases and the assumptions upon which my research is based.

Orlikowski and Baroudi's classification

Orlikowski and Baroudi (1991) have proposed a similar system for classifying the major paradigms that structure and organise qualitative research within the field of information systems. Building on the work of Chua (1986), they suggest three paradigms: positivist, interpretive and critical. This classification system is worth noting because it is presented within the context of information systems research and is often cited in the literature of that discipline (Klein & Myers 1999; Trauth 2001).

Brief descriptions of the three paradigms are provided below (Orlikowski & Baroudi 1991; Klein & Myers 1999; Myers 1997).

- *Positivist* research assumes that reality is objective and can be described by measurable properties that are independent of the researcher. Typical characteristics of positivist research include formal a priori propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from a representative sample to a stated population.
- *Interpretive* research assumes that reality is accessible through social constructions such as language, consciousness and shared meanings. Interpretive research does not predefine dependent and independent variables, but attempts to understand phenomena through the meanings that people assign to them.
- *Critical* research assumes that social reality is historically constituted and is produced and reproduced by people. It aims to critique the status quo, exposing and thereby transforming oppressive social conditions. Critical research seeks to be emancipatory, and assumes that people can act (in a limited capacity) to change their social and economic circumstances.

Using Orlikowski and Baroudi's (1991) classification scheme as a guide, this study is most closely aligned with the interpretive approach to qualitative research. There are recognisable similarities between Orlikowski and Baroudi's (1991) description of interpretive research and Guba and Lincoln's (1994) description of postpositivist research. The terms *postpositivist* and *interpretive* may be used interchangeably in this thesis.

Theory, explanations and causality

Different scholars use the term *theory* to mean different things (Fawcett & Downs 1986). The definitions presented below are indicative of the broad range of meanings that can be found in the literature.

A theory is a construct that accounts for or organizes some phenomenon (Stevens Barnum 1998 p. 1).

Theory: A set of well-developed concepts related through statements of relationship, which together constitute an integrated framework that can be used to explain or predict phenomena (Strauss & Corbin 1998, p. 15).

A theory is a set of interrelated constructs (concepts), definitions, and propositions that present a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomena (Kerlinger 1973, p. 9).

Each definition places certain restrictions on what is considered theory. Some definitions are more restrictive than others.

Gregor (2002) observes that there is surprisingly little discussion within the information systems community about what constitutes acceptable theory and what form contributions to knowledge can take. In an attempt to redress the situation, she proposes a taxonomy of five theory types, categorised according to the purpose they serve: theory for analysing and describing; theory for understanding; theory for predicting; theory for explaining and predicting; and theory for design and action. As was the case with the research paradigms that were discussed earlier, the distinctions between these theory types are not clear-cut.

- *Theory for analysing and describing* classifies or describes properties of individuals, groups, situations, events or other entities according to observed commonalities. This kind of theory is needed when very little is known about the phenomenon being investigated.
- *Theory for understanding* explains how and why something happened. It is not formulated in such a way that predictions can be generated and tested. This kind of theory typically yields conjectures, which may form the basis of subsequent theory development or be used to inform practice. Any generalisations or ascriptions of causality must be made with caution.
- *Theory for predicting* can be used to predict outcomes from a set of factors without necessarily understanding the causal relationships between the dependent and independent variables that are involved. Theories that explain the underlying relationships are preferred to this kind of theory.
- *Theory for explaining and predicting* can be used to predict phenomena and explain the underlying causes. For many scholars, this is the 'real' view of theory. However, there are surprisingly few well-developed examples of this kind of theory in the information systems literature.
- *Theory for design and action* is about the tools and methodologies used in the development of information systems. There is very little discussion in the information systems literature about the nature of this kind of theory.

The theory presented in this thesis falls into the second category—theory for understanding. As explained in Chapter 1, the aim of this study was to obtain a better understanding of the flow experiences of Web users.

The research method that was employed for this study—grounded theory—is particularly well suited to developing 'theory that is integrated, consistent, plausible, close to the data' (Glaser & Strauss 1967, p. 103). However, the method is not so well suited to developing predictive theories. In a critical consideration of the grounded theory method, Dey (1999, p. 267) makes this comment:

The ability to make predictions depends on being able to specify the total picture, but this is possible only within closed systems. In the more or less open systems of society (which reflect our capacity to initiate change) it is hard to extend explanation

of how things work into predictions of what will happen, even if we can specify initial conditions.

Since prediction requires not only explanation, but also a specification of the conditions under which the prediction will hold true, it is very unlikely that the results of this study could be used for that purpose. Perhaps the best one can hope for is to recognise a range of possibilities that can provide guides to action. Further details about grounded theory will be provided later in this chapter.

Causality in qualitative research

Since theory for understanding aims to explain how and why something happened, Gregor (2002) states that any ascriptions of causality must be made very carefully. Miles and Huberman (1994, pp. 144–148) provide some useful ideas about causality and how it might be assessed in qualitative studies. Their discussion begins with a consideration of the classic rules for determining causality:

- Temporal precedence: A precedes B
- Constant conjunction: When A, always B
- Contiguity of influence: A plausible mechanism links A and B

Recognising that human behaviour is too complex to be explained by this bare-bones view of causality, they take a more pragmatic approach and suggest other ideas that might lead us to conclude that an observed association represents a causal link:

- Strength of association (much more B with A than with other possible causes)
- Consistency (A is found with B by many studies in different places)
- Specificity (a particular link is shown between A and B)
- Temporality (A before B, not the reverse)
- Biological gradient (if more A, then more B)
- Plausibility (a known mechanism exists to link A and B)
- Coherence (A-B relationship fits with what else we know about A and B)
- Experiment (change A, observe what happens to B)
- Analogy (A and B resemble the well-established pattern noted in C and D)

Continuing with this theme, Miles & Huberman (1994, pp. 144–148) propose five factors that should be considered when determining causality:

- *Local emphasis.* Causality is linked with specific events that are nearby in time. If distant factors have an effect, they can be traced to local factors.
- *Causal complexity.* The causes of any event are multiple and conjunctural—they combine and affect each other as well as the effects. Effects of multiple causes are not the same in all contexts, and different combinations of causes sometimes have similar effects. Causes and effects can be thought of as a network representing a system changing over time. People are not billiard balls, but have complex intentions and operate in a complex web of other people's intentions and actions.

- *Temporality*. Causality depends on time. Assessing causality requires us to understand the 'plot'—the events of interest arranged in a loose causal order. There are always multiple intersecting plots.
- *Retrospection*. Assessing causality involves retrospective analysis, not merely chronicling. It is a retrospective gathering of events into an account that makes the ending reasonable and believable.
- *Variables and processes*. Understanding causality involves moving back and forth between variable analysis and process analysis—identifying abstract concepts, seeing their interaction and determining the flow of connected events over time.

Using these five factors as a basis, Miles and Huberman (1994, p. 147) explain why they consider qualitative analysis to be a very powerful method for assessing causality:

Qualitative analysis, with its close-up look, can identify *mechanisms*, going beyond sheer association. It is unrelentingly *local*, and deals well with the *complex* network of events and processes in a situation. It can sort out the *temporal* dimension, showing clearly what preceded what, either through direct observation or *retrospection*. It is well equipped to cycle back and forth between *variables* and *processes*—showing that "stories" are not capricious, but include underlying variables, and that variables are not disembodied, but have connections over time.

Clearly, there are good reasons for reassessing the traditional view that qualitative studies are only suitable for exploratory investigations, and that strong explanations can only be generated through quantitative studies. To find a supporting example that is relevant to this study, one need only refer to the literature review in Chapter 2 of this thesis. As reported there, quantitative studies have been used almost exclusively to investigate the flow experiences of Web users, but they have failed to provide satisfactory answers to fundamental questions such as how and why it occurs. A structural equation model's confirmation that 'focused attention correlates positively with telepresence' tells us nothing about the reasons for that correlation or the mechanisms that are involved.

Rationale for the research method

Just as there are different paradigms that can inform qualitative research, so there are different qualitative research methods. Myers (1997) defines a research method as 'a strategy of inquiry which moves from the underlying philosophical assumptions to research design and data collection'. Common qualitative research methods include ethnography, case studies, grounded theory and phenomenological studies (Creswell 1994, pp. 12–13). The research method that was chosen for this study is grounded theory.

Grounded theory

Grounded theory is a primarily inductive investigative process in which the researcher formulates a theory about a phenomenon by systematically gathering and analysing relevant data (Glaser 1992, p. 16; Glaser & Strauss 1967, p. 1; Strauss & Corbin 1998, p. 12). The researcher does not commence the study with a preconceived theory that needs to be proven, as is common in quantitative studies, because the purpose of this research method is building theory, not testing theory (Dey 1999, pp. 3–4).

Rather than begin the study with a preconceived theory in mind, the researcher begins with a general area of study and allows the theory to emerge from the data. Strauss and Corbin (1998, p. 12) describe the rationale for this approach:

Theory derived from data is more likely to resemble the "reality" than is theory derived by putting together a series of concepts based on experience or solely through speculation (how one thinks things ought to work).

Since the boundaries of the phenomenon being studied may not be clear at the outset of the investigation, the research question may simply identify the phenomenon of interest. As mentioned in Chapter 1, the primary research question for this study was: What is the nature of flow, as experienced by Web users engaged in information-seeking activities?

Sources of data for a grounded theory study typically include fieldwork interviews, observations and documents. As in most other qualitative research methods, data collection and data analysis occur simultaneously in the development of grounded theory (Glaser & Strauss 1967, p. 43). Data are collected in the light of the emerging theory using a process known as theoretical sampling.

Theoretical sampling is the process of data collection for generating theory whereby the analyst jointly collects, codes, and analyzes his data and decides what data to collect next and where to find them, in order to develop his theory as it emerges. This process of data collection is *controlled* by the emerging theory ... (Glaser & Strauss 1967, p. 45)

The researcher attempts to build a theory from the data using a 'constant comparative' method of analysis. The method involves four stages: generating categories and their properties; integrating categories and their properties; delimiting the theory; and writing the theory (Glaser and Strauss 1967, p. 105).

The first stage of the constant comparative method involves identifying concepts called categories and properties. A category is a conceptual element of a theory—an abstract representation of something the researcher identifies as being significant in the data. A property is a conceptual characteristic or attribute of a category (Glaser 1998, p. 135; Glaser and Strauss 1967, p. 36; Strauss & Corbin 1998, p. 113). For example, in this study 'interface usability' is cited as a category representing the usability of a Web site or its constituent pages. 'Organisation of content'—the

accessible or inaccessible manner in which a site's content is structured—is cited as a property of this category.

The researcher generates concepts (categories and properties) by comparing incidents in the data and looking for patterns. As concepts emerge, they are compared with other incidents for verification, and with other concepts for establishing the best fit with the data. A single incident may relate to multiple categories or properties (Glaser 1978, pp. 49–50; Glaser and Strauss 1967, pp. 105–108; Strauss & Corbin 1998, pp. 78–85).

As the constant comparative method proceeds, concepts tend to become integrated. The researcher develops a sense of how they relate to each other, and generates explanations about the phenomena being studied. These emerging propositions begin to form a theoretical framework, which serves as a guide to further data collection and analysis (Glaser 1978, pp. 117–119; Glaser & Strauss 1967, pp. 108–109; Strauss & Corbin 1998, pp. 144–145). Like categories and properties, the integrated theory emerges from the data. Glaser and Strauss (1967, p. 41) direct that 'the theory should never just be put together, nor should a formal-theory model be applied to it until one is sure it will fit, and will not force the data'.

As the theory develops, it crystallises around a central explanatory category that reflects the main theme of the study. The emergence of the core category delimits the research because only concepts that are related to the core are included in the theory. Data collection and analysis become more selective and focused, resulting in a theory with a smaller set of higher-level concepts (Glaser 1978, pp. 61–62; Glaser & Strauss 1967, pp. 109–113; Strauss & Corbin 1998, pp. 146–148).

Data collection and analysis cease when the researcher achieves theoretical saturation—the point at which 'no additional data can be found that would add to the categories being developed and examined' (Minichiello et al. 1995, p. 162). All that remains then is to write up the emergent theory, drawing on the theoretical memos that have been written about each category during the study. The researcher may also return to the coded data when necessary to extract additional evidence or illustrations of key points (Glaser 1978, pp. 116–141; Glaser & Strauss 1967, p. 113; Strauss & Corbin 1998, pp. 245–263).

Many of the analytic processes that have been introduced in this section will be elaborated upon later in this chapter. Hopefully, the reader can already see that the grounded theory method is capable of producing 'complex theory that corresponds closely to the data' (Glaser & Strauss 1967, pp. 113–114). No doubt, this ability to move 'beyond conjecture and preconception to ... the underlying processes of what is going on' is largely responsible for the method's burgeoning popularity in applied fields such as health, education, business, management and marketing (Glaser 1998, pp. 4–5).

Verification

Grounded theory originated in a 'vigorous and uncompromising critique' of verification research studies (Dey 1999, p. 231). Glaser and Strauss's (1967, pp. 1–2) original text on grounded theory attacked what they believed was:

... an overemphasis in current sociology on the verification of theory, and a resultant de-emphasis on the prior step of discovering what concepts and hypotheses are relevant for the area that one wishes to research.

Grounded theory was proposed as an alternative approach to the modes of theorising that dominated sociological research at the time, namely quantitative testing and verification of 'dreamed-up, speculative, or logically deduced theory' (Glaser and Strauss 1967, p. 5).

Glaser and Strauss stress that the grounded theory method is for building theory, not verifying it. Grounded concepts are suggested, not proven. The resulting theory is an integrated set of propositions, not findings (Glaser 1978, p. 134; Glaser & Strauss 1967, p. 103). Verification of grounded theory is left to other research methods that are better suited to that purpose (Glaser 1992, p. 16).

While never precluding the verification of grounded theory, Glaser and Strauss repeatedly downplay the need for such follow-up studies. They suggest that if theory is grounded in data, then in some sense it has already been verified.

Grounded theory looks for what is, not what might be, and therefore needs no test. Grounded theory gets its concepts from the data; it does not bring ideas to force the data, that need to be subsequently tested ... (Glaser 1992, p. 67).

The argument that verification is built into grounded theory is reinforced by the claim that 'the constant comparative method provides a means of "testing" hypotheses against evidence' (Dey 1999, p. 37). Grounded theory may be modified in the light of new evidence, but is rarely discarded.

The theory should not be written in stone or as a "pet", it should be readily modifiable when new data present variations in emergent properties and categories. The theory is neither verified nor thrown out, it is modified to accommodate by integration the new concepts (Glaser 1992, p. 15).

Thus, the generation of grounded theory using the constant comparative method 'subsumes and assumes verifications and accurate descriptions', as long as theory generation remains the chief concern and verification remains subordinate to that aim (Glaser & Strauss 1967, p. 28). There need not be any sharp separation between the generation and verification of grounded theory.

Induction versus deduction

Grounded theory is often described as an inductive—as opposed to deductive—research method. In an inductive research model, the researcher gathers

'all of the relevant facts' and then systematically examines them to see what theory is suggested by this collection. The theory emerges from the data. In contrast, a deductive research model begins with an existing body of theory from which the researcher generates hypotheses. These hypotheses are then tested against a collection of 'hypothesis-relevant facts' to determine their truthfulness (Wengraf 2001, p. 2).

The notion that grounded theory is a wholly inductive process is an 'over simplification of the very complex thinking patterns involved' (Glaser 1998, p 43). Like all social research, grounded theory actually relies on an interplay between inductive and deductive reasoning (Strauss & Corbin 1998, pp. 136–137). Grounded theory is primarily inductive in the sense that categories, properties and relationships are developed by comparing incidents in the data. However, the method also involves deductive work such as theoretical sampling—deciding how to sample for additional data on the basis of concepts that have already emerged.

This use of deductive reasoning differs markedly from the manner in which a researcher may use deductive reasoning in a typical quantitative study—logically deducing hypotheses from a pre-existing body of theory. During theoretical sampling, the deductions are sourced from concepts that have emerged from the data, not from pre-existing theories in the literature. The focus of this deductive work is on maximising opportunities for exploring emerging concepts, not on deriving hypotheses for verification. In grounded theory, deductions are made in the service of further induction (Glaser 1978, pp. 37–38).

Causality in grounded theory

Earlier in this chapter we considered some ideas about how causality can be assessed in qualitative studies. Dey (1999, pp. 149–181) provides a useful discussion about how causality is dealt with in the development of grounded theory. He begins his discussion by distinguishing between different kinds of causal conditions that feature in grounded theory studies. Conditions can be necessary; sufficient; necessary and sufficient; necessary but not sufficient; or sufficient but not necessary.

- A *necessary* condition is one that must be present before a certain outcome can occur. For example, a tree cannot live without sunlight. So sunlight is a necessary condition for tree life.
- A *sufficient* condition is one that can produce a certain outcome by itself, with no other conditions required. For example, all that is required for a tree to die is to remove it from the soil. So removal from the soil is a sufficient condition for a tree's death.

Conditions can also be distinguished as being single, multiple or conjunctural.

- Sometimes a *single* condition is necessary and sufficient to produce a particular outcome.

- Sometimes *multiple* conditions can each produce the same outcome independently.
- Sometimes a particular combination of conditions—a *conjuncture*—is required to produce a particular outcome.

Dey's (1999, pp. 165–172) reason for distinguishing between these different kinds of conditions is that they require different types of explanations. Classic methods of establishing causality through agreement and difference, which may work for single causes, fail to cope with the complexity of multiple and conjunctural causality. Recognising these difficulties, Glaser and Strauss (1967, p. 104) contrast grounded theory with the method of analytic induction, which is underpinned by classic methods of establishing causality:

In contrast to analytic induction, the constant comparative method is concerned with generating and plausibly suggesting (but not provisionally testing) many categories, properties, and hypotheses about general problems (e.g., the distribution of services according to the social value of clients). Some of these properties may be causes, as in analytic induction, but unlike analytic induction others are conditions, consequences, dimensions, types, processes, etc. In both approaches, these properties should result in an integrated theory. Further, no attempt is made by the constant comparative method to ascertain either the universality or the proof of suggested causes or other properties.

Dey (1999, p. 169) interprets the 'universality' of a causal condition in terms of its necessity, and concludes that grounded theory is primarily concerned with the identification of sufficient but not necessary conditions. Further, he concludes that the focus of grounded theory seems to be on the joint effects of multiple and conjunctural forms of causality rather than single forms of causality. In other words, grounded theory is more concerned with 'analyzing complex multicausal processes as a whole ... than with identifying and isolating particular causal factors' (Dey 1999, p. 170).

Disagreements about grounded theory

One of the major issues confronting grounded theory today is the disagreement that exists within the research community about what the method is in principle, and how to put it into practice. Dey (1999, p. 2) observes that:

... some critics dispute the claims of other researchers to have used grounded theory—not unlike, it may seem to an outsider, the way exponents of various cults bicker over the right interpretation of a religion.

These differences of opinion are largely due to a public dispute between the original founders of grounded theory, which occurred in the 1990s. Glaser and Strauss first articulated their ideas about grounded theory in the 1967 book *The Discovery of Grounded Theory*. Glaser furthered these ideas in his 1978 book *Theoretical Sensitivity*, however, 'the abstract terms and dense writing Glaser employed rendered the book inaccessible to many readers' (Charmaz, 2002, p. 512). Grounded theory

gained a wider audience when Strauss and Corbin released the book *Basics of Qualitative Research* in 1990. Glaser repudiated this publication, claiming that it bore little resemblance to the original method that was expounded in *The Discovery of Grounded Theory*. Glaser felt so strongly about the matter that he asked Strauss to withdraw the book from publication. When Strauss did not comply, Glaser wrote a scathing correctional rejoinder entitled *Basics of Grounded Theory Analysis* in 1992. Strauss and Corbin released a second edition of *Basics of Qualitative Research* in 1998.

Glaser's (1992, p. 3) chief concern with Strauss and Corbin's version of the grounded theory method is that 'it produces a forced, preconceived, full conceptual description', rather than allowing theory to emerge naturally through the constant comparison of data. In the book *Theoretical Sensitivity*, Glaser (1978, p. 72–82) discusses eighteen theoretical coding families that help researchers conceptualise how categories may relate to each other to become an integrated theory. Strauss and Corbin's version of grounded theory focuses on only one coding family, or 'coding paradigm' as they call it. In a technique described as 'axial coding', Strauss and Corbin (1998, p. 127–128) suggest that researchers should look for conditions, actions/interactions and consequences as a guide to establishing relationships between categories. Glaser (1992, p. 28) makes the following comment about axial coding:

There is not just one theoretical code that is a must in all cases: such as Strauss' incessant and insistent focus on conditions. A pet theoretical code violates relevance and forces data. The researcher must be open to the emergence of whichever of the vast array of theoretical codes fit and work the substantive codes at the time.

Glaser (1992, pp. 61–67) argues that Strauss and Corbin's coding paradigm imposes a pet theory on the data rather than letting the theory emerge through the constant comparative method. Dey (1999, p. 14) notes that 'as this paradigm seems to impose a conceptual framework in advance of data analysis, it does not sit easily with the inductive emphasis in grounded theory'.

Some scholars claim that the dissension among grounded theory proponents has brought the method into disrepute. Dey (1999, p. 24), on the other hand, suggests that the questions raised by the dispute are of considerable merit because they force researchers to confront some fundamental and difficult issues about the nature of social research.

If we accept the elementary (but awkward) principle that to do research requires reflection on what we are doing and how we do it, at the very least we should try to confront and clarify these issues.

Implications for this study

Like many researchers who have employed grounded theory, my introduction to the method came through Strauss and Corbin's (1998) book *Basics of Qualitative Research*. Dey (1999, p. 13–14) observes that this book has become 'the standard

introduction to grounded theory in place of the original text' by Glaser and Strauss (1967).

I was completely unaware of the dispute between Glaser and Strauss when I commenced my study. A journal article by Melia (1996) first brought the debate to my attention. I discovered Melia's article at a time when I was having difficulty reconciling my early analysis work with Strauss and Corbin's formulaic approach to grounded theory. Subsequent consideration of relevant publications (Dey 1999; Glaser 1978, 1992, 1998; Glaser & Strauss 1967; Lehmann 2001; Urquhart 2001) and discussions with other grounded theorists clarified the issues involved and led me to adopt Glaser's method. To put this decision into perspective, it is worth noting the following comment from Miles and Huberman (1994, p. 5):

To us it seems clear that research is actually more a craft than a slavish adherence to methodological rules. No study conforms exactly to a standard methodology; each one calls for the researcher to bend the methodology to the peculiarities of the setting ...

This thesis documents any circumstances that required me to deviate from Glaser's guidelines during the course of the study. The next section outlines one such case.

Avoiding preconceptions

Grounded theory researchers are encouraged to commence their studies with as few preconceived ideas as possible—particularly preconceived theories that dictate relevant concepts and hypotheses (Glaser 1978, pp. 2–3; Glaser & Strauss 1967, pp. 33–34). Glaser (1998, p. 68) explains the reason for this principle:

This dictum is brought about by the concern not to contaminate, constrain, inhibit, stifle or otherwise impede the researcher's effort to discover emergent concepts and hypotheses, properties and theoretical codes from the data that truly fit, are relevant and work. He is free of received or preconceived concepts that may really not fit, work, or be relevant but appear to do so momentarily.

A grounded theory researcher may study an area with a particular focus, question or problem in mind, but should avoid preconceived theory. Following this advice helps the researcher to be more faithful to the data—more open to what is actually happening. Ignoring this advice may result in 'a forcing of data, as well as a neglect of relevant concepts and hypotheses that may emerge' (Glaser & Strauss 1967, p. 34).

Reviewing the literature

The recommendation to avoid preconceived ideas extends to the conventional practice of reviewing the literature at the outset of a research project. One of the preliminary tasks in a traditional deductive study is to read the relevant literature to the fullest extent possible with the aim of developing a theoretical framework for

subsequent testing and verification. In contrast, a researcher developing grounded theory deliberately avoids reviewing the literature at the outset of the study. As suggested earlier, the rationale for this approach is to keep the researcher open to the concepts and relationships that will emerge from the data, and to avoid derailments in the form of assumptions about what ought to be found in the data (Glaser 1978, p. 31; 1992, pp. 31–32; 1998, pp. 67–73; Strauss & Corbin 1998, p. 49).

This stance on avoiding the literature only applies at the beginning of a grounded theory study. Once the emerging theory is sufficiently developed and close to completion, the researcher reviews the literature in the field with the aim of relating it to his or her work. By this stage of the study the researcher's grasp of the emerging theory should be strong enough to avoid being shaken by catchy, speculative ideas (Glaser 1978, pp. 31–33; 1992, p. 32; 1998, pp. 76–78). Thus, the literature is not discounted altogether. A grounded theory will combine 'mostly concepts and hypotheses that have emerged from the data with some existing ones that are clearly useful' (Glaser & Strauss 1967, p. 46). As Dey (1999, p. 4) notes:

The important point, presumably was not to be "doctrinaire"; the researcher had to explore evidence in its own terms rather than immediately fitting it into some preconceived framework.

Problems with starting from scratch

The extent to which a grounded theory researcher can avoid preconceived ideas is a matter of degree. Any researcher, no matter how inductive, approaches a study with some orienting ideas—rudimentary concepts about the phenomenon being studied, general research questions, hunches about where to look for answers, biases from previous experience, and so on (Miles & Huberman 1994, p. 17). Even Glaser and Strauss (1967, p. 253) acknowledge that no researcher 'can possibly erase from his mind all the theory he knows before he begins his research'. Glaser (1978, pp. 44–46) describes a number of possible scenarios with regard to the degree of 'openness' a researcher may have at the outset of a study:

- A researcher may begin a study with complete openness and virtually no problem in mind. In this situation, relevant problems and processes emerge quickly from the data, and false starts are soon corrected by the constant comparative method.
- A researcher may begin a study with a partial framework including a defined problem area, a central research question, a general research perspective, initial concepts and field research strategies. This approach is less than completely open, 'but still quite receptive to the emergent'.
- A researcher may begin a study with an existing theory in mind if it seems quite grounded in the data, but this approach is risky. The researcher must be very cautious when determining the theory's 'emergent fit' against the data, or risk derailing the study.

In addition to the question of feasibility, many qualitative researchers question the merit of Glaser and Strauss's advice about minimising prior conceptions in a grounded theory study. They acknowledge the need for open-mindedness, but contest the recommendation to completely disregard the literature at the outset of a study.

Wengraf (2001, p. 93) believes that 'to avoid struggling to "reinvent the wheel" ... you need to look carefully at existing relevant research fields and disciplines'. He adds that a knowledge base derived from reading is essential for formulating good research questions (Wengraf 2001, p. 80).

McCracken (1988, p. 31) suggests that reviewing the literature sharpens the researcher's capacity for surprise by providing 'a set of expectations the data can defy'. Data that run contrary to one's expectations are conspicuous and highly provocative.

Miles and Huberman (1994, p. 17) remind us that all researchers have background knowledge, and that 'not to "lead" with your conceptual strength can be simply self-defeating'. Researchers are aware of questions that should be asked, they know which incidents to attend to closely, and they recognise details that would elude a less knowledgeable observer.

Finally, Dey (1999, p. 251) neatly summarises the views expressed above:

... conceptual frameworks can act as guides rather than as prison guards ... prior conceptions need not become preconceptions. As I have remarked elsewhere, there is a difference between an open mind and an empty head. In a similar vein, I also compared fixed and flexible ideas to light cast by a lamppost and a torch; for when it comes to examining data, the torch will certainly prove better than searching in the dark ...

Use of the literature in this study

Regardless of whether avoiding the literature is a useful strategy or not, it was not an option in this study. Conducting a preliminary review of the literature was a formal requirement of my PhD research program. I had no reason to resist that requirement because I did not select grounded theory as my research method until after I had reviewed the relevant literature and developed a better understanding of the research problem. Glaser (1998, p. 120) relates a letter that he received from a Masters student in a similar situation and suggests a strategy for remaining open to the data in such circumstances:

... the researcher can write a paper on his literature review and publish it, in order to establish and state the assumptions he absorbed from the literature so they become data to constantly compare with what is really going on. This keeps track of the literature contamination impact.

Wengraf (2001, p. 94) advocates a similar approach for manifesting assumptions, which might otherwise remain hidden as unconscious theory about the phenomenon being studied:

... it is ... important to engage in a very systematic inventory of one's own prejudices, stereotypes, phantasies, hopes and fears, ideological and emotional desires and purposes and to record these very systematically in writing.

The ideas that I absorbed from my review of the literature are documented in a paper that I presented at the doctoral consortium of the OZCHI 2000 conference prior to commencing data collection (Pace 2000). OZCHI is the annual conference of Australia's human-computer interaction community. The paper contains a conceptual model, which was derived solely from my review of the literature (see Figure 3.1). At the time the paper was presented, I had decided that a qualitative research method was the most appropriate way of investigating my research problem, and I was leaning towards a case study approach (Yin 1993, 1994). The paper makes no mention of grounded theory because I had not yet examined that research method.

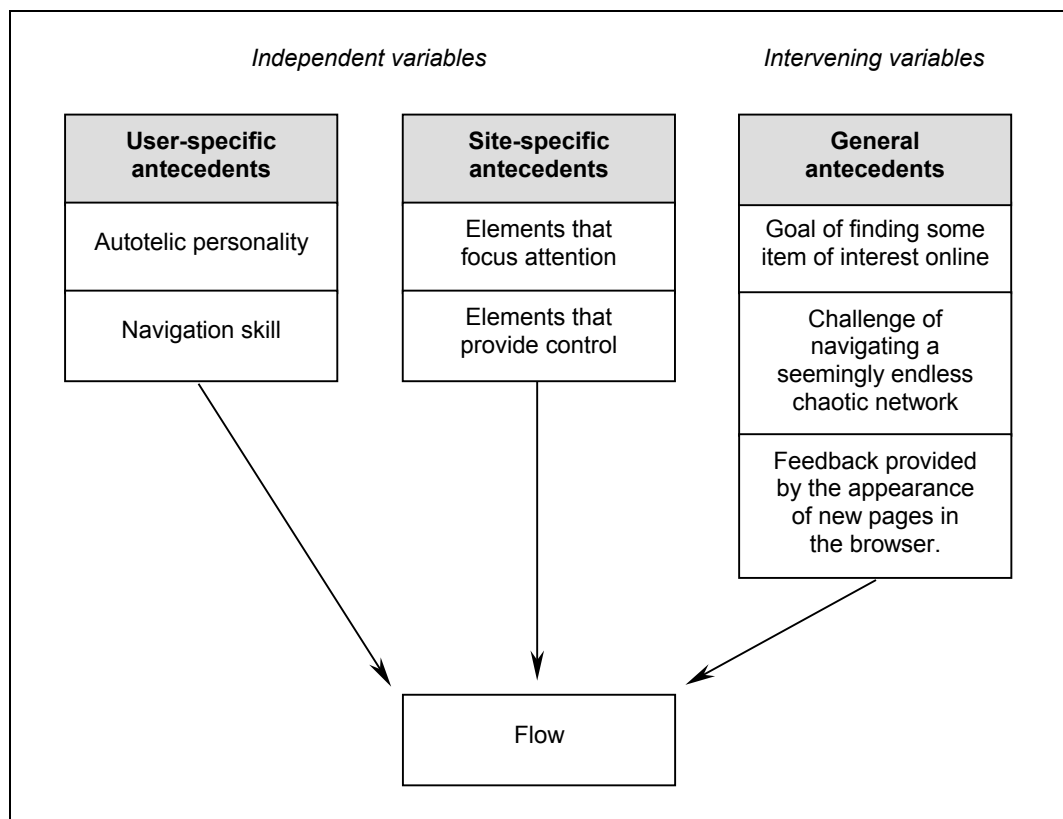


Figure 3.1. Early, flawed conceptual model of the flow experiences of Web users, derived solely from a review of the relevant literature (Pace 2000).

The conceptual model in the conference paper is very different to the theory that later emerged from the data. The model presents a flawed, simplistic view of the flow experiences of Web users, and highlights the value of theory derived from data as

opposed to theory derived through speculation or logical deduction. Publishing the model in the OZCHI 2000 conference proceedings turned out to be a useful way of documenting my assumptions and premises prior to entering the field of study, even though that was not my reason for writing the paper. The publication provides evidence that during the course of this study I suspended my knowledge of the literature and allowed a theory to emerge from the data, rather than try to substantiate a preconceived model.

Data collection

The data collection procedures for this study involved semi-structured in-depth interviewing and theoretical sampling. This section discusses these procedures and related practical matters such as defining the interview questions, inviting informants to participate in the study, catering for ethical considerations, selecting a suitable interview location, employing an appropriate interview technique, recording interviews, transcribing interviews, and using questionnaires as a secondary data source.

Semi-structured in-depth interviews

Semi-structured in-depth interviews were chosen as the primary source of data for this study because most of the skills and challenges associated with the flow experiences of Web users are not directly observable. Taylor and Bogdan (1998, p. 88) define in-depth interviews as 'face-to-face encounters between the researcher and informants directed toward understanding the informants' perspectives on their lives, experiences, or situations as expressed in their own words'. These interviews are semi-structured in the sense that:

... most of the informant's responses can't be predicted in advance ... and you as interviewer therefore have to improvise probably half—and maybe 80% or more—of your responses to what they say in response to your initial prepared question or questions (Wengraf 2001, p. 5).

Unlike structured interviews, in-depth interviews are dynamic. The style of questioning and discussion offer greater flexibility than a survey-style interview and provide 'a more valid explication of the informant's perception of reality' (Minichiello et al. 1995, p. 65). An in-depth interview has the appearance of a regular conversation, but it is a controlled conversation geared to the interviewer's research interests.

In-depth interviewing was a particularly suitable method of data collection for this grounded theory study because a primary focus of this technique is 'to understand the significance of human experiences as described from the actor's perspective' (Minichiello et al. 1995, p. 12). Some scholars argue that 'quantitative researchers seldom are able to capture the subject's perspective because they have to rely on more remote, inferential empirical materials' (Denzin & Lincoln 1994, p. 5). In contrast, the

primary instrument for data collection in an in-depth interview is the researcher, not some inanimate mechanism such as an interview schedule or protocol (Miles & Huberman 1994, p. 7).

Depth of understanding was not the only reason for choosing in-depth interviewing as the data-collection method for this study. Taylor and Bogdan (1998, pp. 90–91) suggest that in-depth interviewing is especially well suited in the following situations:

- the investigator has a relatively clear sense of the research interests and the kinds of questions that need to be pursued;
- participant observation is not practical;
- the investigator has time constraints and needs to complete the study within a shorter period of time than participant observation would allow; and
- the investigator is interested in understanding a broad range of settings or people.

One of the drawbacks of using in-depth interviews for data collection is that they are 'subject to the same fabrications, deceptions, exaggerations, and distortions that characterize other conversations' (Taylor & Bogdan 1998, p. 98). How does the researcher know that the informant is telling the truth, and that the informant's definition of a situation is accurate? Minichiello et al. (1995, p. 72) reason on this matter by raising some additional questions. Who defines what counts as truth in the informant's world, and whose definition of the situation can be regarded as accurate? Minichiello et al. argue that 'the informant's definition is paramount, because that is the focus of the research process' in this kind of study. The only way a researcher can get at what goes on in the minds of his or her informants is to rely to some degree upon their testimony. Csikszentmihalyi and Robinson (1990, p. xiii) reinforce this point:

Experiences are subjective phenomena and therefore cannot be externally verified.
Either one trusts the words of the person who reports the experience or one does not.

Since the activities of a person's mind correspond to electrochemical changes in their central nervous system, some people have asked me why I did not use physiological and neurological observations to investigate the flow experiences of Web users. Their suggestions usually involve testing whether a person's heart rate, pulse, brain waves or perspiration change in response to the experience. There are several reasons why this approach is inappropriate. Firstly, connecting a person to electronic monitoring devices would probably be distracting enough to interfere with their ability to experience flow. But more importantly, breaking down a mental experience into the physiological mechanisms implicated in its occurrence will not help one understand what the experience means to the person who is having it. Csikszentmihalyi and Robinson (1990, p. 20) state that subjective interpretation is the key to understanding flow experiences:

Although physiological, perceptual, and cognitive processes are important components, they are relatively meaningless until given weight and value by the interpretation of the subjective experience.

Interview questions

As mentioned in Chapter 1, the purpose of this study was to answer the question: What is the nature of flow, as experienced by Web users engaged in information-seeking activities? This central research question (CRQ) had eight associated research questions, or theory questions (TQ):

TQ1: What are the salient features and dynamics of the flow experiences of Web users?

TQ2: Under what conditions are Web users likely to experience flow?

TQ3: How do the flow experiences of Web users compare with the general dimensions of flow proposed by Csikszentmihalyi?

TQ4: What makes information-seeking on the Web an activity that is conducive to experiencing flow?

TQ5: What challenges do Web users perceive when seeking information and what skills do they employ in dealing with those challenges?

TQ6: Does a Web user's skill level influence his or her propensity to experience flow, and if so how?

TQ7: What characteristics of individual Web users influence their propensity to experience flow?

TQ8: What characteristics of individual Web sites influence the flow experiences of Web users?

These theory questions are not the same as the interview questions (IQ) that were used during data collection. Wengraf (2001, pp. 61–62) recommends that informants should not be asked theory questions in the course of an interview. Instead, theory questions should govern the production of interview questions. As illustrated in Figure 3.2, the central research question was spelled out into several theory questions, and for each theory question, a corresponding set of interview questions was developed. Theory questions were formulated in the language of the researcher and the research community, while interview questions were formulated in the language of the informants.

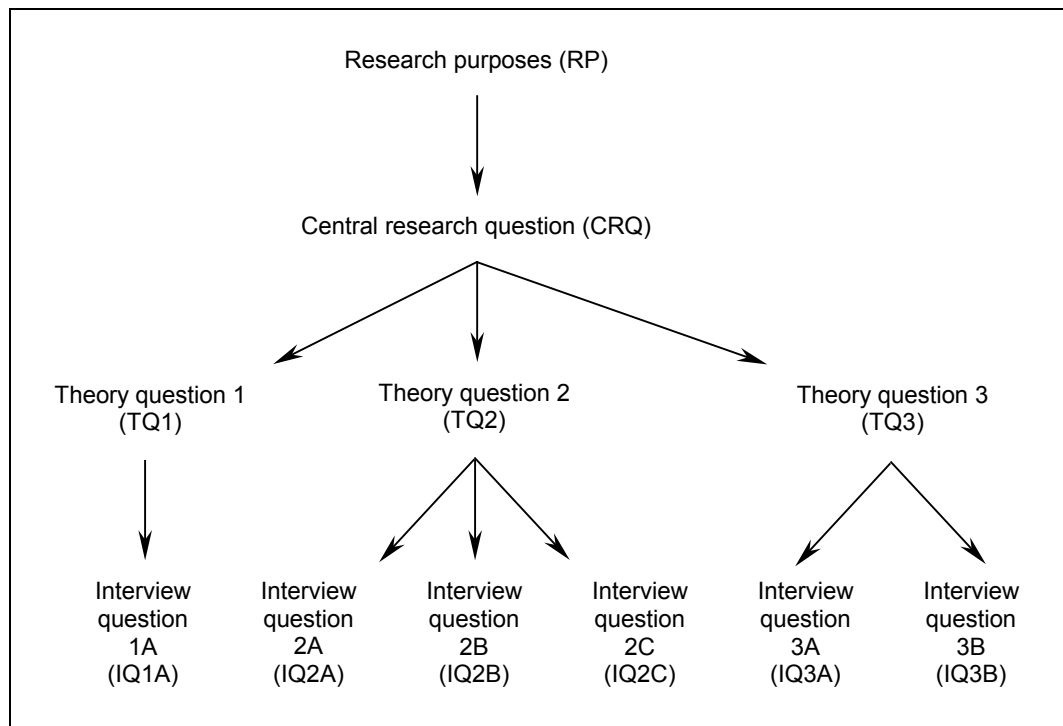


Figure 3.2. Central research question, theory questions and interview questions.
Adapted from Wengraf (2001, p. 157).

The interview questions that correspond to the eight theory questions are listed below. The interview questions that relate to theory questions 1, 2 and 3 are grouped together because of their close ties. Every other theory question immediately precedes its corresponding group of interview questions.

TQ1: What are the salient features and dynamics of the flow experiences of Web users?

TQ2: Under what conditions are Web users likely to experience flow?

TQ3: How do the flow experiences of Web users compare with the general dimensions of flow proposed by Csikszentmihalyi?

IQ: When I first introduced you to the term *flow*, you told me that you had experienced that same feeling while using the Web. Think about one of your flow experiences now and tell me what you can remember about it. I'm interested in anything that you can recall.

IQ: What were you doing on the Web during your flow experience?

IQ: How did your flow experience feel?

IQ: Show me a Web site that you spent a significant amount of time at during your flow experience. Guide me through some of the pages that you visited at that site. Show me where you went and what you did.

- IQ: What was your purpose or motivation for visiting this Web site?
- IQ: What do you enjoy about visiting this Web site?
- IQ: How often do you visit this Web site on average?
- IQ: How often do you experience flow while using the Web? (Every time you use the Web? Most times? Very rarely?)

TQ4: What makes information-seeking on the Web an activity that is conducive to experiencing flow?

- IQ: What do you enjoy most about using the Web?
- IQ: What do you dislike most about using the Web?
- IQ: Do you ever use search engines to track down specific information on the Web?
- IQ: Do you enjoy searching for information on the Web?
- IQ: What do you enjoy/dislike about searching for information on the Web?
- IQ: Do you ever get sidetracked when you're searching for information on the Web?
- IQ: Do you ever use the Web to casually browse for interesting sites—maybe for fun or relaxation?

TQ5: What challenges do Web users perceive when seeking information and what skills do they employ in dealing with those challenges?

- IQ: Some Web activities could be described as challenging in the sense that they take more mental effort than others. What aspects of using the Web do you find most challenging?
- IQ: Was there anything that you found particularly challenging about your Web activities on the occasion when you experienced flow?

TQ6: Does a Web user's skill level influence his or her propensity to experience flow, and if so how?

- IQ: How comfortable do you feel using computers in general?
- IQ: How comfortable do you feel using the Web in general?
- IQ: How satisfied are you with your current skills for using the Web?
- IQ: When did you first start using the Web?

IQ: On average, how often do you use the Web now? (Daily? Weekly? Monthly? Less than once per month?)

IQ: How many hours do you spend using the Web each week?

TQ7: What characteristics of individual Web users influence their propensity to experience flow?

IQ: Note the informant's gender.

IQ: What is your date of birth?

IQ: What is the highest level of education you have completed? (Primary school? High school? TAFE course? Undergraduate university degree? Postgraduate university degree?)

IQ: What is your main occupation?

IQ: People employ different strategies when they're learning to use new software. When you want to learn how to use a new program, how do you go about it?

IQ: Can you think of any other activities you engage in, besides using the Web, that have given you this feeling of flow?

TQ8: What characteristics of individual Web sites influence the flow experiences of Web users?

IQ: How do you feel about this site's content?

IQ: How do you feel about this site's appearance?

IQ: How easy or difficult is it to find your way around this site?

IQ: How would you rate the download speed of this Web site? (Faster than most? Slower than most?)

The order in which the interview questions are presented in this 'logical schedule' is not the same order that was used in the actual interviews. The logical schedule ensures that there is a tight fit between theory questions and interview questions, but posing questions to the informants in this order would have risked 'coming on too strong' early in the interview. The 'sequence schedule' in Appendix A shows the more appropriate order in which interview questions were posed to the informants. The sequence schedule also includes examples of 'prefatory statements' that were used during the interviews to alert informants that questioning was about to focus on a new area (Wengraf 2001, p. 198).

The fact that interview questions were prepared for this study does not mean that the interviews were conducted in the same structured manner as a controlled survey-style

interview. The interview questions formed the basis of an interview guide, which helped me to ensure that key topics were explored with each informant (Minichiello et al. 1995, pp. 81–84). Taylor and Bogdan (1998, p. 106) describe the general questioning strategy that was used in the study's interviews:

... ask open-ended, descriptive questions about general topics; wait for people to talk about ... what is important from their points of view; probe for details and specific descriptions of their experiences and perspectives.

Taylor and Bogdan mention two types of questions in their description: open-ended primary questions which are used to introduce key topics, and probing secondary questions which are used to clarify the informants' words and gain more detail. In this study, the primary open-ended questions were prepared in advance, and the follow-up questions, probes, prompts and other interventions were improvised during the interviews. Some of the questions listed in the schedule above read more like yes-or-no questions than open-ended questions, but follow-up probes allowed informants to expand their initial responses in a more open way.

The use of probing questions is the main element that 'differentiates in-depth interviewing from normal everyday conversations' (Minichiello et al. 1995, p. 89). In normal conversation, people tend to mentally fill in any gaps in meaning in the other person's words. In contrast, in-depth interviewers must often set aside what they think they know and probe for clarification and greater detail, even at the risk of appearing naive.

Theoretical sampling

An essential feature of grounded theory research is theoretical sampling, a procedure whereby 'researchers consciously select additional cases to be studied according to the potential for developing new insights or expanding and refining those already gained' (Taylor & Bogdan 1998, pp. 26–27). As mentioned earlier in this thesis, the research question addressed by a grounded theory study becomes progressively more focused and narrow during the research process as concepts and their relationships are discovered. Consequently, sampling decisions depend on analysis of the incoming data in relation to the evolving theory.

Choices of informants, episodes, and interactions are being driven by a conceptual question, not by a concern for "representativeness." To get to the construct, we need to see different instances of it, at different moments, in different places, with different people. The prime concern is with the conditions under which the construct or theory operates, not with the generalization of the findings to other settings (Miles & Huberman 1994, p. 29).

During theoretical sampling, the researcher tries to develop emerging concepts by maximising and minimising differences among informants. Informants are selected according to their potential to provide the required variation. As Minichiello et al. (1995, pp. 13–14) explain, the aim of theoretical sampling is 'not to strive for a

representative sample but to identify purposive cases that represent specific types of a given phenomenon'.

Minimising differences among informants increases the probability that the researcher will collect similar data on a given category, and thereby verify its existence. Differences that are found in the data during this kind of comparison may reveal properties of a category. Maximising differences among informants increases the probability that the researcher will collect varied data on a given category, and thereby develop its properties. Similarities that are found in the data during this kind of comparison will indicate general uniformities of the greatest scope within the theory (Glaser & Strauss 1967, pp. 55–56).

Since theoretical sampling is conducted on the basis of emerging concepts, 'neither the number nor the type of informants needs to be specified beforehand' (Taylor & Bogdan 1998, p. 92). The researcher begins the study with a general idea of the type of people who will be interviewed, but is prepared to modify those plans after the initial interviews. Data collection continues until the researcher achieves theoretical saturation—the point at which 'no additional data can be found that would add to the categories being developed and examined' (Minichiello et al. 1995, p. 162). Strauss and Corbin (1998, p. 212) provide a more precise definition, stating that a category is considered saturated when:

... (a) no new or relevant data seem to emerge regarding a category, (b) the category is well developed in terms of its properties and dimensions demonstrating variation, and (c) the relationships among categories are well established ...

Qualifying this definition, Glaser and Strauss (1967, p. 70) suggest that the depth of inquiry into different categories will vary because not all categories are equally relevant to the emerging theory. Core categories should be saturated as completely as possible. Efforts to saturate less relevant categories should not be made at the expense of the core categories.

Comparisons with statistical sampling

Clearly, theoretical sampling is very different to statistical or random sampling, commonly used in quantitative studies. Theoretical sampling aims to maximise opportunities for exploring emerging categories and their properties. Statistical sampling aims to be representative of the population under study. An adequate theoretical sample depends on the diversity of the informants selected for saturating categories according to the type of theory being developed. An adequate statistical sample depends on the sample size and assurances that each individual in the sample had an equal and independent chance of being selected. An inadequate theoretical sample is easily detected because the associated theory is usually thin and poorly integrated with too many obvious unexplained exceptions. An inadequate statistical sample is often more difficult to detect because it calls for a knowledge of statistical methods, and 'other researchers tend to accept technical sophistication uncritically' (Glaser & Strauss 1967, p. 63).

These differences between theoretical sampling and statistical sampling need to be kept in mind when designing a study or judging its credibility. Statistical sampling is not required in a grounded theory study, either to discover concepts or to confirm their existence. Only twenty-two informants participated in this study. Despite this size limitation, the study produced important insights that have gone unnoticed in statistical studies with much larger samples.

Informants selected for this study

The informants who were selected for this study were all persons who could recall experiencing flow while engaged in information-seeking activities on the Web. The technique that was used to identify suitable informants and to request their participation in the study is explained later in this chapter.

In the initial sampling, I consciously varied the gender, age, educational attainments, occupations and Web experience of the selected informants, with the aim of uncovering a broad range of perspectives. I imagined that once a number of interviews had been completed and some categories had started to emerge, I would change the sampling strategy to further develop those emerging categories. However, none of these particular characteristics of the informants proved to be relevant during the course of the study. Glaser (1998, p. 148) makes the following comment with regard to this situation:

Through constant comparing, saturation and theoretical sampling, categories and their properties earn their way into the theory as relevant to its working ... Non-earning categories or properties are irrelevant and should not be allowed to clutter the theory's parsimony and scope ... This position flies in the face of ... the standard referral to face sheet data such as gender, age, religion, nationality, color, social class, marital status, occupation, etc. as if they were obviously relevant ... If a condition or a face sheet item is relevant it will emerge as part of the analysis, otherwise ignore it.

While the resulting theory appears to be applicable to people of varying gender, age, educational attainments, occupations and Web experience, its generality is constrained by the fact that all informants were residents of the same geographical region—the city of Mackay on the east coast of Australia. Future research could possibly extend the scope of the theory by comparing groups from different regions or countries.

Table 3.2 summarises the informants' characteristics. There were twenty-two informants and eight sampling dimensions, which means that each informant had a unique configuration, but one sharing some dimensions with one or more other informants. The sampling dimensions included gender, age, highest level of education, current occupation, confidence using the Web, frequency of Web use, hours of Web use per week, and years using the Web.

Table 3.2. Sampling dimensions and characteristics of the informants

Informant	Gender	Age	Education	Occupation	Confidence using the Web	Frequency of Web use	Hours of Web use per week	Years using the Web
1	Male	42	Bachelor Degree	Computer technician	Very confident	Daily	20–40	6
2	Female	50	Bachelor Degree	Teacher's aide	Not very confident	Weekly	1–5	4
3	Male	42	Bachelor Degree	Postgraduate student	Moderately confident	Weekly	1–5	1
4	Male	36	Bachelor Degree	Postgraduate student	Not very confident	Daily	10–20	3
5	Female	21	Year 12	Administrative assistant	Moderately confident	Daily	10–20	3
6	Female	21	Bachelor Degree	Software developer	Very confident	Daily	5–10	6
7	Male	22	Bachelor Degree	Software developer	Very confident	Daily	5–10	5
8	Male	17	Year 12	Undergraduate student	Very confident	Daily	5–10	4
9	Female	27	Bachelor Degree	Public relations officer	Moderately confident	Daily	1–5	7
10	Female	28	Year 12	Administrative assistant	Moderately confident	Weekly	1–5	6
11	Male	41	Masters Degree	University lecturer	Very confident	Daily	10–20	4
12	Male	35	Bachelor Degree	Computer technician	Very confident	Daily	20–40	7
13	Male	26	Bachelor Degree	Web designer	Very confident	Daily	10–20	5
14	Female	55	Graduate Diploma	Librarian	Very confident	Daily	10–20	9
15	Female	32	Bachelor Degree	Librarian	Very confident	Daily	20–40	8
16	Male	18	Year 12	Kitchen-hand	Very confident	Daily	20–40	6

(Continued)

Table 3.2. (continued)

17	Male	18	Year 12	Junior clerk	Moderately confident	Weekly	1–5	6
18	Female	20	Year 12	Undergraduate student	Moderately confident	Weekly	5–10	3
19	Male	18	Year 12	Apprentice electrician	Not very confident	Weekly	1–5	5
20	Female	33	Associate Diploma	Undergraduate student	Moderately confident	Weekly	5–10	2
21	Female	27	Certificate	Kitchen-hand	Not very confident	Weekly	1–5	1
22	Female	19	Year 12	Undergraduate student	Moderately confident	Weekly	5–10	1

The gender balance among the informants was evenly split. There were eleven males and eleven females.

The informants' ages ranged from 17 to 55 years, with a mean of 29.5, a median of 27, and a standard deviation of 11.1.

The informants' educational attainments ranged from senior secondary school to postgraduate degree level with both tertiary and secondary qualifications well represented. Highest qualifications included one Masters Degree, one Graduate Diploma, ten Bachelor Degrees, one Associate Diploma, one TAFE Certificate, and eight Senior Secondary School Certificates (Year 12).

The informants' occupations were also quite varied. They included four undergraduate students, two postgraduate students, two administrative assistants, two computer technicians, two kitchen-hands, two librarians, two software developers, one apprentice electrician, one junior clerk, one public relations officer, one teacher's aide, one Web designer, and one university lecturer.

The informants' levels of experience with the Web ranged from 1 to 9 years, with a mean of 4.6, a median of 5, and a standard deviation of 2.3. Informants who reported using the Web on a daily basis numbered 13; the other 9 used it weekly. When asked to estimate the number of hours they spent using the Web each week, 7 informants reported 1 to 5 hours, 6 reported 5 to 10 hours, 5 reported 10 to 20 hours, and 4 reported 20 to 40 hours. When asked how confident they felt using the Web, 10 informants reported feeling very confident, 8 were moderately confident, and 4 were not very confident.

Wengraf (2001, p. 96) suggests that any relationship that exists between a researcher and his or her informants should be made explicit in a report of this kind, in case it is necessary to account for the influence of that relationship on the interview data. None of the informants in this study were personal friends, relatives or students of mine at the time of their interview, but I have since become better acquainted with some of them. Four of the twenty-two informants work at the same institution as I do, but I have no reason to believe that association had any significance to the interview data. Putting it another way, the interviews did not involve any questions or answers that we would have been tempted to avoid because of their impact on our association (Wengraf 2001, p. 106).

Approaching informants

Before inviting a potential informant to participate in the interview process, it was necessary to determine whether that individual could recall experiencing flow while using the Web or not. One way of acquiring this information quickly and without commitment was to present each potential informant with a written description of flow, and to ask if he or she had ever experienced such a phenomenon while using the Web. Potential informants who answered affirmatively were then invited to

participate in an interview. The description of flow that was used for this exercise is provided in Appendix B.

Many researchers investigating flow have employed this technique of presenting study participants with a description of the phenomenon before eliciting their experiences (Allison & Duncan 1988; Chen, Wigand & Nilan 1999, 2000; Delle Fave & Massimini 1988; Han 1988; Jackson 1996; Massimini, Csikszentmihalyi & Delle Fave 1988; Novak, Hoffman & Yung 2000). Wengraf (2001, pp. 64–65) stresses the importance of speaking to informants in their own language or idiolect, as opposed to the language of the researcher and research community. He illustrates this point by describing the confusion that resulted when a researcher posed 'a so-called interview question ... in Psychology-speak, rather than in a language "ordinary-enough" for her interviewee's idiolect'. Similar confusion could have resulted from engaging potential informants in a discussion about flow without first explaining the meaning of the term.

Bok van Kammen and Stouthamer-Loeber (1998, p. 387) recommend that in their first contact with potential informants, researchers need to set the right tone by 'taking away fears, inspiring trust, and creating interest in taking part in the research project'. In this study I attempted to establish the right tone by discussing with the informants topics such as the purpose of the study, the location and approximate duration of the interview, procedures for maintaining confidentiality and anonymity, and the voluntary nature of their participation (Taylor & Bogdan 1998, pp. 96–97). Informants were also asked to prepare for their interview by writing down the addresses of any Web sites they could recall visiting during their flow experiences.

To assist with this orientation process I provided each informant with an information sheet, which summarised the details mentioned above and specified the agreed-upon time and date of the interview (see Appendix C). The information sheet also told informants how to contact me before or after their interview if they had any questions or comments.

Accompanying each information sheet was a consent form (see Appendix D), which informants were asked to sign and date prior to their interview. The consent form reminded the informants that their participation in the study was entirely voluntary, their interview data would be treated confidentially, and their anonymity would be preserved. The informants' signatures confirmed that they understood these matters and that they were at least eighteen years of age. In the case where one of the informants was only seventeen years of age, his parents' consent was also obtained in writing.

Ethical considerations

Standard procedures were taken to ensure that the rights of the informants were protected during the course of this study. Well before any informants were recruited, ethical clearance was obtained from the Human Ethics Research Review Panel

(HERRP) at Central Queensland University. The HERRP is constituted in accordance with the joint Australian Vice-Chancellors' Committee and National Health and Medical Research Council Statement and Guidelines on Research Practice.

Since the interview process involved voluntary cooperation, study participants were informed at the earliest opportunity about what they had volunteered for. Each informant received an information sheet (see Appendix C) that provided the following details:

- my name, position and contact details;
- the name of the organisation under which I was conducting the research (Central Queensland University);
- a brief description of the purpose of the study;
- the agreed-upon time, date, location and duration of the interview;
- procedures for maintaining the confidentiality of interview data and the anonymity of the informants; and
- assurance that participation in the study was voluntary and that informants could withdraw at any stage without consequences.

These points were discussed verbally with each informant at the time he or she agreed to participate in the study. They were also reviewed by way of reminder at the beginning of each interview.

Only persons who were at least eighteen years of age were invited to participate in the study. Participant-recruitment efforts were directed at persons who appeared to be over eighteen years of age. When potential informants agreed to participate in the study, they were asked to confirm their eligibility by signing a consent form (see Appendix D).

Informants were assured that their interview data would be treated confidentially and that I would be the only person who could ever associate individual informants with their comments. To that end, no names were used in the research process. Interview recordings and transcripts were labelled with identification numbers rather than the names of the informants. Documentation that linked the identification numbers to the names of the informants was treated confidentially, and was not stored with the interview recordings or transcripts.

The chance of breaching confidentiality was minimised by the fact that I conducted all of the interviews myself, transcribed them myself and analysed them myself. When another researcher was employed to independently code three interview transcripts for checking purposes, she was given no information about the identity of the informants.

All records related to the study have been stored securely, and all reports on the study, including this thesis, have been written in a manner that preserves the anonymity of the informants. Just as in other phases of the study, identification numbers have been substituted for the names of informants.

Interview location and duration

The interviews for this study were conducted in my office at the Mackay campus of Central Queensland University. This choice of location follows Taylor and Bogdan's (1998, p. 97) recommendation to 'find a private place where you can talk without interruption and where the informant will feel relaxed'. Although many people feel most comfortable in their own homes, there were sound reasons for preferring the office as the interview location. In many people's homes it is difficult to talk privately. The office venue saved me from having to deal with interference from telephone calls, television, relatives and so on, as well as problems such as inadequate lighting, ventilation or space (Bok van Kammen & Stouthamer-Loeber 1998, pp. 378–379).

Another advantage of the office venue was that it provided easy access to a computer with an Internet connection, which was needed to help participants recall specific features of the Web sites they discussed. This technique can be likened to the way that personal documents such as diaries and letters are sometimes used in interviews to spark memories and to help people recall old feelings (Taylor & Bogdan 1998, p. 105; Wengraf 2001, p. 157).

Each interview lasted for approximately an hour. Very little time—around fifteen minutes—was required to set up for the interview before the informant arrived. Around one hour was required after the interview to make undisturbed notes about the session and to retrieve from the Web browser's cache any pages that were visited during the session. These saved Web pages were later used to jog my memory while listening to the recorded interview.

Interview technique

Earlier in this chapter I described the general strategy of semi-structured, in-depth interviewing that was used in this study—asking open-ended questions about general topics, allowing the informants to talk about topics that were important from their perspective, and probing for details about their experiences. This interviewing strategy allowed me to touch on a core of key topics with each informant without precluding other topics that might arise in the course of conversation.

Good in-depth interviewing requires more than asking the right questions however. It involves relating to informants on their own terms and creating an atmosphere in which they feel comfortable talking openly about their experiences. Minichiello et al. (1995, pp. 78–79) suggest that the success of an in-depth interview largely depends on the establishment of a 'productive interpersonal climate' between the researcher

and the informant, as opposed to the distant stance encouraged by quantitative methods. During my interviews I tried to establish a rapport with each informant by applying some of Taylor and Bogdan's (1998, pp. 99–101) suggestions:

- being non-judgmental when informants opened up about their feelings and views;
- refraining from interrupting informants, even when they spoke at length about topics that I was not particularly interested in;
- paying attention and communicating a sincere interest in what the informants had to say; and
- being sensitive to how my words and gestures affected the informants.

To provide an example of this last point, during the course of one interview I noticed that whenever I stopped taking notes the informant promptly stopped talking. It became apparent that she interpreted my pauses as a signal that I had heard enough about the current topic of discussion. I found myself having to feign note-taking throughout the interview simply to encourage the informant to continue talking. This sort of sensitivity helped me to avoid inadvertently creating the wrong impression and to encourage informants to speak openly.

At the end of each interview I always gave the informant an opportunity to make comments or ask questions about anything that he or she thought was relevant to the topic or the interview process. I also made sure that the informant was aware of my appreciation for the time and energy that he or she had committed to the study by participating in the interview. Bok van Kammen and Stouthamer-Loeber (1998, p. 386) suggest that it is important to make interviews a positive experience for informants because their last impression of the interviewer may determine how willing they are to participate again.

Throughout the study I tried to improve my interviewing skills by reviewing and reflecting on my efforts. Transcribing the interview recordings provided a good opportunity to analyse, not just the informants' responses, but my interviewing practice as well.

Recording and transcribing interviews

All of the interviews for this study were tape-recorded with the informants' permission, and later transcribed to provide accurate records for analysis. None of the informants appeared to be disturbed by the presence of the tape recorder, perhaps because they already knew that their words were being analysed. Even so, I tried to minimise any potential discomfort by using a small recorder with a sensitive microphone and placing it in an unobtrusive location during the interviews. Long-playing tapes were used to avoid unnecessary interruptions.

In addition to recording the interviews, I took brief notes to keep track of comments that needed to be followed up on, and to record any non-verbal expressions that were essential to understanding the meaning of an informant's words. Note-taking also helped me to demonstrate to informants that I was actively listening to what was being said.

Glaser (1998, pp. 107–113) strongly recommends that grounded theory researchers avoid recording interviews because it overwhelms the researcher with unnecessary data and slows down the research process. For example, when one is delimiting an emerging theory, taping forces the collection of repetitious data about categories and properties that have already emerged in earlier interviews. Glaser further claims that the traditional use of recorded interviews as evidence for verifying findings is not applicable in a grounded theory study where the focus is on generating concepts and propositions.

Despite Glaser's objections, I believe that the benefits of recording my interviews far outweighed the disadvantages. The tape-recorder allowed me to capture much more interview data than I could by relying on memory alone. Tape-recording also reduced some of the pressure of the interview situation, allowing me to focus on listening to the informant, improvising probing questions, and monitoring the interpersonal climate, rather than taking extensive notes.

Transcribing the recordings did slow down the research process as Glaser warned, but it also triggered a flood of memories and ideas, which became theoretical memos. Stopping to write theoretical memos during an interview isn't practical because it takes far too long and would certainly break contact and rapport with the informant. However, stopping to write theoretical memos while transcribing is not a problem because an audio tape can wait indefinitely.

Surveying the informants

In an effort to explore the influence of personality on the flow experiences of Web users, each informant was asked to complete two questionnaires after the interviews. One questionnaire measured the informant's internal-external locus of control, and the other measured the informant's need for cognition.

Locus of control

Locus of control is defined as 'a generalized expectancy concerning behavior-outcome contingencies' (Leone & Burns 2000, p. 64). In simpler terms, it could be described as a personal view about how much external forces control and influence events in one's life. Individuals with a high *internal* locus of control believe for the most part that the rewards and punishments they experience are contingent upon their own actions. They believe they are the masters of their own fates, and if something good happens to them it is largely a result of their own behaviour. In contrast, individuals with a high *external* locus of control believe for the most part that the

rewards and punishments they experience are contingent upon unstable forces such as luck, chance, or the control of powerful others. They believe they are at the mercy of circumstances, and if something good happens to them it is largely the result of external forces.

Wallace (1999, pp. 172–173) suggests that individuals with a strong internal locus of control 'may be singularly vulnerable to the Internet's time sink' because 'it gives us so much freedom to control'. Web users have complete control over what sites they view, what they read, what they download, what links they follow, and so on. Wallace speculates that people with a high internal locus of control may enjoy this sense of control over their environment and consequently spend significant amounts of time online.

Since losing track of time is a commonly reported dimension of the flow experience, internal-external locus of control appeared to be worth exploring as a possible link between personality and the flow experiences of Web users. Rotter's (1973) internal-external locus of control scale was used to measure the construct for each informant (see Appendix E). The instrument consisted of 29 questions, each of which paired an internal statement with an external statement. Six of the questions were fillers. To calculate a respondent's score, one point was allocated for each external statement selected. Scores could potentially range from 0 (most internal) to 23 (most external). Some examples of the internal-external statement pairs are provided below:

- a. Many of the unhappy things in people's lives are partly due to bad luck.
- b. People's misfortunes result from the mistakes they make.

- a. In the long run, people get the respect they deserve in this world.
- b. Unfortunately, an individual's worth often passes unrecognised no matter how hard he tries.

- a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.
- b. By taking an active part in political and social affairs the people can control world events.

Need for cognition

Need for cognition refers to 'an individual's tendency to engage in and enjoy effortful cognitive endeavors', that is, thinking (Cacioppo & Petty 1982, p. 116; Cacioppo, Petty & Kao 1984, p. 306). Verplanken, Hazenberg and Palen  wen (1992) have demonstrated that individuals with a high need for cognition are motivated to expend more cognitive effort on information searches than individuals with a low need for cognition.

Since information-seeking was a focus of this study, need for cognition appeared to be worth exploring as a possible link between personality and the flow experiences of Web users. Cacioppo, Petty and Kao's (1984) need for cognition scale was used to measure the construct for each informant (see Appendix F). The scale contained

eighteen items, which were measured on seven-point Likert scales. Nine of the items were negatively worded and reverse scored. Some examples of the scale items are provided below:

I like to have the responsibility of handling a situation that requires a lot of thinking.

Thinking is not my idea of fun.

I only think as hard as I have to.

I really enjoy a task that involves coming up with new solutions to problems.

Theorising with quantitative data

The use of quantitative survey results in a qualitative study may seem contradictory, but this is not the case. Drawing on Salomon (1991), Miles and Huberman (1994, p. 41) state that the issue is not quantitative-qualitative at all, but 'whether we are taking an "analytic" approach to understanding a few controlled variables, or a "systemic" approach to understanding the interaction of variables in a complex environment'. Similarly, Weinstein and Tamur (1978, p. 140) see quantification not as an end in itself, but rather as:

... a means of making available techniques which add power and sensitivity to individual judgement when one attempts to detect and describe *patterning* in a set of observations ... Why throw away anything helpful?

The questionnaires provided information about personality that was not easily obtained through in-depth interviews, so it made sense to use them. Glaser and Strauss (1967, p. 185) have no objections to the use of quantitative data in a grounded theory study, stating that 'they can be a very rich medium for discovering theory'. They add that 'quantitative data is so closely associated with the current emphasis on verification that its possibilities for generating theory have been left vastly underdeveloped'.

Data analysis

Data collection and data analysis occur simultaneously in the development of grounded theory. In this respect, qualitative data analysis clearly differs from the 'quantitative approach of dividing and engaging in the separate activities of data collection, analysis, and writing the results' (Creswell 1994, pp. 153). The reason for alternating data collection with analysis is twofold. It allows for theoretical 'sampling on the basis of emerging concepts', and it 'enables validation of concepts and hypotheses as these are being developed' (Strauss & Corbin 1998, p. 46). Provisional concepts and propositions that fail to fit the data can be discarded or revised during the research process.

Earlier in this chapter, grounded theory was described as a 'constant comparative method' of analysis. This section will elaborate on that description with a discussion of three phases of coding: open coding, theoretical coding, and selective coding. This emphasis on coding is appropriate because, as Glaser (1978, p. 55) explains, it is the key process in the constant comparative method:

The essential relationship between data and theory is a conceptual code. The code conceptualizes the underlying pattern of a set of empirical indicators within the data ... the code is of central importance in the generating of theory ...

Open coding

Open coding is defined as 'the analytic process through which concepts are identified and their properties and dimensions are discovered in data' (Strauss & Corbin 1998, p. 101). It is the 'initial step of theoretical analysis that pertains to the ... discovery of categories and their properties' (Glaser 1992, p. 39). Open coding begins with conceptualisation. The data are broken down into discrete incidents—objects, events, actions, ideas, and so on—which are closely examined and compared for similarities and differences. Incidents that the researcher identifies as being significant are assigned labels known as codes (Glaser 1992, p. 38–40; Strauss & Corbin 1998, pp. 101–105).

Codes identify concepts or abstractions of incidents in the data. They give the researcher a 'condensed, abstract view ... of the data that includes otherwise seemingly disparate phenomena' (Glaser 1978, p. 55). As illustrated in Figure 3.3, a code conceptualises an underlying set of empirical indicators within the data (Glaser 1978, pp. 62–65). Incidents that share essential characteristics are given the same code to indicate their common link. A single incident may be assigned multiple codes. In fact, researchers are encouraged to assign each incident as many relevant codes as possible (Glaser 1978, p. 56).

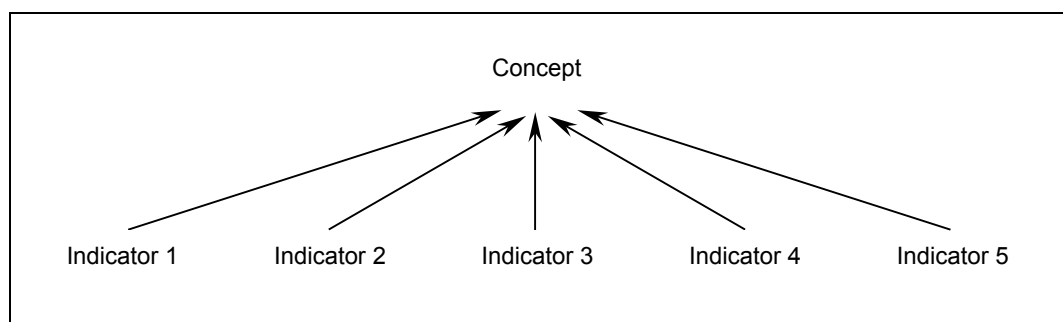


Figure 3.3. A code conceptualises an underlying set of empirical indicators within the data. Adapted from Glaser (1978, p. 62).

Codes can be attached to data chunks of any size—phrases, sentences or whole paragraphs. Different researchers code their data in different ways. Some write

directly on field notes or transcripts, some write on cards, and some use qualitative analysis software such as NVivo, NUD*IST or ATLAS. The labels that are used for codes are arbitrary, but are generally suggested by the context of the incident being coded. Appendix G provides a list of the codes that were created during this study, together with their meanings.

Different kinds of concepts exist in a grounded theory. The most fundamental distinction is between categories and properties. A category is a conceptual element of a theory—an abstract representation of something significant in the data. A property is a conceptual characteristic or attribute of a category (Glaser 1998, p. 135; Glaser and Strauss 1967, p. 36; Strauss & Corbin 1998, p. 113). To reuse an earlier example, in this study interface usability is cited as a category representing the usability of a Web site or its constituent pages. Organisation of content—the accessible or inaccessible manner in which a site's content is structured—is cited as a property of this category.

A researcher generates categories and properties by performing three kinds of comparisons: incident to incident; concept to incident; and concept to concept. Comparing one incident to another establishes initial categories, properties and relationships. Comparing an emerging concept to further incidents verifies the concept as a pattern in the data and helps to develop its properties. Comparing one concept to another establishes the best fit of several concepts to a set of indicators, and clarifies the levels of abstraction of concepts that refer to the same set of indicators (Glaser 1978, pp. 49–50; Glaser and Strauss 1967, pp. 105–106; Strauss & Corbin 1998, pp. 78–85).

Categories and properties are abstractions in the sense that they represent elements of not one informant's story, but rather the stories of many informants. Their relevance to all cases in a study gives them explanatory power. Categories and properties vary in their degree of abstraction. They usually emerge from the data at a low level of abstraction in the early phases of analysis. But as initial concepts are compared to each other, the researcher realises that some of them can be grouped under more abstract, higher-order concepts. Developing high-level concepts is important because it reduces the number of units the researcher must work with (Glaser & Strauss 1967, p. 36; Strauss & Corbin 1998, pp. 113–114).

Theoretical sensitivity

Open coding requires a researcher to be theoretically sensitive.

Theoretical sensitivity refers to the researcher's knowledge, understanding, and skill, which foster his generation of categories and properties and increase his ability to relate them into hypotheses, and to further integrate the hypotheses, according to emergent theoretical codes (Glaser 1992, p. 27).

Theoretical sensitivity involves a researcher's temperament and theoretical insight into the area being investigated. Strauss and Corbin (1998, p. 47) suggest that both

professional experience and the literature can enhance one's theoretical sensitivity, providing a rich source of ideas to stimulate thinking about the data. Concepts can even be 'borrowed from existing theory', provided that they fit the data and that emergent concepts remain the focus of the method (Glaser & Strauss 1967, p. 36).

Professional experience and the literature can also block theoretical sensitivity. Potential sensitivity is lost when researchers commit themselves exclusively to a specific preconceived theory because they can no longer see around their pet ideas (Glaser & Strauss 1967, pp. 46–47). As explained earlier in this chapter, the issue is not whether one uses existing knowledge, but how.

A major contributor to my theoretical sensitivity during this study was my background as a Web designer and lecturer in multimedia. My professional experience and familiarity with the literature in the field of human-computer interaction undoubtedly helped me to respond to nuances of meaning in the data. I am not suggesting that I forced explanations on to the data. Rather, my immersion in the discipline gave me insights that helped me to recognise significant incidents and to ask fruitful questions.

Guidelines for open coding

The following guidelines from Glaser (1978, pp. 57–60) were applied during the open coding phase of this study.

- *Ask questions of the data.* The process of open coding is informed by continually asking the following three questions while comparing incidents in the data. What is this data a study of? What category or property does this incident indicate? What is the participant's main concern?
- *Analyse the data line by line* to produce a dense theory and to ensure that no important details are missed.
- *Do your own coding.* Hiring a coder is only appropriate in studies where all of the potential codes have been predetermined, not a grounded theory study.
- *Always interrupt coding to record ideas in theoretical memos.* This important guideline will be discussed in more detail later in this chapter.
- *Stay within the confines of the substantive area and field of study.* A developing theory may be enriched by sampling data from substantive areas other than the one under investigation. This practice should be avoided until the researcher is sure of the relevance, fit and workability of the initial conceptual framework.
- *Do not assume the analytic relevance of any face sheet variable until it emerges as relevant.* Variables such as age, sex, social class, and race should not be included in a theory until they emerge as being relevant.

Memo-writing

Writing theoretical memos is an essential step in the process of generating grounded theory. A memo is 'the theorizing write-up of ideas about codes and their relationships as they strike the analyst while coding' (Glaser 1978, p. 83). Memos capture and record the emerging theory. They accumulate and mature until the point of theoretical saturation when they can be sorted and written up.

A memo's purpose is to capture the researcher's fleeting ideas at the moment they occur. During coding, researchers often struggle to deal with a proliferation of ideas simultaneously—theoretical notions, the current incident in the data, alternative ways it should be coded and compared, and so on. To relieve this conflict, the researcher must cease coding and write a theoretical memo about his or her ideas, taking as much time as is necessary. If the researcher refuses to interrupt the coding process to write a memo, the current ideas may be lost as his or her mind moves on to new thoughts and more coding (Glaser 1978, p. 83; Glaser 1998, pp. 182–183; Glaser & Strauss 1967, p. 107).

Glaser (1978, pp. 84–87) provides some useful ideas about memo-writing, which were applied during the course of this study.

- *Ideas*. A memo may consist of a few words, a sentence, a paragraph or a few pages. In other words, it can be anything that captures the researcher's momentary thoughts. Memos are primarily conceptual in intent. They don't just report data; they aid the development of grounded theory in many different ways. Memos can raise data to a conceptual level; develop the properties of a category; present propositions about connections between categories and their properties; integrate these connections with clusters of other categories to generate theory; locate an emerging theory within other theories; and more.
- *Freedom*. Memo-writing is not constrained by the usual factors that one associates with writing theory. Memos do not have to be well-written in terms of spelling, grammar and punctuation. Getting the idea out is the important thing. Memos are written to oneself, and are not usually shown to others. Furthermore, they are working documents and a long way from final drafts.
- *Memo fund*. The memos that accumulate during a study are collectively referred to as a memo fund, and serve as a source of all writings from that study. Books, journal articles, conference papers and other publications can all be drawn from the same memo fund.
- *Sortable*. The memos that constitute a memo fund need to be easily sorted by ideas. Memos should always be dated, entitled with key concepts or relationships, and linked to relevant field notes and other memos. Memos should be kept separate from field notes so they are not confused with data.

The process of memo-writing should persist throughout an entire study, continually capturing the researcher's ideas about the emerging theory. When memo-writing is

not done or is done insufficiently, the resulting theory is usually thin and descriptive rather than rich and explanatory. Without memos, there are no theoretical ideas to sort, integrate and write up.

Data displays

The memo-writing process in this study was complemented by the preparation of various kinds of data displays such as network diagrams and matrices of information. Miles and Huberman (1994, p. 11) define a data display as 'an organized, compressed assembly of information that permits conclusion drawing and action'.

Data displays are not a requirement of the grounded theory method, but I used them because they are a useful aid to data analysis. Data displays allow a researcher to simultaneously view data drawn from the full range of informants and events under study—data that has been condensed, distilled and systematically arranged to answer the research questions at hand. The coherent arrangement of data in such a display helps the researcher to make comparisons, detect differences, identify patterns, and ultimately draw valid conclusions (Miles & Huberman 1994, pp. 91–92).

Formats for displaying qualitative data fall into two major categories: matrices and networks.

- A *matrix* is essentially a table with defined rows and columns. Thinking of a matrix as a 'crossing' of two lists, one can imagine different ways in which it might be used: eyeballing data in an exploratory way, combining parallel data for a single case, combining data from several cases, reporting findings, and so on. The data entered into a matrix can also have various forms: short blocks of text, quotes, phrases, ratings, abbreviations, symbolic figures, and more (Miles & Huberman 1994, pp. 93–94).
- A *network* is a collection of nodes (points) connected by links (lines). The meanings of the nodes and links depend on what the researcher is trying to understand. For example, nodes may represent events, and links may represent connections between those events. Networks can incorporate a lot of information, and are very useful when it is necessary to focus on more than a few variables at a time. One type of network display—a concept map—will be used to help explain the theory in the next chapter (Miles & Huberman 1994, pp. 94–98).

Computer use

Qualitative analysis software named NVivo (formerly NUD*IST) was used to assist with coding and memo-writing in this study. As illustrated in Figure 3.4, NVivo allows a researcher to code a document such as an interview transcript simply by highlighting a passage of text and assigning it a code. The code may be newly created or selected from a list of existing codes. NVivo allows researchers to use meaningful phrases as codes, rather than abbreviations, which are commonly used when coding by hand. It is important that a code is close to the concept it describes because 'the

analyst must be able to get back to the original concept as quickly as possible, without having to translate the code into the concept' (Miles and Huberman 1994, p. 64). For example, 'challenge of activity' is preferable to the more cryptic 'CHL-ACT', which in turn is preferable to a numerical code.

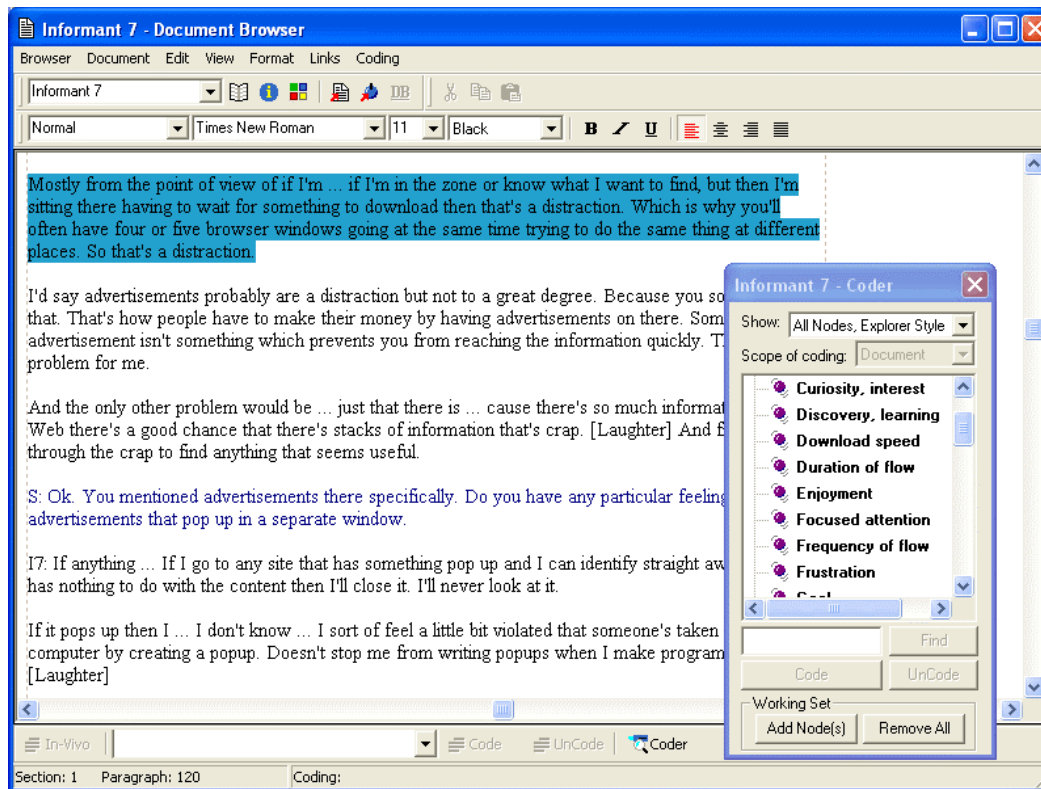


Figure 3.4. NVivo allows the user to code a document simply by highlighting a passage of text and assigning it a code name (QSR International 2000).

Once a passage of text has been coded in NVivo, the code name and a coloured bracket appear aligned with the corresponding lines of text (see Figure 3.5). These 'coding stripes' remain aligned with the text as the document is scrolled. This practice complies with Glaser's (1978, p. 71) suggestion that the best way to achieve the goals of open coding 'is to code in the margin right next to the indicator'.

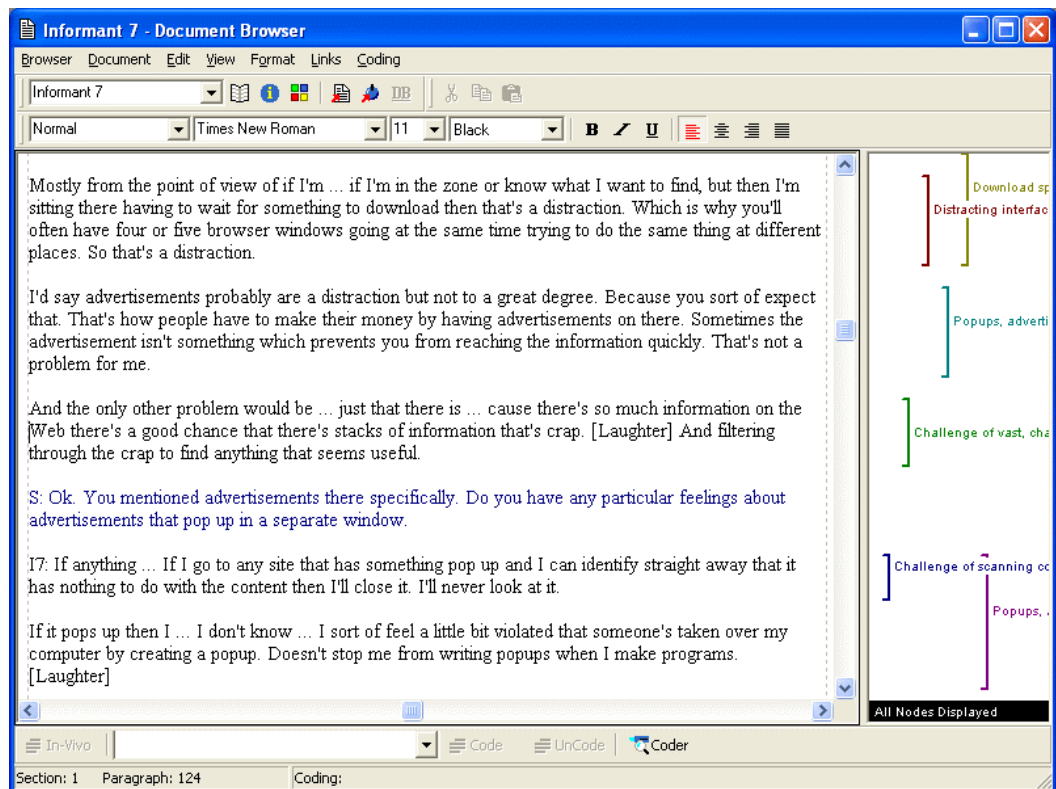


Figure 3.5. Once a passage has been coded in NVivo, the code name and a coloured bracket appear, aligned with the corresponding lines of text (QSR International 2000).

NVivo provides many other functions that supported my activities in this study. Examples include:

- importing, creating, editing and formatting rich text documents, whether they be field notes, memos or some other kind of document;
- creating hypertext links between documents, such as linking memos to relevant field notes;
- organising codes into hierarchical structures reflecting levels of abstraction;
- attaching attributes and values—such as an informant's age or gender—to documents and codes;
- searching documents for text and codes;
- creating reports that show patterns among codes and attributes; and
- producing diagrams of conceptual models with hypertext links to source documents.

Despite these features, Glaser (1998, p. 185–186) discourages grounded theory researchers from using qualitative analysis software, claiming that it hinders and stultifies the process. That was not my experience. As long as the researcher, and not

the software, is driving the research method, computer-aided analysis can be an enormous benefit in my view. I did not feel compelled to use all of NVivo's features in the precise manner in which they were designed to be used, nor did I feel compelled to use features that appeared to be of little relevance to my study. Rather, I selectively used those features that supported my way of doing things, adapting them if necessary. No doubt, this is how NVivo's developers expect their software to be used. To quote from the users' manual:

Once you are familiar with these ingredients, your project will take shapes that are determined, not by the structure and functions of a software package, but by your methodological approach and research goals (Richards 2000, p. 187).

Check-coding

As a means of checking the reliability of my open coding, a second researcher was employed to independently code three of my interview transcripts and to compare her renditions with mine. The check-coder was a full-time PhD student and experienced coder who had previously completed two postgraduate qualifications: a Master of Educational Policy and Administration and a Graduate Diploma in Cultural Studies. I did not know the check-coder prior to asking for her assistance with the study.

Intercoder reliability was measured using the following formula from Miles and Huberman (1994, p. 64), who warn that the initial result is rarely better than 70% because 'each coder will have preferences ... and each vision is usually legitimate'.

$$\text{reliability} = \text{number of agreements} \div (\text{total number of agreements} + \text{disagreements})$$

Applying this formula proved to be difficult because the grounded theory method does not define the size of a codable block of data. Codes can be applied to phrases, sentences or whole paragraphs. To overcome this ambiguity, the check-coder and I decided to label each of our codes as either a match (M), an agreement (A) or a disagreement (D). The meanings of these terms within the context of this exercise are explained below.

A match occurred when both researchers applied codes with the same meaning to a block of data. For example, the check-coder applied the code 'personal comfort' to the following comment in a transcript:

Just the fact that there's always information at your fingertips. It's fairly accessible.
Yeah, a lot easier than going to the library or whatever.

I applied a code named 'easy access to information' to this comment. After explaining the meanings of our codes to each other, we agreed that they were the same in this instance and labelled them as matches.

An agreement occurred when one researcher applied a code to the data and the other did not, but we both agreed that it was a sensible interpretation of the data. For

example, the check-coder applied a code named 'goal' to the following comment to indicate that the user had a specific goal in mind when conducting a search:

I can't remember what it was exactly, but it was something ... I had a JavaScript error that I was trying to fix. And because it was a fairly specific search it took me ages to get the result that I wanted.

I had overlooked that point while coding, but I agreed that it was a sensible application of the 'goal' code, so we labelled it as an agreement.

A disagreement occurred when one researcher applied a code to the data and the other felt that it was not a sensible interpretation of the data. For example, the check-coder used a code that she called 'character of the computer'. I didn't understand her explanation of that code and couldn't see its application to the data. Consequently, we labelled each instance of that code as a disagreement.

After comparing our coding of the first interview in this manner, the number of matches, agreements and disagreements on the two transcripts were tallied. The results are shown in the first row of Table 3.3. The degree of intercoder reliability was then calculated with Miles and Huberman's formula, substituting the 'number of agreements' in their definition with the number of matches (M) and agreements (A).

reliability = number of agreements ÷ (total number of agreements + disagreements)

reliability = (M + A) ÷ (M + A + D)

Table 3.3. Intercoder reliability calculations

Transcript	Matches (M)	Agreements (A)	Disagreements (D)	Reliability (M+A) ÷ (M+A+D)
1	90	91	49	79%
2	92	65	28	85%
3	100	73	34	84%

The result for the first interview was 79%—slightly better than the 70% agreement that Miles and Huberman aimed for initially. When this procedure was repeated for the second and third transcripts the results were 85% and 84% respectively. Miles and Huberman (1994, p. 64) suggest that this increase should be expected because 'each analyst tends to be more ecumenical during later coding for having assimilated a colleague's rival vision of data that initially looked codable in only one way'. Since my three transcripts had all been coded prior to the checking procedure, only the check-coder's actions could have been influenced in this way.

This check-coding procedure is not a requirement of the grounded theory method. Although it yielded the desired results, the following comment from Glaser and Strauss (1967, p. 103) makes me question its necessity and appropriateness:

... Still dependent on the skills and sensitivities of the analyst, the constant comparative method is not designed (as methods of quantitative analysis are) to guarantee that two analysts working independently with the same data will achieve the same results; it is designed to allow, with discipline, for some of the vagueness and flexibility that aid the creative generation of theory.

Theoretical coding

Theoretical coding is the process of conceptualising how categories and properties 'may relate to each other as hypotheses to be integrated into a theory' (Glaser 1978, p. 72). Putting it another way, theoretical coding involves taking the concepts that emerged during open coding and reassembling them with propositions about the relationships between those concepts. Concepts that are grounded in the data will integrate without many problems because reality is integrated.

... This goes back to the whole notion that the researcher is just discovering what is going on. The world is integrated whether the researcher likes it or not. It is the grounded theorist's task to discover it. He cannot integrate the world. It is going on whether or not he has a theory. Thus the grounded theory problem is to discover this integration while generating a theory that explains what is going on, that is discover the integration that's occurring in the world (Glaser 1998, p. 189).

Glaser (1978, p. 72–82) discusses eighteen theoretical coding families that help researchers conceptualise how categories may relate to each other to become an integrated theory (see Table 3.4). Theoretical coding families are examples of possible theoretical structures. They make the researcher aware of certain kinds of relationships that may exist in the data. For example, the most commonly used theoretical coding family is the Six Cs, illustrated in Figure 3.6. The Six Cs encourages researchers to look for causes, contexts, contingencies, consequences, covariances and conditions in the data.

In this study, theoretical coding was not a distinct sequential step following open coding. The two phases proceeded quite naturally together. Theoretical coding requires that the researcher have some categories to work with, but often a sense of how categories relate to each other begins during open coding. Like most grounded theory researchers, I tended to focus more on open coding when discovering codes within the data, and more on theoretical coding when sorting and integrating memos (Glaser 1978, p. 56).

Table 3.4. Glaser's theoretical coding families. Adapted from Glaser (1978, pp. 72–82) and Dey (1999, p. 107)

Theoretical coding family	Examples
Six Cs	Causes, contexts, contingencies, consequences, covariances and conditions
Process	Stages, phases, progressions, etc.
Degree	Limit, range, intensity, etc.
Dimension	Elements, divisions, properties, etc.
Type	Type, form, kinds, styles, classes, etc.
Strategy	Strategies, tactics, mechanisms, etc.
Interactive	Mutual effects, reciprocity, mutual trajectory, etc.
Identity-self	Self-image, self-concept, self-worth, etc.
Cutting point	Boundary, critical juncture, turning point, etc.
Means-goals	End, purpose, goal, etc.
Cultural	Norms, values, beliefs, etc.
Consensus	Clusters, agreements, contracts, etc.
Mainline	Social control, recruitment, socialisation, etc.
Theoretical	Parsimony, scope, integration, etc.
Ordering or elaboration	Structural, temporal, conceptual
Unit	Collective, group, nation, etc.
Reading	Concepts, problems and hypotheses
Models	Linear, spatial, etc.

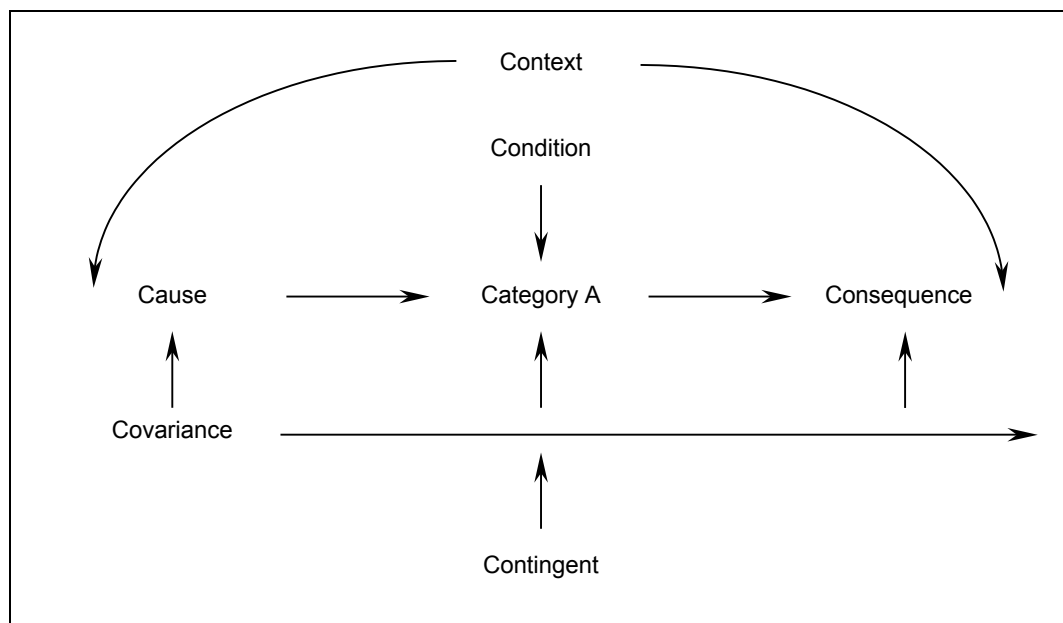


Figure 3.6. The Six Cs is the most commonly used theoretical coding family. Adapted from Glaser (1978, p. 74).

Selective coding

Selective coding is the process of delimiting coding to only those concepts that relate to a core explanatory category. The core category reflects the 'main theme' of the study; it 'sums up in a pattern of behavior the substance of what is going on in the data' (Glaser 1978, p. 61). Selective coding can only begin when the core category has been identified. If a study yields two or three potential core categories, the researcher must select one as the core and demote the others to a subservient role in the theory. According to Glaser (1978, p. 94), this simplification strategy is necessary because attempting to write about all potential core categories 'with no relative emphasis is to denude each of its powerful theoretical functions'. Not surprisingly, 'flow' was the core category in this study.

Once selected, the core category becomes a guide to further data collection and analysis. Theoretical sampling becomes more focused on the central issues of the emerging theory. Coding is delimited to only those concepts that relate to the core category. Memo-writing becomes more focused on integrating categories to form an overall theoretical structure. Major modifications become fewer and fewer. In short, the theory begins to crystallise around the core category (Glaser 1978, pp. 61–62; 1992, pp. 75–76).

Selective coding curbs what could otherwise become an overwhelming task. Without a focus, data analysis can drift into irrelevant areas, rather than achieve the tight integration and dense development of categories required of a grounded theory. Selective coding maximises the scope and parsimony of the emerging theory by helping the researcher to account for as much variation in the data as possible with as few concepts as possible. Committing to a core category makes it possible to reduce the original set of categories to only those that are relevant. Consequently, more time can be devoted to the constant comparison of incidents that are applicable to this smaller set of categories, and the discovery of underlying uniformities that yield more abstract, higher-order categories. The result is a theory with a smaller set of higher-level concepts and broader applicability (Glaser & Strauss 1967, pp. 109–111).

Sorting memos and writing theory

The final stage of this study involved sorting the theoretical memos into an outline and writing up the theory. Glaser (1978, p. 116) describes the theoretical sorting of memos as 'the key to formulating the theory for presentation to others'. The researcher begins the process by collating the memos on each category and property, and sorting them as they relate to the core category. Each memo is compared with the others in a search for similarities, connections and conceptual orderings. The resulting structure provides an outline for writing, with the discussions in the memos becoming the major themes of the theory. The researcher may also return to the coded data when necessary to extract additional evidence or illustrations of key points (Glaser 1978, pp. 116–120; Glaser & Strauss 1967, p. 113).

Theoretical sorting produces some important benefits for theory-writing (Glaser 1978, pp. 116–127):

- Sorting keeps the researcher working at a conceptual level and prevents a regression back to simply writing up data.
- Sorting forces the complex integration of a theory. If a researcher skips the sorting phase and goes directly to writing, it is likely that the resulting theory will be thin and less than fully integrated.
- Sorting relieves the researcher of the burden of preconceiving an outline and the detailed connections between ideas.
- Sorting has a corrective effect as the researcher moves back and forth between memos and the emerging outline, trying to determine where all of the ideas fit.
- Sorting generates new memos, new ideas and new connections because the researcher is constantly and closely comparing ideas.
- The same memos can be resorted for other purposes at another time.

Summary

Qualitative research is 'an inquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting' (Creswell 1994, pp. 1–2). The factors that primarily influenced my decision to use qualitative methods for this study were the nature of the research problem and the degree of uncertainty surrounding the phenomenon under investigation. Qualitative research has only recently gained acceptance within the field of information systems.

All research is guided by a worldview or set of fundamental beliefs known as a research paradigm. This study was designed to be consistent with the assumptions of the postpositivist research paradigm, as defined by Guba and Lincoln (1994). Postpositivists assume that reality exists, but that it cannot be perfectly apprehended because of human limitations and the intractable nature of phenomena. Postpositivists aim for objectivity in their research, but assume that it is impossible for an investigator to study an entity without influencing it or being influenced by it. Replicated findings are taken as probably true, but are always subject to falsification. Postpositivists use mainly qualitative research methods with the aim of redressing some of the perceived problems of positivism.

There are recognisable similarities between Guba and Lincoln's (1994) description of postpositivist research and Orlikowski and Baroudi's (1991) description of interpretive research. The terms *postpositivist* and *interpretive* may be used interchangeably in this thesis.

The research method that was selected for this study is grounded theory—a primarily inductive investigative process in which the researcher formulates a theory about a phenomenon by systematically gathering and analysing relevant data. The purpose of this research method is building theory, not testing theory. Rather than begin the study with a preconceived theory in mind, the researcher begins with a general area of study and allows the theory to emerge from the data.

Grounded theory researchers are encouraged to avoid the traditional practice of reviewing relevant literature at the outset of a study. The rationale for this approach is to keep the researcher open to the concepts and relationships that will emerge from the data, and to avoid derailments in the form of assumptions about what ought to be found in the data. Since circumstances prevented me from applying that recommendation in this study, I documented the ideas that I absorbed from my review of the literature in a conference paper prior to entering the field of study.

The data for this study primarily consisted of semi-structured in-depth interviews with informants who could recall experiencing flow during Web navigation. These interviews had a flexible and dynamic style of questioning and discussion directed toward understanding the significance of flow experiences from the informant's perspective. Using a process known as theoretical sampling, informants were selected according to their potential for providing new insights or expanding and refining those already gained. All interviews were tape-recorded with the informants' permission, and later transcribed to provide accurate records for analysis.

As with much qualitative research, data collection and data analysis occurred simultaneously in this study. A theory was derived from the data using a constant comparative method of analysis with four stages: generating categories and their properties; integrating categories and their properties; delimiting the theory; and writing the theory.

The first stage, called open coding, involved identifying categories and properties in the data. A category is a conceptual element of a theory—an abstract representation of something the researcher identifies as being significant in the data. A property is a conceptual characteristic or attribute of a category. Categories and properties were generated by comparing incidents in the data and looking for patterns. As concepts emerged, they were compared with other incidents for verification, and with other concepts for establishing the best fit with the data. Theoretical memos were written about categories, properties and their relationships during coding. Qualitative analysis software named NVivo (formerly NUD*IST) was used to assist with coding and memo-writing.

The next stage, called theoretical coding, involved taking the concepts that emerged during open coding and reassembling them with propositions about their relationships. These emerging propositions formed a theoretical framework, which served as a guide to further data collection and analysis. As with the categories and properties, the integrated theory emerged from the data; it was not preconceived or forced upon the data.

As the theory developed, it crystallised around a core explanatory category that reflected the main theme of the study—flow. The identification of the core category led to selective coding—the process of delimiting coding to only those concepts that relate to the core category. Data collection and analysis became more focused, resulting in a theory with a smaller set of higher-level concepts.

Data collection and analysis ceased once the study achieved theoretical saturation—the point at which no additional data could be found that added to the categories being developed. All that remained then was to write up the emergent theory, drawing on the theoretical memos that had been written about each category during the study.

The credibility of this study and its research method will be assessed against several sets of criteria in Chapter 9 of this thesis.

Theory overview, goals and navigation behaviour

The next four chapters explain the grounded theory that was developed during the course of this study. Each chapter discusses a group of related concepts and relationships from the theory:

- goals and navigation behaviour in Chapter 4;
- challenges and skills in Chapter 5;
- attention in Chapter 6; and
- dimensions of flow in Chapter 7.

This chapter introduces the theory by presenting a concept map of major categories and relationships, which subsequent chapters repeatedly reference. This chapter also discusses the role that curiosity and time urgency play in the formation of a Web user's information-seeking goals, and how those goals influence navigation behaviour.

Aids to understanding the theory

Chapters 4 to 7 use several devices to help the reader understand how the components of the theory fit together, and how certain conclusions were drawn.

- *Concept map.* As suggested by Ryan and Bernard (2000), the overall theory is presented as a concept map of the major categories and the relationships among them. Explanatory text that draws attention to the features of the concept map and makes sense of them is provided throughout Chapters 4 to 7. The concept map will be discussed in more detail in the next section.
- *Supporting quotes.* The text of Chapters 4 to 7 is supplemented with direct quotes from informants that serve as exemplars of particular concepts and relationships.

In some cases tables of quotes are provided for the reader's inspection. These tables do not present all of the informants' comments that provide empirical support for a particular concept or relationship—just selected examples.

- *References to relevant literature.* References to relevant literature are made throughout Chapters 4 to 7 to demonstrate how this theory compares with the findings of other researchers. As explained in Chapter 3, this is a common practice in grounded theory studies. Researchers developing grounded theory generally avoid reviewing the literature at the outset of the study in an effort to stay open to the concepts and relationships that will emerge from the data. Once the emerging theory is sufficiently developed and close to completion, the researcher reviews the literature in the field with the aim of relating it to his or her work.
- *Formal definitions and propositions.* Definitions of concepts and relational propositions are provided throughout Chapters 4 to 7 to formalise the theory. The definitions of concepts are constitutive rather than operational. A constitutive definition—also known as a theoretical, nominal or rational definition—attempts to state just what the concept means. In contrast, an operational definition provides a concept with empirical meaning by stating how it can be measured (Fawcett & Downs 1986, pp. 21–24).

The propositions in this thesis define relationships between concepts. Some propositions are explanatory and others are correlational. Explanatory propositions suggest that the existence of, or a change in one concept leads to an effect on another concept. The direction of influence is identified. Correlational propositions describe a relationship between two concepts without implying that one causes the other to change. The propositions in this theory are not referred to as hypotheses because they do not contain the empirical indicators found in operational definitions of concepts. A hypothesis is a proposition that is empirically testable (Cooper & Emory 1995, pp. 40–41; Dubin 1978; Fawcett & Downs 1986, pp. 24–38).

Concept map

The concept map in Figure 4.1 represents the theory that emerged from the data in this study. The diagram consists of a collection of boxes connected by arrows. The boxes represent concepts and the arrows represent relationships between concepts. The relationships are directional rather than purely correlational. The concept at the tail of an arrow is assumed to exert an influence on the concept at the head. In some cases the arrows are labelled with a brief description of the relationship being represented, but in most cases the arrows are not labelled and the reader must refer to the accompanying text in Chapters 4 to 7 to discern the meaning of the relationship.

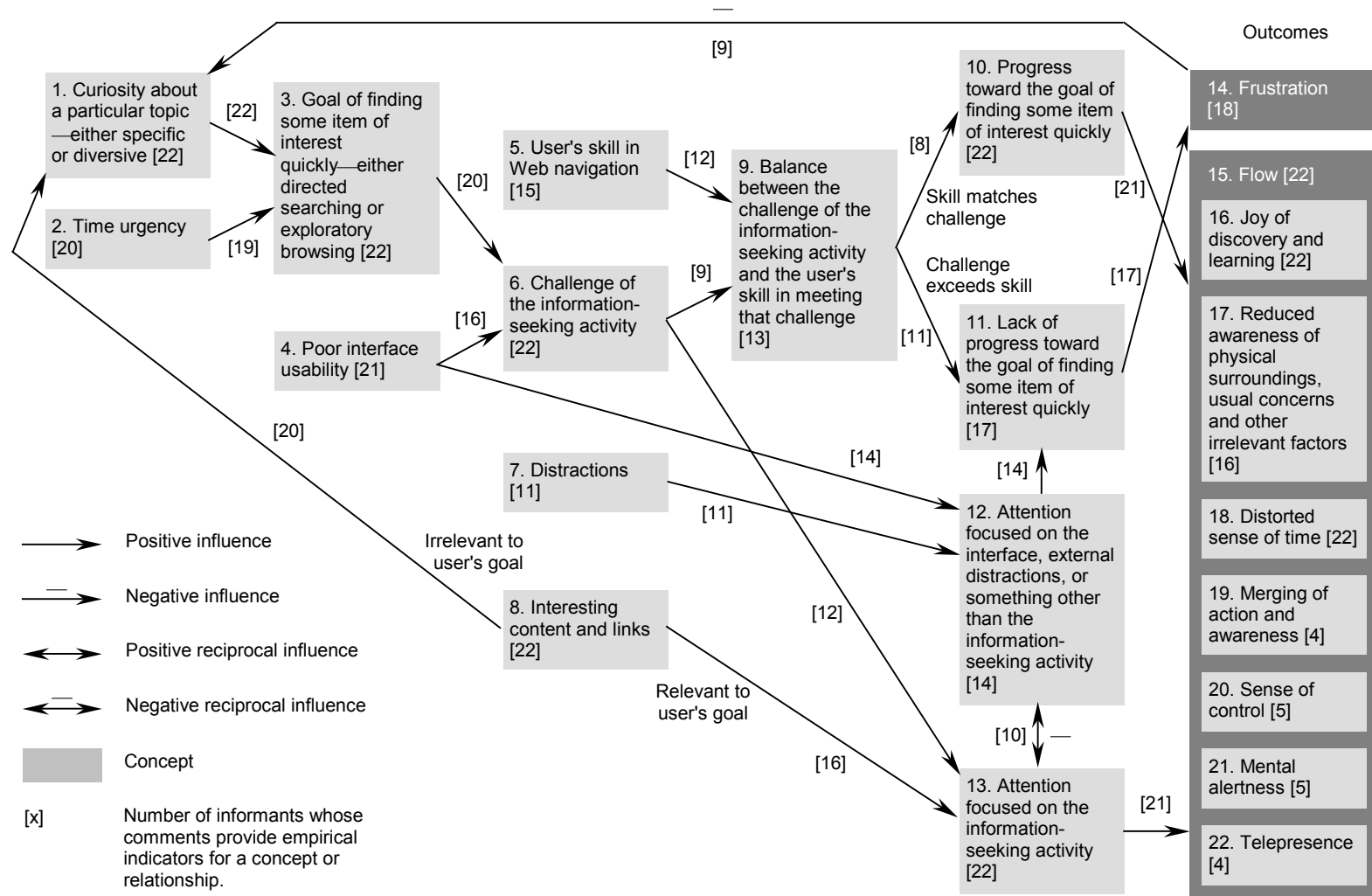


Figure 4.1. Concept map depicting a grounded theory of the flow experiences of Web users

The boxes in the diagram are numbered so that concepts may be easily referred to in the text. The box numbers do not represent a sequence, but the diagram does have a temporal dimension. The concepts have been arranged on the page in a temporal order, showing what precedes what in the network of relationships leading to either flow or frustration.

The number in square brackets that appears inside each box and alongside each arrow represents the number of informants whose comments provide empirical indicators for that particular concept or relationship. These numbers give the reader an idea of how important a topic was across the entire group of informants. For example, one may be able to discern that all informants touched on concept 18, but only a small group touched on concept 19. These numbers cannot be used to make claims about the absolute importance of one concept or relationship over another. Given the semi-structured nature of the interviews, not all informants had an equal opportunity to discuss all of the concepts and relationships that are represented in the diagram.

Figure 4.2 shows another version of the concept map, which gives the reader an indication of how the theory is presented in this thesis. The diagram groups together related concepts and identifies the specific chapters in which they are discussed. Concepts related to goals and navigation behaviour are discussed in Chapter 4. Concepts related to challenges and skills are discussed in Chapter 5. Concepts related to attention are discussed in Chapter 6. And concepts related to dimensions of flow are discussed in Chapter 7.

Directed searching and exploratory browsing

During this study, informants reported engaging in two general types of navigation behaviour: a directed searching mode and an exploratory browsing mode.

Definition 1.1: Directed searching is a navigation mode in which a Web user is motivated to find a particular piece of information.

Definition 1.2: Exploratory browsing is an experiential navigation mode that is characterised by diffuse motives such as passing time or seeking stimulation.

When Web users engage in directed searching they have a clearly defined goal. Table 4.1 provides some examples of specific things that informants recalled searching for: the solution to a software installation problem, contact details for a local Tai Chi group, a missing software library, advice about the value of taking mineral supplements, pictures that illustrate how to set up boxing equipment, and so on.

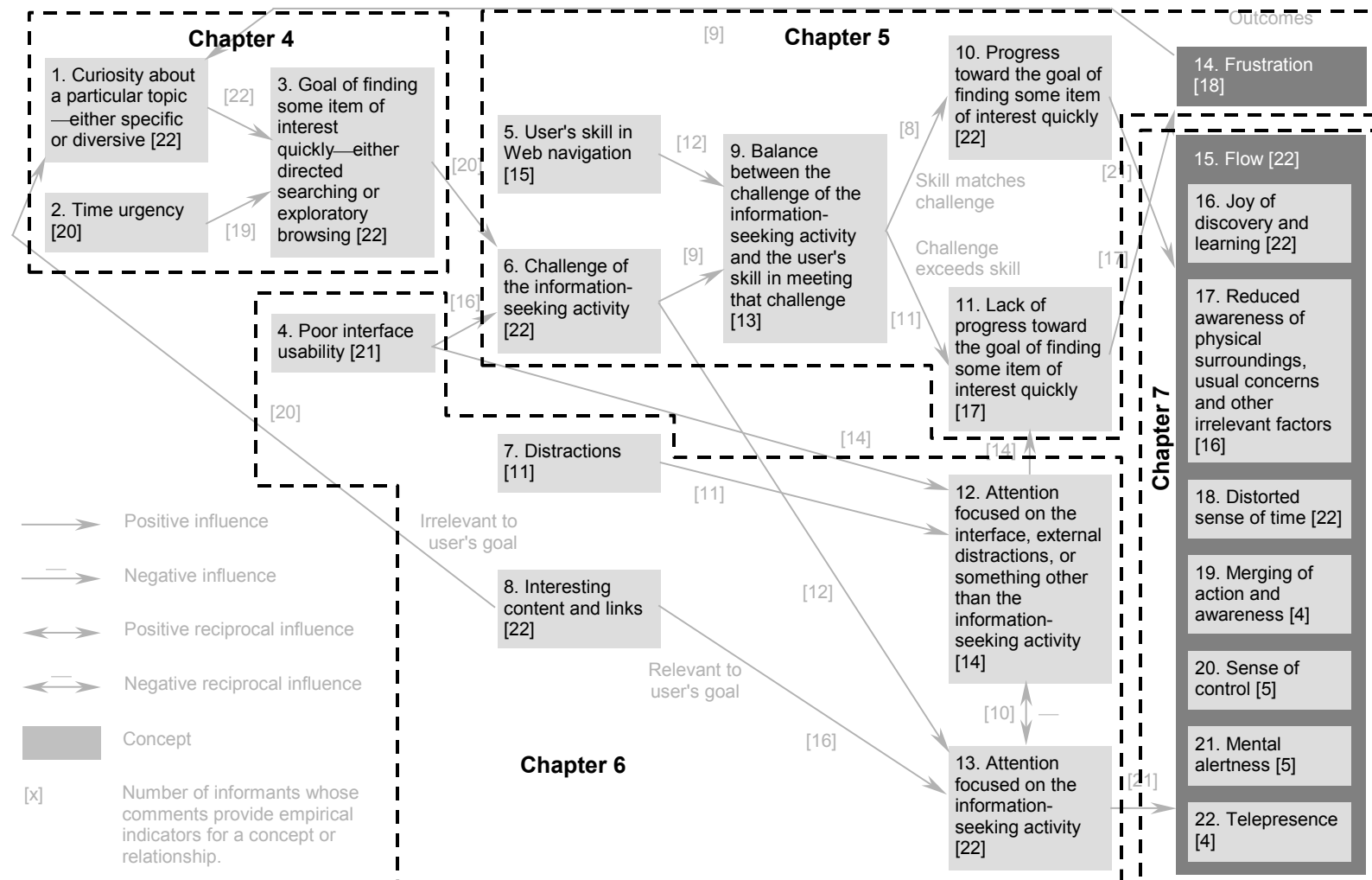


Figure 4.2. Matching elements of the concept map to particular chapters of this thesis.

Table 4.1. Sample comments from informants describing directed searching activities.

Informant	Comment
1	Having installed Access, it told me that there was no license for Access on this computer, and I had to go looking for what the problem was.
5	I was actually looking for a place to do Tai Chi ...
12	Most of that stuff with Linux is source code, so you've got to compile it. And then you realise you're missing such-and-such a library, so you spend the next hour trying to find that.
14	... I was looking for a health site. And I was looking for whether or not I should be taking mineral supplements. So it was a personal health issue for me.
17	I've been trying to buy a lot of boxing equipment. I've got it all now. I've just got to search for pictures of how to set it all up.

In contrast, when Web users engage in exploratory browsing they have a vague or ill-defined goal. Table 4.2 provides some descriptions of exploratory browsing activities. It is very difficult to specify exactly what the informants were looking for on the basis of these comments. As Whitaker (1998, p. 65) observes, 'some navigation is undertaken for the value of the journey itself ... many users surf the net with the primary purpose of enjoying the process of exploration'.

Table 4.2. Sample comments from informants describing exploratory browsing activities.

Informant	Comment
1	It can be like a bit of an investigation, you know. A bit like travelling around the place. I poke around and see what I can find new.
5	It's interesting to see what actually comes up when you type in a specific word or phrase. Just all the different things that could be related to that that you didn't think of. I've actually, by doing that, come across some interesting things, and then sort of went, 'Oh', and looked at them.
8	... a lot of the time I just get on just to look at different things. Sort of whatever pops up.
12	... I just come home from work and I just want to relax and I'll sit in front of the computer. You know, I'm tired and I'll think, 'I'll just surf the Web for a half hour or something and go to bed'. And before you know it, it's like two or three hours have gone and ... you haven't really achieved anything. You've just been mucking around. That happens quite often.
22	Sometimes when I look at the Australian Bureau of Statistics ... there is so much information on the one site that you just jump from one thing to another thing. You can just keep on looking at so many things. That site in particular—you can stay on that site for hours and be kept amused ...

Directed searches may begin at either a search engine or a known address such as a bookmarked Web site. For example, Informant 8 remarked, 'When I am looking for something specific I usually go to a search engine first, unless I've got a specific site

to sort of go and start on'. Similarly, Informant 7 said that when he searches for information he uses bookmarked sites that have proven to be useful in the past, subject-specific search engines, and general-purpose search engines, in that order of preference.

Exploratory browsing may also begin at either a search engine or a known Web address. For example, Informant 3 maintains a bookmark for Weekly World News (<http://www.weeklyworldnews.com>), a 'tabloid trashy newspaper' that he regularly peruses for entertainment. Informant 16 uses the alternative strategy—a search engine—to browse for information when he's bored:

... if I'm bored and looking for something to do, I might just go to a search engine and type 'Mackay' and just see what comes up. And just browse through Mackay business pages and anything in general in Mackay.

A recognised distinction

This distinction between directed searching and exploratory browsing is not a new idea. Many studies of user navigation strategies distinguish between the two. Hoffman and Novak (1997, p. 45) describe the two kinds of navigation behaviour as 'goal-directed' and 'experiential'. Laurel (1993, p. 26) describes them as 'instrumental' and 'experiential'. Catledge and Pitkow (1995, p. 1066) refer to them simply as 'searching' and 'browsing'.

Interestingly, the notion of directed searching and exploratory browsing extends to other media. Rubin and Perse (1987, p. 59) have identified a similar distinction between 'ritualised' and 'instrumental' orientations to television viewing:

Ritualized use focuses more on the medium, rather than on particular content, and is associated with diffuse motives (e.g., pass time, habit, relaxation) and more exposure to and affinity with the medium. It is a less intentional and nonselective orientation, a time-filling activity, and a tendency to use a medium regardless of content ...

Instrumental use, though, is more intentional and selective, and reflects purposive exposure to specific content. It is marked by using a medium's content for information utility reasons, and affinity with and perceived realism of that content.

Exploratory browsing can be likened to ritualised media use in the sense that it is 'a more or less habitualized use of a medium to gratify diversionary needs or motives', while directed searching can be likened to instrumental media use, which refers to 'goal-directed use of media content to gratify informational needs or motives' (Rubin 1984, p. 69).

Interrelated navigation strategies

Directed searching and exploratory browsing are not dichotomous forms of navigation behaviour. On the contrary, they are closely interrelated. Web users move back and forth between the two modes, often many times within the same session.

In some cases, a user engaged in exploratory browsing will come upon something that makes him want to initiate a directed search. Informant 12 described one such occasion that occurred while he was browsing newly released software on the Fresh Meat site (<http://www.freshmeat.net>). While attempting to compile some of the open source code that he had downloaded from the site, he discovered that he was missing a particular software library, and subsequently spent the next hour searching for it.

The flipside of that situation is when a user engaged in a directed search decides to suspend the activity and start browsing in an exploratory way. For example, Informant 4 recalled an occasion when he was searching for a particular company's details on the Australian Wines site (<http://www.australianwines.com.au>), and ended up browsing the Web for information about 'wines, foods, what food to eat with what wine', and other related topics.

Several researchers have commented on the interrelatedness of exploratory browsing and directed searching. Catledge and Pitkow (1995, p. 1066) state that 'browsing and searching are not mutually exclusive activities', and 'users often move back and forth between strategies'. Similarly, McAdams (1995, p. 42) says that 'these two types of activity in an information space are not exclusive, and any user who comes in for one type of activity may want to switch to the other at some point'. Rubin (1984, p. 76) reached a similar conclusion with regard to ritualised and instrumental orientations to television viewing:

... ritualized and instrumental television use may not be clearly dichotomous. The factor solution and past research support the idea of potential interrelatedness. Just as audience activity is variable, individuals might "view" ritualistically or instrumentally to a degree in accordance with variable background, time, and situational demands.

Differing attitudes toward exploratory browsing

Rubin's (1984, p. 69) research into ritualised and instrumental television use suggests that individuals tend toward one of [the] two types of viewing'. While this study did not reach the same conclusion about Web users, there were apparent differences in the informants' attitudes toward exploratory browsing.

Some Web users routinely connect to the Internet with the primary intention of engaging in recreational exploratory browsing, while others rarely do so. For an example of the former type of user, consider the following comment from Informant 12:

Firstly I should mention that there's not just one occasion. It happens all the time. Like I say, I just come home from work and I just want to relax and I'll sit in front of the computer. You know, I'm tired and I'll think, 'I'll just surf the Web for a half hour or something and go to bed'. And before you know it, it's like two or three hours have gone and ... you haven't really achieved anything. You've just been mucking around. That happens quite often.

Most of the time when that happens I've just come home from work. You just want to forget about everything. You're not really looking for anything. You just jump on and start mucking around. One thing leads to another and you know.

In contrast to this experience, other informants said that they rarely connected to the Internet for the primary purpose of engaging in exploratory browsing. These individuals insisted that they nearly always have a more specific goal in mind when they connect, but they often get sidetracked or choose to engage in exploratory browsing later. Table 4.3 provides some examples of comments from these informants.

Table 4.3. Sample comments from informants who rarely connect to the Internet for the primary purpose of engaging in exploratory browsing.

Informant	Comment
6	Usually I only use the Internet if I'm looking for something specific. I don't tend to sort of get on there looking for ... you know, to download songs or just general browsing. Usually I only use it if I've got a purpose.
13	I think more often than not, if I'm at home and I've got on to check e-mail or something like that, and I've got an hour spare then I'll go and have a look around for a while ... It would be rare that I'd get onto the Internet just to have a look around. Usually while I'm on there, I like to look around.
14	I don't like to do things like surf the Net for fun. I need to have a reason for going there.
20	I use it for private purposes, but there's normally always something that I go online for. I mean I might look at other things while I'm there, but I've never really just hopped on just for the fun of it, to have a look.
22	I usually do have a reason to initially log on. I usually do have something in particular ... I probably have done it, but it's very rare that I'd just log on just to float around in it.

Goals

Regardless of whether a Web user is engaged in directed searching or exploratory browsing, the individual has a goal (see box 3 in Figure 4.1).

Definition 1.3: A Web user's goal is to find some item of interest quickly.

Web users engaged in directed searching have a clearly defined goal, and those engaged in exploratory browsing have an ill-defined goal, but the important point is the presence of a goal in each case.

The goals of informants engaged in directed searching were easily discerned from their descriptions of the activity (see Table 4.1). For example, Informant 5 said, 'I was actually looking for a place to do Tai Chi'. The goals of informants engaged in exploratory browsing were not so easily identified (see Table 4.2). In fact, cursory inspection of comments about exploratory browsing sometimes suggested that this

type of navigation behaviour did not involve a goal. Closer examination revealed otherwise. To illustrate this idea, recall the comment from Informant 12 in the preceding section, which described his nightly ritual of surfing the Web after work. The remark, 'You're not really looking for anything', suggests that exploratory browsing does not involve a goal. However, consider the following description of the same activity made by the same informant:

Some nights I just go home and I don't really have anything in particular I want. There's nothing good on TV so you jump on the computer and just start and think of something you want, and a couple of hours later you're still sitting there.

Note the remark, 'You jump on the computer and just start and think of something you want'. Clearly the user was pursuing an item of interest while engaged in exploratory browsing. Informant 12 made this point explicit later in his interview when he said, 'Most of the time I've actually got something I want to do. I'm looking for something. Even just when I'm browsing or whatever'. Table 4.4 presents some other descriptions of exploratory browsing activities that identify a goal, albeit an ill-defined one.

Table 4.4. Sample descriptions of exploratory browsing activities that identify a goal.

Informant	Comment	Target
1	I got stuck on this site and was playing, looking through the JavaX. They've got examples that you can run. ... I was thinking this is really cool stuff after the Java Windows Toolkit, the JWT.	Interesting Java code.
7	A lot of things that I would look for ... like go to the <i>Star Wars</i> site maybe once every couple of weeks to see if anything's changed.	New information about <i>Star Wars</i>
12	The children do a lot of assignments now, and they do a lot of research on the Web for that. It's quite difficult to actually pinpoint exactly the information you want ... Once again it comes down to the children's perception of what they want. If you can determine exactly what they want it makes it a lot easier, but sometimes they don't really know themselves. They spend a lot of time just looking till hopefully they're going to find something they want.	Information related to the children's school assignment.
15	I still would have a topic in mind. I might not know what sites are available, and it could be for personal use or even entertainment, but I would still have a particular topic in mind. For example, when I found out I was pregnant I wanted to find out what information was available on the Internet, but I still had the topic of pregnancy in mind.	Information about pregnancy.
17	I sort of look under new bands, new music. I sometimes get told about them by my mates, and I go have a listen to one of their songs, and if I like them usually download an album or something.	New music

At the beginning of this section, the goal of a Web user engaged in directed searching or exploratory browsing was described as 'finding some item of interest quickly'. Note

that there are two parts to this goal: (1) finding an item of interest; and (2) doing so quickly. The following proposition suggests that the first part of the goal arises from curiosity or interest in a particular topic, and the second part arises from a sense of time urgency.

Proposition 1.1: A Web user's information-seeking goal is determined by his or her curiosity in a particular topic and sense of time urgency.

Both of these factors will be discussed in the sections that follow.

Curiosity and interest

Curiosity and interest play a vital role in the flow experiences of Web users. For the purposes of this study, curiosity is simply defined as follows:

Definition 1.4: Curiosity is a desire to know something.

The topics that a Web user pursues during flow need not have broad appeal, but they must be of interest to the individual. Informant 4 plainly made this point when he said, 'I'm searching on media studies of Zimbabwe. It's probably uninteresting to you, but to me it's interesting'. Table 4.5 provides some similar comments from informants that highlight the important role curiosity and interest play in the formation of information-seeking goals.

Table 4.5. Sample comments from informants that reveal the important role curiosity and interest play in the formation of information-seeking goals.

Informant	Comment
1	... curiosity ... definitely would be part of it. See what's there. That is probably the same thing that drove people to travel around the world in sailing ships and catch scurvy. It's the last frontier, the cyber-frontier. [Laughs] I think there's a lot of that in the Internet, you know. In the Web.
5	... it's something that can hold my interest. Obviously if it's something your boss makes you do and you really don't want to be doing it, it's hard to get into it ... If you're looking for something that you're personally interested in, I think it's quite easy to slip into that flow sort of state.
12	Every person I believe has certain interests in life. With TV, for example, you've got to watch what they present to you, whereas on the Web you can find stuff that you're interested in.
13	It has to be something that I'm interested in. A topic that holds my interest.
14	... both of them were enjoyable because I was doing things for my own personal interest ...

Berlyne (1960) proposed a categorization of different types of curiosity. One dimension of his categorisation that is relevant to this study is the distinction between specific and diversive curiosity.

Definition 1.5: Specific curiosity is the desire for a particular piece of information, as typified by an attempt to solve a problem or puzzle.

Definition 1.6: Diverse curiosity is a more general seeking of stimulation or novelty, as typified by a bored television viewer flipping between channels.

The following comment from Informant 12 provides an example of specific curiosity:

Sometimes you're at work and you get a problem. You basically don't get time to fix it at work. So you come home, you do a bit of research on why it's happening, what the fixes are, and stuff like that. That can be pretty time-consuming.

The following comment from Informant 9 provides an example of diverse curiosity:

I'm a bit of a magazine addict, and I often look at magazine sites ... like, say the *Cosmo* site ... Sometimes if I'm bored at work I might go there and have a look.

In the context of information-seeking, specific and diverse curiosity appear to correspond to the topics that were discussed earlier in this chapter (see Figure 4.3).

Proposition 1.2: Specific curiosity corresponds to well-defined goals and directed searching.

Proposition 1.3: Diverse curiosity corresponds to ill-defined goals and exploratory browsing.

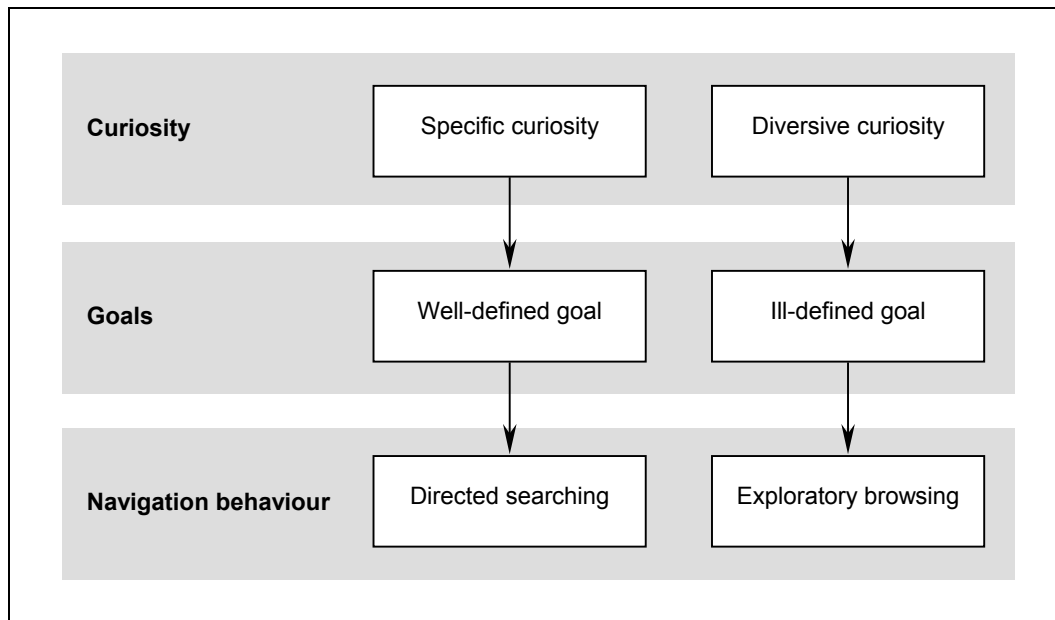


Figure 4.3. The relationship between curiosity, goals and navigation behaviour.

It is evident from the comments of informants that the Web has the potential to satisfy both specific and diverse curiosity. The Web is an extraordinary source of

information for individuals seeking knowledge, and an extraordinary source of novelty for individuals seeking stimulation.

Time urgency

Time urgency, like curiosity, is one of the factors that determine a Web user's information-seeking goal. Drawing on the work of Landy et al. (1991, p. 645), time urgency is defined as follows:

Definition 1.7: Time urgency is an individual's tendency to consider time as a scarce resource and to plan its use carefully.

Time urgency appeared to be a feature of the goals of all informants in this study, regardless of their demographic details, their navigation behaviour (searching or browsing), or their time constraints. Even in their leisure hours, the informants had no desire to waste time on pages that were of little interest to them, as the following comment from Informant 7 suggests:

As I've got older I've just been aware of how important time is. So to me, if I look at a page, and if I can't identify within a second that I don't think it's useful ... If I can't identify quickly that it's not what I want, then to me I sort of think, 'I'm not going to waste any more time on this because time is of the essence. Let's go to the next thing'. And spending an extra twenty seconds on one page to totally prove that this wasn't what I want, was twenty seconds that I could have spent doing something else.

Table 4.6 provides other examples of comments from informants that reveal a sense of time urgency in their goals.

Table 4.6. Sample comments from informants that reveal a sense of time urgency in their goals.

Informant	Comment
7	... I would enjoy finding information that I'm searching for quickly. That's sort of enjoyable to me. Especially because it's usually for a problem. So a problem arises. I need an answer. If I find that quickly that's enjoyable.
11	I guess the perception that I can find it instantly ... quickly. Rather than go to the library and look up indexes, you can be directed to the information right on the spot ... instantly ... I click and it's shown to me ... Instant access.
15	I want the information and I want it straight away.
18	... I'm just so busy, as everyone else is. I'm always seeing that everyone's always pressed for time. So the quicker you can find information, it's of more benefit to you.
22	... you just want to get the specific information, and get it fast ...

Not all informants revealed their sense of time urgency as directly as Informant 7 or the others quoted in Table 4.6. Informants revealed their desire for speed in different ways, some of which are described below.

- *Imposing a time limit on a search.* Some informants made time urgency an explicit part of their information-seeking goals by consciously setting a limit on the time they would devote to a search. Informant 14 said:

If it's not an imposed thing like somebody needs to know by a particular time, it's that I've got forty thousand other things to do, and so I can only allot this much time to searching for the answer to a problem.

- *Opening multiple browser windows.* Some informants employed a multi-window browsing strategy that was clearly motivated by a desire to get something else done while waiting for slow pages to download. Informant 16 said:

... I could have all day to do all the different processes I'm doing at once. But it's just the fact that the option is there for me to do multiple tasks, and so I take advantage of that.

- *Appreciating easy access to information.* Some informants expressed appreciation for the easy access to information that the Web provides, particularly when compared to traditional sources of information like libraries. Informant 12 said:

It's certainly a lot easier than say, going to a library, and searching through all the books and stuff. If you know exactly what you want, you can find your information very quickly.

- *Selecting the first results returned by a search engine.* Some informants demonstrated their sense of time urgency by selecting the first results returned by a search engine, rather than inspecting others for relevance. Referring to the results returned by a search engine, Informant 1 said:

First one on the list. This is actually a book. ... They reckon advertising doesn't work. That's rubbish. People who spell aardvark with three A's in the phone book, and all that.

- *Spending time at the first relevant site.* Some informants devoted time to the first site they found that satisfied their interest, even if they suspected that other more interesting sites might exist. Referring to a search for house plans, Informant 7 said:

... that was the very first site that I found that had plans available to be printed, that had a lot of information about how the building process works for dummies I guess. So once I found a site like that I thought, 'I'll stop here. This is a useful site'.

- *Losing patience with slow downloads.* Some, if not all, informants lost patience with slow downloads. Describing the progress meter in a download dialog box, Informant 21 said:

... the other day I was on it and looking for stuff and my bar's going ch, ch, ch. And it sticks there for a bit. And then it goes vrrrt, like this. And I'm going, 'Well that took a long time'. And I'm losing patience. I'm losing patience big time.

- *Losing patience with splash screens.* Some informants were irritated by splash screens, which slowed them down as they attempted to reach a site's home page. Informant 13 said:

Another thing that annoys me is when you go to sites and they don't get to the point. You have to go through five or six start-up screens or introductory screens before you get to the content of the site. I don't have the patience for that.

- *Feeling frustrated when searches take too long.* Some, if not all, informants felt frustrated when it took longer than they would like to find an item of interest. Informant 8 said:

If the search drags on then it starts to get annoying ... I enjoy doing it because I'm looking for what I want. But if it starts to become long and tedious, it gets a bit annoying.

Getting sidetracked

Just as Web users can change from one navigation mode to another, they can also get sidetracked from one topic to another. This thesis uses the expression 'getting sidetracked' to describe occasions when a Web user engaged in an information-seeking activity decides to pursue a different goal because his or her curiosity is aroused by interesting content or links that are not directly relevant to the task at hand (see boxes 1 and 8 in Figure 4.1). Table 4.7 provides some comments from informants describing situations in which they were sidetracked from their current task. The following proposition generalises their comments. The meaning of the term 'interesting content' will be explored and defined in Chapter 6.

Proposition 1.4: Interesting content that is not relevant to a Web user's current information-seeking goal is positively related to changes in the focus of the user's curiosity.

The curiosity that Web users exhibit when they are sidetracked appears to be short-lived in the sense that it arises, changes focus and ends abruptly. This observation is consistent with Loewenstein's (1994, p. 86) comment that 'curiosity tends to be highly transient but, at the same time, quite intense'. For example, Informant 5's desire to find contact details for a local Tai Chi group disappeared as soon as a link to the Sportsgirl Web site (<http://www.sportsgirl.com.au>) attracted her attention:

I think I typed in 'sports' ... I was actually looking for a place to do Tai Chi and that sort of thing. So I was looking for a sport. And it ended up coming up with the Sportsgirl Web site. And I ended up looking at clothes all afternoon. So that was kind of cool.

Loewenstein (1994, p. 92) suggests that 'curiosity's transience is explained by the fact that curiosity requires attention, which is a limited cognitive resource'. Curiosity arises from attention to a gap in one's knowledge, and typically ends when attention is distracted.

Table 4.7. Sample comments from informants describing situations in which they were sidetracked from their current task.

Informant	Comment
2	Say I'm looking at the way gender is viewed. Suddenly something will come up and I'll read it and it's so interesting, and then I'll realise what I've read. I've read say a feminist point of view of woman's subjugation or something. And it's been really interesting. But it really is not related to my topic.
3	I went to the University of Melbourne. Somebody had written a book on the history of agricultural shows in Australia. I went there and got all the information, which was good. And it had other links to other sections of the University, which had other links to other universities, which had other links to agricultural organisations ... From there you can find yourself in animal welfare issue sites, and then it's only a small jump away to sort of radical, eco-terrorist-type sites. And from there, you get a lot of fun sites, you know.
12	I go to a couple of sites that give you the latest happenings in say, for my example, the Linux operating system. And sometimes down the side they'll have the latest news. You see that and you think, 'Oh that's interesting'. Click on that, and it leads to something else, and you end up totally way off what you started on.
13	There have been times when I've been shopping for something or looking at a game or something, and then found a site that reviews games or has other associated parts, and I've gone on to there. And then they have some good links further away. And I lose track of what I'm doing completely.
20	Only about a month or so ago, I was researching. What was that assignment? I'm not sure exactly what it was. It was to do with a health assignment. And one of the journals was how to get rid of nits. It was like a forty page article, and I ended up reading the whole lot ... Yeah, different ways they've come up with on how to fix the problem. 'Cause I've got three kids, so it's a problem.

It is important to note that getting sidetracked does not necessarily disrupt a flow experience. When Web users are sidetracked, their fundamental goal of finding an item of interest within the shortest possible time remains unchanged; it is only the item of interest that changes. The user may move seamlessly from one phase of the flow experience to another.

Sometimes the change in the Web user's goal necessitates a change in search mode. For example, the previous comment from Informant 5 suggests that her navigation behaviour changed from directed searching ('looking for a place to do Tai Chi') to exploratory browsing ('looking at clothes all afternoon') when she became sidetracked.

Losing sight of one's original goal

Sometimes getting sidetracked prevents a Web user from achieving his or her original goal of finding information on a particular topic. As Informant 10 recalled, 'I didn't actually find exactly what I was looking for because I got sidetracked'. Informant 19 related a similar experience:

You go looking for something—for one thing—and ... you'll see ... another option ... And you think, 'Oh, I'll just click on that first and have a quick read, and then I'll

go back to it'. Usually you just end up reading and by the time you realise, the time's gone. It's like, 'Oops, I was supposed to research the other thing, not that one'.

Some informants in this situation later felt annoyed with themselves for their perceived lack of self-discipline. Informant 11 provided the following example:

... within the media on the page there are links to what information that you want, but there are other little links in smaller fonts. They are small but they look interesting and they distract you ... and you get sidetracked ... it could be interesting, and the more you get into it, it becomes interesting and you get more sidetracked. Eventually you get angry with yourself. You come back to where you started and you lost what you were looking for.

Not all informants felt this way. Some were unconcerned about getting sidetracked because they often found interesting or useful information on other topics. As Informant 10 put it, 'Getting sidetracked pays off'. Informant 9 expressed herself this way:

... I try not to get too sidetracked, but it does happen ... It's not hugely serious stuff generally. If you're enjoying what you're looking at, then that's fine. So I guess it's no big deal because you can always go back and re-search for something.

Handling the temptation

Some disciplined informants refused to allow themselves to get sidetracked from their original goal—usually because of time constraints—but admitted that they were often tempted to do so. Informant 14 expressed it this way: 'The temptation is there. Because of the time constraint thing, I sometimes have to stop myself from going off on a tangent'. Informant 18 described a technique that she uses to prevent herself from getting sidetracked:

Like I said, there's a lot less time for me to spend on the Net. So what I actually do is ... I write down what I need to find on the Net before I go on, and if I start getting sidetracked, I look down. What was it I needed to find? And so I still have that there to find out. And I just put aside everything until I find that. If I've got extra time, then I'll go and search the other things ... I have to write things down a lot. If I don't write it down, I'll forget it.

A Web user's susceptibility to getting sidetracked seems to be influenced by various factors, some of which are described below.

- *Definition of the user's information-seeking goal.* Some informants claimed that having a well-defined goal reduced the likelihood of getting sidetracked during Web navigation. Informant 6 said, 'Whenever I do look for something my topic is fairly well defined. That's why I tend not to stray'. Informant 11 made a similar comment:

If at the beginning ... I'm looking for a broad topic ... then I can get sidetracked. If I know what I'm looking for, then I can focus because I know that at the end there is a piece of information that I want.

- *Time constraints.* The extent of a user's time constraints may influence his or her susceptibility to getting sidetracked. For example, Informant 15 said that having free time increased the likelihood that she would give in to the temptation of getting sidetracked:

If I have a topic in mind and I'm on a deadline or a tight schedule, then I need to keep to that core information I'm looking for. But if I've got an extra bit of time, I think, 'Ok there's something that's not on the topic I'm looking for, but just out of interest, I'll have a look anyway'.

- *Fulfilment of the primary reason for going online.* Some informants were more amenable to getting sidetracked once they had satisfied their primary reason for going online. Informant 3 provided an example related to his postgraduate study:

And it seems to be once you've found the information you want—you've printed it out or bookmarked it—and you see a site and you follow the site, you can end up well away from even university sites ...

- *Boredom or frustration with the current task.* Some informants became more susceptible to getting sidetracked as their interest in the current search waned, usually because the search wasn't progressing well. Informant 22 made this comment:

You get a bit bored and you see something that looks interesting. And you think, 'Oh I'll just go and have a look at that'. Sort of takes you to another level ... I find that if I can't find what I'm looking for, I get frustrated and then I just think, 'Oh well, I'll just go and look at something else, just to get my mind off it' ... It's so tempting because you've got it right at your fingertips. It's not like reading a book and you've got to put it down and go and find another book of interest that you can read. It's right there in front of you ... And it's human nature to do things that interest you more.

This experience of the informants was common enough to warrant the following proposition. The meaning of the term 'frustration' will be explored and defined in Chapter 5.

Proposition 1.5: Frustration with an information-seeking activity has a negative influence on a Web user's curiosity or interest in the information being sought.

Summary

During this study, informants reported engaging in two general types of navigation behaviour: a directed searching mode in which one is motivated to find a particular piece of information, and an exploratory browsing mode that is more experiential in

nature. Directed searching and exploratory browsing are not dichotomous forms of navigation behaviour. On the contrary, they are closely interrelated. Web users move back and forth between the two modes, often many times within the same session.

Regardless of whether a Web user is engaged in directed searching or exploratory browsing, the individual has a goal of finding some item of interest within the shortest time possible. The item of interest may be as specific as the answer to a particular question or as vague as somebody's definition of a 'cool site', but the fundamental goal is the same in each case

A Web user's goal stems from two factors: curiosity or interest in a particular topic; and a sense of time urgency.

Berlyne (1960) has proposed a categorization of different types of curiosity: specific curiosity, which is the desire for a particular piece of information, and diversive curiosity, which is a more general seeking of stimulation or novelty. In the context of Web use, specific curiosity corresponds to well-defined goals and directed searching, while diversive curiosity corresponds to ill-defined goals and exploratory browsing.

Time urgency appeared to be a feature of the information-seeking goals of all informants, regardless of their demographic details, their navigation behaviour (searching or browsing), or their time constraints. Even in their leisure hours, the informants had no desire to waste time on pages that were of little interest to them. Informants revealed their desire for speed in many different ways.

Just as Web users can change from one navigation mode to another, they can also get sidetracked from one topic to another. This thesis uses the expression 'getting sidetracked' to describe occasions when a Web user engaged in an information-seeking activity decides to pursue a different goal because his or her curiosity is aroused by interesting content or links that are not directly relevant to the task at hand. Getting sidetracked does not necessarily disrupt a flow experience. When Web users are sidetracked, their fundamental goal of finding an item of interest within the shortest possible time remains unchanged; it is only the item of interest that changes. The user may move seamlessly from one phase of the flow experience to another.

Challenges and skills

The previous chapter introduced the theory that was developed during this study, and discussed the role that curiosity and time urgency play in the formation of a Web user's information-seeking goals and subsequent navigation behaviour. This chapter continues the explanation of the theory by discussing the challenges that Web users face when seeking information, the skills they use in meeting those challenges, and the relationship that exists between challenges and skills.

Challenges

Web users face certain mental challenges (see box 6 in Figure 4.1) as they try to attain their goal of finding an item of interest within the shortest time possible. For the purposes of this study, challenge is defined as follows:

Definition 2.1: A Web user's challenge is an opportunity to use certain skills in working towards the attainment of an information-seeking goal.

By definition, challenges arise as a consequence of a Web user's goal.

Proposition 2.1: The existence of a goal is a necessary condition for a Web user to perceive challenges within the context of information-seeking.

Table 5.1 provides some comments that describe the challenges of information-seeking activities in general terms, but many informants described the challenges in quite specific terms. Applying open coding to these comments revealed the following array of challenges, each of which will be discussed in this section:

- negotiating a vast, constantly changing, uncharted information space;
- selecting suitable key words for a search engine query;
- using the correct syntax for a search engine query;
- distinguishing relevant links from irrelevant links;

- dealing with a large collection of potentially relevant links;
- scanning a page for relevant information; and
- understanding the content and non-linear structure of a Web site.

Table 5.1. Sample comments from informants describing general challenges associated with searching and browsing activities.

Informant	Comment
4	There's a lot of things, especially with my research ... A lot of it's archives ... Trying to find the information is probably the hardest. And I suppose the biggest challenge is trying to find the places where it's at or being held.
5	I find I have some trouble with searching for things on the Web. I get to places that are totally irrelevant to what I'm looking for.
8	Then I think, 'I've got to find it'. Because it's sort of like challenging me saying, 'You can't find it'. So I've got to.
11	It becomes a challenge to you to find it. It bothers you. It bothers me when I can't find it. And when it bothers me, somehow I get back to it every once in a while. If it bothers my conscience that some information is not correct, especially in this situation, it's a challenge for me to find it. And when I have found some satisfactory explanation then I give up ... In this kind of search, it's a search to clear my conscience. And I will keep on searching until I think that I am satisfied to a certain extent. And this search perhaps is what makes me immersed in the sense of timing.
14	It ended up being quite complex finding it.

Challenges are an important factor in the flow experiences of Web users because they help to focus the user's attention, as will be discussed in the next chapter.

Negotiating a vast, constantly changing, uncharted information space

One of the challenges facing Web users as they search or browse for information is negotiating the vast, constantly changing, uncharted information space that is the Web. The sheer amount of information that is available online makes finding anything a challenge—just like the proverbial needle in a haystack. Not only is the information on the Web voluminous, it is constantly changing and is not indexed in any conventional manner. As Informant 1 noted, 'There's so much out there that you'll go there one day and then you'll come back, and you'll actually end up on a different path and finding something different'. Table 5.2 provides some other comments from informants describing the challenge of negotiating a vast, constantly changing, uncharted information space.

Table 5.2. Sample comments from informants describing the challenge of negotiating a vast, constantly changing, uncharted information space.

Informant	Comment
5	Unless you have a specific URL it's hard ... It creates more problems unless you have a specific address. It's just so ... huge and you have no idea which end to start from.
8	... sometimes you can be looking for something specific and with the vast amount of information on there, sometimes it's quite hard to just find exactly what you're looking for. It's a case of perseverance.
9	So I guess I find that more of a challenge, to find exactly what you're looking for because there is so much information.
10	If you're trying to research a particular topic, there's just too much information.
12	There's lots and lots of stuff here that's just rubbish I suppose. But anyone who makes any sort of program that runs on say Linux, Unix, whatever—it will be on here. As you can see, there's just hundreds and hundreds of programs there. And they're only the ones added in the last few days.

Selecting suitable key words for a search engine query

Search engines are popular tools for locating Web pages, but the results they return are usually of mixed relevance to the user's query. The key words that make up a query have a direct influence on the relevance of the results that are returned. Key words need to be specific enough to avoid generating a plethora of irrelevant results, but general enough to generate at least some results. Striking the right balance can be difficult. Table 5.3 provides some comments from informants describing the challenge of selecting suitable key words.

Table 5.3. Sample comments from informants describing the challenge of selecting suitable key words for a search engine query.

Informant	Comment
1	Actually searching is always challenging 'cause you don't know exactly how to word what you're looking for. You've actually got to experiment a couple of times to actually come up with the wording that produces the results that you want.
3	But probably the most challenging part of it is actually ... when you're in a search engine and it's looking for that series of words that ... get you where you want to be. So, you spend a little bit of time trying to get the words right so that you don't have to trawl through a lot of rubbish.
5	Maybe putting in incorrect information. Not telling it what it needs.
6	I had a JavaScript error that I was trying to fix. And because it was a fairly specific search it took me ages to get the result that I wanted. Plus also I probably wasn't typing in the right criteria. 'Cause I wasn't sure exactly the name of what I was looking for. But I did find it eventually.
13	When I first started in '98 I had a lot of trouble with it. I couldn't communicate what I wanted to search engines. I think I was using Alta Vista back then. But after a few years of getting used to what key terms to use, I find I can communicate better. I can speak 'search engine'. I put the right terms in now, and get rid of the confusing stuff.

Using the correct syntax for a search engine query

Most search engines allow users to conduct basic searches for information simply by entering a few descriptive key words, but advanced searches usually require the use of operators that have special meaning to the search engine. For example, Google (<http://www.google.com>) can be instructed to search for a complete phrase rather than individual words by enclosing the phrase in quotation marks. Google also supports the logical OR operator for retrieving pages that include either word A or word B. Table 5.4 provides some comments from informants describing the challenge of using the correct syntax for a search engine query.

Table 5.4. Sample comments from informants describing the challenge of using the correct syntax for a search engine query.

Informant	Comment
2	Sometimes I type a word. Sometimes I don't do it right. I've tried to use those things at the bottom but they limit me too much ... dates and things like that.
3	... very strange ... 'cause this time when I was doing it I'm not sure whether I was actually putting the quote marks in them to keep it together. I know a couple of times ... you'll get beef sites. But they're not beef as in we think of beef. They're like sexual beef sites. You'll have these beefcakes and stuff like this.
6	Sometimes I'm not sure exactly what key words to type in. Like with Alta Vista if you type plus (+) whatever plus (+) whatever, it makes sure that it includes both of those words. But sometimes with different search engines, if you just type in a few words or whatever it returns results differently to other search engines like Alta Vista might.
14	And having to fiddle around and think in computer-speak ...
18	I either put ... what I'm looking for in those little inverted commas. I use that a lot. So that finds the exact phrase of what I'm actually looking for. Or if it's a general topic and I don't have a phrase, I just put keywords in and use Boolean operators like AND and OR. And if that doesn't work, if I still can't find exact information, then I'll just e-mail some friends and see if they know of sites. Usually I've found it by just doing the first two.

Distinguishing between relevant links and irrelevant links

Distinguishing between relevant and irrelevant links is another challenge that Web users face as they search or browse for information. Very often this challenge arises when inspecting the results generated by a search engine. Search engine results are usually presented as a list of links to Web pages that contain the words in the user's search query (see Figure 5.1). Each entry in the list may consist of a page title or URL followed by a text excerpt showing the context in which the search terms appear on that page. The page title and the text excerpt help users to decide whether the destination page is relevant to their goal or not.

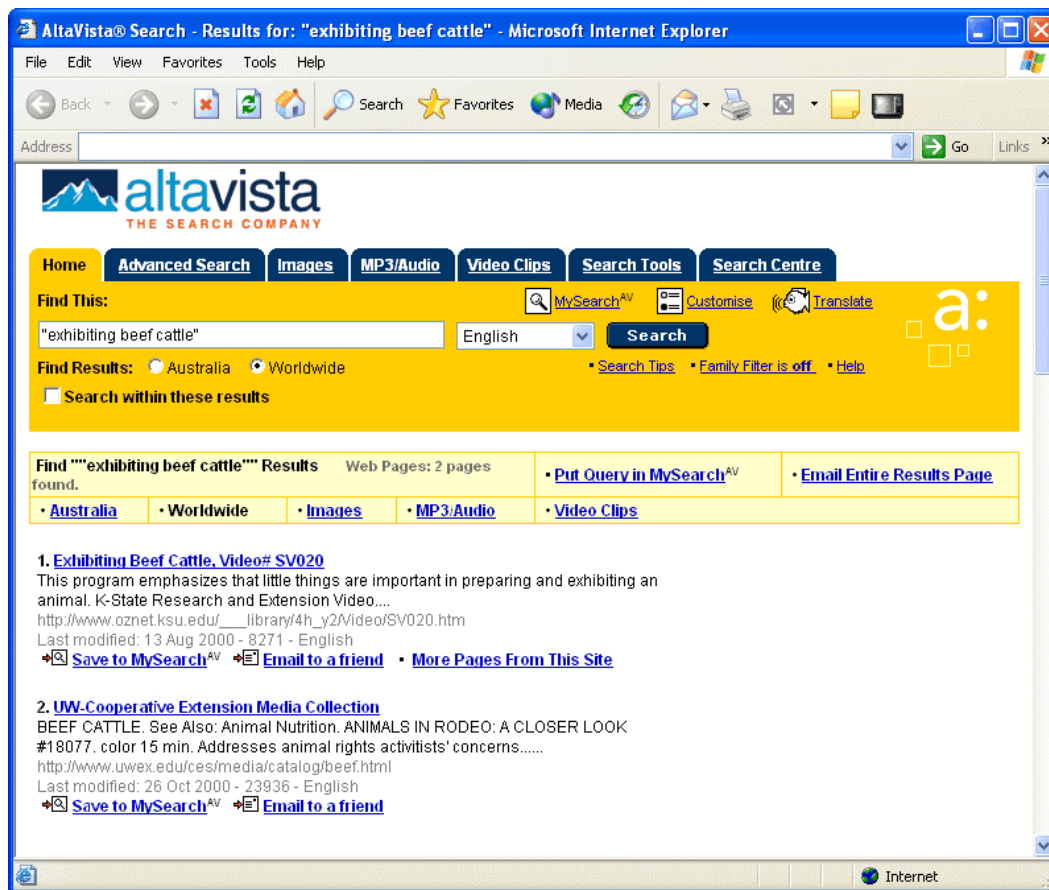


Figure 5.1. Distinguishing between relevant and irrelevant search results generated by AltaVista (<http://www.altavista.com>) was a challenge for Informant 3.

The challenge of distinguishing between relevant and irrelevant links may also arise while inspecting other kinds of links, such as those within the body of a Web page or those on a navigation bar. Links within the body of a Web page can be likened to search engine results in the sense that the surrounding information provides some context, which helps the user to assess the link's relevance. In contrast, the relevance of a link on a navigation bar must often be determined solely on the basis of the link's brief label.

Regardless of whether a link appears within the context of surrounding information or not, determining its relevance to one's goal calls for judgement and discernment on the part of the user. Following an irrelevant link wastes time—something that Web users are keen to avoid. Table 5.5 provides some comments from informants describing the challenge of distinguishing between relevant links and irrelevant links.

Table 5.5. Sample comments from informants describing the challenge of distinguishing between relevant links and irrelevant links.

Informant	Comment
7	... there's so much information on the Web there's a good chance that there's stacks of information that's crap. And filtering through the crap to find anything that seems useful ...
9	I guess at first just where to start is always a big thing, because if you follow one lot of links then it quite often cuts out another lot that maybe you don't get back to.
14	I guess because I am pretty impatient, the challenge is sorting out the wheat from the chaff ... I guess it's the non-discriminatory nature of it. You get stuff and you then have to sort through it. And that's the challenge that I find ... The fact that you get a lot of stuff, and you then have to sift through it.
19	... after you finish searching one link you can still go back and search the other link. I suppose it's which one you want to find out first, or which one is more important to you at the time that you would want to search out.
21	... when you search with Google it just comes up with a list for you ... It was difficult in making choices of which one do I want to pick.

Dealing with a large collection of potentially relevant links

Search engines often generate thousands of results in response to a single query. Dealing with such a large collection of potentially relevant links can be quite challenging—even overwhelming—for users, as the comments in Table 5.6 testify. Even pages that present a lengthy index or table of contents can be intimidating. See Figure 5.2 for an example provided by Informant 6.

Table 5.6. Sample comments from informants describing the challenge of dealing with a large collection of potentially relevant links.

Informant	Comment
6	It was challenging—because there were so many links everywhere—to try and figure out where to go next and stuff like that.
9	... trying to find something really specific ... Like I've put in, you know, searching for something, and you come up with a hundred things. And that would annoy me. And it may not necessarily be what I want. Like I wouldn't go through all the hundred things. So I guess I find that more of a challenge, to find exactly what you're looking for because there is so much information ... perhaps to find what I wanted I would need to look through a hundred different things. I would probably give up after maybe a couple of pages.
10	... if you're trying to find a law act and there's just like fifty million different amendments on different Web sites and that sort of thing. So if you're trying to actually get to one particular one, it's a bit hard.
18	Actually locating the specific information that I'm looking for. Because often I just get so many hits, and I just think, 'How am I going to narrow this down?' So it pretty much comes down to trying to actually narrow it down to find specifics of exactly what I'm searching for.
20	Probably the number that you get pulled up. Very hard to just get a small list I find. You've got to go through heaps before you find what you want ... I find it hard to be able to reduce it enough so it's not so cumbersome.



Figure 5.2. Dealing with the large collection of potentially relevant links on the Learn ASP site (<http://www.learnasp.com>) was a challenge for Informant 6.

Scanning a page for relevant information

Whenever Web users retrieve a new page, they generally scan it for relevant information rather than read it word-for-word, possibly because of their sense of time urgency. Usability studies conducted by Nielsen (2000, p. 104) confirm this observation:

Because it is so painful to read text on computer screens and because the online experience seems to foster some amount of impatience, users tend not to read streams of text fully. Instead, users scan text and pick out keywords, sentences, and paragraphs of interest while skipping over those parts of the text they care less about.

Informant 18 said that during this scanning activity she assesses a site to decide whether she will stay and explore it or move on: 'Once I find out it is a genuine site—they know what they're talking about—I'll start to explore it a bit'. Table 5.7 provides some other comments from informants describing the challenge of scanning a page for relevant information.

Table 5.7. Sample comments from informants describing the challenge of scanning a page for relevant information.

Informant	Comment
3	... you're only half sort of watching what's happening. You're probably only focusing on one thing and that's seeing these magic words come up: 'exhibiting beef cattle'. And that's all you're looking for every time you go to a new page. And if it's not there, you're back to the next one. See what that looks like.
7	So I was madly clicking on any information I could find, and in most cases I wasn't reading it. But I was looking at it, making sure that there was information, looking at the title, looking to see if it was relevant, and printing it out.
11	Links. The next link. This is what I'm looking for. Have I missed it or not? If not I keep on clicking, clicking, backtracking, going forward. And so you look at a page, you don't read everything there, but you pinpoint what you need and focus on the right information.
18	Usually when I get to a site like this I have a look around at what I've been taken to because sometimes it just picks up the actual phrase that I've just put in. So I usually try and click on their home page. And this is actually for the Firestorm Dojos. So I'll read a bit about them to see what the site's about. So I'll just scan through this information. I actually will read it and find out things to affirm what I already know. For example, Zen Do Kai, which is a Japanese term meaning 'best of everything', 'progression'. So I'll think, 'Ok, this is a site I want to stay at because it's got information that I know is pretty much correct'. So if it was something that said Zen Do Kai means something totally different, then I'd probably go back and try something else.
21	If you don't understand it to the full extent and you're an inexperienced person like myself, you'll go and get into this stuff and click onto these highlighted sections and think it might be important, when it's not. 'Cause sometimes it's not very self-explanatory—to me anyway ... Once I get to the information I can decide, 'Yes, this is what I want, and this is what I'll print out'.

Understanding the content and non-linear structure of a Web site

When Web users eventually find a site containing information that they want to read in detail, they face a new challenge—understanding the material. Since Web content is rarely organised in a linear fashion, part of the user's challenge is discerning the logical structure of the site and determining a suitable path through its pages. Informant 8 mentioned that making the wrong choices 'can be a bit overwhelming' because 'you're not sure what you're reading'. Table 5.8 provides some other comments from informants describing the challenge of understanding the content and non-linear structure of a Web site.

Table 5.8. Sample comments from informants describing the challenge of understanding the content and non-linear structure of a Web site.

Informant	Comment
1	Understanding the content, when it gets to the event. Well, because it is challenging content.
8	... until I got my head around how it worked, anything to do with Linux was quite a challenge. But now I sort of understand a lot of the basics of the operating system. So it makes more sense. Like they have set the site out so there are parts for beginners, and I went and read those, but ... if you sort of jump straight into stuff like this it can be a bit overwhelming. You're not sort of sure what you're reading.
9	... I guess I was just looking at all sorts of different things in there like, 'What does this mean and what does this mean?' Kind of linking it all together to form a bit of a picture.
18	Probably reading as much as I could because I knew I only had an hour to be on there. And I just thought it would take me a lot longer. So I was just clicking back and forth. Click on one link. Read it. 'Wow that's really interesting'. Go back. Click on the next one. Read it. And keep going down.
22	Finding exactly what you want out of a huge site. Being able to find ... categories, and know how to break down the subject ... Knowing how to get your way around it ... With most of your sites, you've got your basic links which help you to put it into categories, so you can easily find the way you're going. But there are ... a lot of sites that I've found that are pretty broad. And you don't quite know where to go. Or they're a little bit harder to find specific information.

Skill

The informants who participated in this study varied considerably in terms of their skill using the Web (see box 5 in Figure 4.1). For the purposes of this study, skill is defined as follows:

Definition 2.2: A Web user's skill is his or her capacity to meet the challenges associated with an information-seeking goal.

Table 5.9 summarises the values that the informants provided for four indicators of a Web user's skill level: confidence using the Web, frequency of Web use, hours of Web use per week, and years using the Web. The values for individual informants are presented in Table 3.2 of Chapter 3.

The informants' levels of experience with the Web ranged from 1 to 9 years, with a mean of 4.6, a median of 5, and a standard deviation of 2.3. Informants who reported using the Web on a daily basis numbered 13; the other 9 used it weekly. When asked to estimate the number of hours they spent using the Web each week, 7 informants reported 1 to 5 hours, 6 reported 5 to 10 hours, 5 reported 10 to 20 hours, and 4 reported 20 to 40 hours. When asked how confident they felt using the Web, 10 informants reported feeling very confident, 8 were moderately confident, and 4 were not very confident.

Table 5.9. Indicators of the informants' skill using the Web.

Indicator	Value	Number of informants
Confidence using the Web	Very confident	10
	Moderately confident	8
	Not very confident	4
Frequency of Web use	Daily	13
	Weekly	9
Hours of Web use per week	1–5	7
	5–10	6
	10–20	5
	20–40	4
Years using the Web	1–3	7
	4–6	11
	7–9	4

Experts and novices experience flow

Both expert and novice Web users recalled past flow experiences during this study. For an example of a user with minimal skills experiencing flow, consider the case of Informant 10. She recalled experiencing flow intermittently over a period of three days when she first acquired a computer with Internet access. Her comment that she had the *Complete Idiot's Guide to Surfing the Net* in front of her testifies to the fact that she had minimal skills:

... when I first got my computer at home, and initially loaded all the software on it and first surfed the Net ... I just went from one site to the other. Yeah, and I think I spent about three days on there. [Laughs] ... I had the *Complete Idiot's Guide to Surfing the Net* in front of me. And that sort of helped me out with search engines and stuff like that. But yeah, I think I just went through and clicked and clicked and got pretty well everywhere I wanted to go.

For an example of a Web user with extensive skills experiencing flow, consider the case of Informant 14—a reference librarian who, at the time of her interview, had used the Web for nine years and spent between ten and fifteen hours online each week. Here is a description of one of her flow experiences:

I was just thinking about the afternoon when I stayed behind after work to look for this particular thing ... I was going from site to site ... There were some very long documents on it, and I was going backwards and forwards between bits of the documents. And I did get quite involved with it ... I really got quite involved in the searching and looking around the thing, and I did lose track of the time. I ended up spending a good half hour more than I originally intended to do, just on this one topic, and in this one site.

Experts and novices experience frustration

Not all searching and browsing activities in the Web environment are enjoyable. Some experiences are very frustrating.

Definition 2.3: Frustration is a feeling of discouragement or dissatisfaction associated with the inability to achieve an information-seeking goal.

During this study both expert and novice Web users recalled frustrating experiences from their past online activities. For an example of a Web user with minimal skills experiencing frustration, consider the case of Informant 2—a teacher's aide who, at the time of her interview, felt very apprehensive about using the Web and estimated that she only used it once every ten days. She recalled becoming frustrated in her attempt to find a 'queer reading' of a film, that is, a textual analysis of a film from a gay perspective:

I'm not scared. I'm not uncomfortable, but I get frustrated 'cause I'm so ignorant that it takes so much of my time and then I don't get a result ... So often when I need to look, I need to have specific words ... If I want to do a mainstream film—which I often do—and I think I want to do a queer criticism of that film, of the relations in it ... I will put in 'queer theory', and then I put the name of the movie ... It will say, 'Can't find anything on this'. And then I'll try and read the instructions which will say, 'You've put in too many words' ... And I might spend half an hour, and then afterwards I find that I've had to put in something like 'reviews' and 'critiques' and put the name of the film ... I find that frustrating 'cause it's time consuming and I don't have that time.

For an example of a Web user with extensive skills experiencing frustration, consider the case of Informant 7—a computer technician who, at the time of his interview, felt very confident about using the Web and said that he used it on a daily basis. He recalled becoming frustrated in his attempt to find the meaning of some cryptic runes that appeared on the cover of a book he was reading:

... I'm reading a *Lord of the Rings* book ... They had like a code on the front of the book—the rune code. And I'm trying to work out what that meant. Last night I was

trying to work out on a piece of paper what it meant, but I couldn't do it. It was too complicated. And so I went on the Web trying to find the answer to the rune codes. And the problem with that is it turns out that Tolkien for some reason had a hobby of making up his own languages. And he made up like thousands of languages, and some of them are so complex that no one has actually been able to interpret. And so trying to find a simple answer to 'What does that word mean on the front cover?' was pretty hard ... if I know that I've wasted half an hour trying to find an answer or to fail in finding the information I need, then that's sort of half an hour that I felt hasn't been too productive.

Success and flow

When a Web user makes progress toward attaining his or her information-seeking goal, the situation has the potential to induce flow (see boxes 10 and 15 in Figure 4.1). Successful attainment of an information-seeking goal is defined as follows:

Definition 2.4: Successful attainment of an information-seeking goal occurs when the information being sought is found within a reasonable amount of time from the user's perspective.

Making progress toward a successful outcome does not guarantee a flow experience because many other factors are involved, but it does appear to be a necessary condition for flow in searching and browsing activities. Table 5.10 provides some comments from informants that demonstrate the link between flow experiences and progressing toward a successful outcome. The following proposition expresses this relationship:

Proposition 2.2: Successful attainment of an information-seeking goal, or progress toward that outcome, is a necessary, but not sufficient, condition for flow.

Table 5.10. Sample comments from informants that demonstrate the link between flow experiences and progressing toward the attainment of an information-seeking goal.

Informant	Comment
2	And I thought, 'My God this is a really interesting perspective'. And it suddenly made me realise that that's what queer theory is about. It says we want to move away from the bipolar or the binary of homosexual and heterosexual, and take in race, ethnicity ... And it just suddenly clicked, and so I think I spent, on that particular time I spent five hours just reading stuff.
9	I remember when all this stuff started in Afghanistan and that, I hopped on the Web. It was the Sunday after it all happened and I was just ... like for about three hours ... I don't know where I went to first. But it was like a new site. And then I went to all these different links to Afghanistan, and then to the history of the country and all the problems it had before, and how the Taliban have been dictating for the last however many years. So I really went to lots of different places. Because I guess it was topical and I guess I was interested in what was going on. Yeah. So that was long. That was more than two hours I think.
14	... I enjoy the fact that there is usually a heap of information about most things. And so, you're almost always assured of finding something. And so it's pretty gratifying from that point of view. For example, my husband and I have been looking at what we're going to do with the next phase of our lives as we so aptly put it, and we've been looking at properties in various places on some fabulous real estate sites, and sometimes they are quite fun. And so, you can usually produce something that's pretty good. And so that's one gratifying thing about it.
18	I was searching for something in particular. It was on Zen Do Kai, which is a martial arts in Australia. And I was just interested to find out a bit more about the culture and background of it—how widespread it is. And I stumbled across a really good Web page for it ... Everything on there was about what I needed to find. I kept exploring the links in this site and it was very interesting—the information I was finding. Before I knew it, easily half an hour was gone and I thought it was only five minutes.
19	... I found a site on Mark Knopfler's guitars and I started reading all about his guitars and which ones he played on which songs for the Dire Straits. I found it quite amazing. I thought it was quite good. I was pretty happy that I found it.

Failure and frustration

When a Web user fails to make progress toward attaining his or her information-seeking goal the experience becomes frustrating (see boxes 11 and 14 in Figure 4.1). Failure to achieve an information-seeking goal is defined as follows:

Definition 2.5: Failure to achieve an information-seeking goal occurs when either the information being sought is not found, or the search takes too much time from the user's perspective.

Recall that a Web user's goal has two components: (1) finding an item of interest; and (2) doing so quickly. Failure to satisfy either of these requirements may lead to frustration. Table 5.11 provides comments from informants describing the frustration that results from not being able to find an item of interest. Table 5.12 provides some comments from informants describing the frustration that results when a search for

information takes too much time. The following proposition expresses this relationship:

Proposition 2.3: Failure to attain an information-seeking goal, or to progress toward that outcome, is a sufficient condition for frustration.

Table 5.11. Sample comments from informants describing the frustration that results from not being able to find an item of interest.

Informant	Comment
11	I get disappointed when I don't find it. When it's click, click, click and then ... it's not enough. Not what you're looking for. So you can click your way around in circles ... I find that when you're looking at ... particular types of information you can click your way around ... a number of organisations ... that may be linked ... You start at one point and click your way around to the same point—to those first organisations. ... You end up not finding what you want.
12	It's frustrating sometimes when you're trying to search for something in particular and you just get lots of useless links and stuff.
15	... you had to go through that many menus and drill down that far before you could even get access to the information. There is also a part there where you're drilling down and you finally think 'Ok I've got the stats that I'm looking for', and then there's a sign on the site that says this will cost you forty dollars ... Not very helpful at all. That's one of the frustrating things about it. They're telling us that we need to use the Internet to access previously print material. And yet because they're putting those pressures on us, they haven't made it easy for us to access it. And as librarians, if we have problems accessing information off the Internet, how on earth can a customer with no Web experience access it? They can't. That's been extremely frustrating for us.
17	... it has a lot of errors sometimes, which I don't know if it's caused by the computer or the Net. When it comes up and you can't open a certain page, when you've already read the description and you really want to get in there. It's like reading the front cover to a book with no pages ... Especially when there's only one page that comes up under the search, and you can't get into it. It just says it's not there anymore.
18	... it's a bit frustrating because you think, 'There's so much out there; why couldn't I have found that now?'

Table 5.12. Sample comments from informants describing the frustration that results when a search for information takes too much time.

Informant	Comment
5	If I'm on a timeframe and I'm trying to search for something and I can't get to it, then I find that frustrating.
7	...the thing I find most frustrating is the time it could possibly take to find what I want
8	If the search drags on then it starts to get annoying ... Like I can sit there for a good fifteen or twenty minutes looking for something and ... I enjoy doing it because I'm looking for what I want. But if it starts to become long and tedious, it gets a bit annoying.
14	... sometimes it really does take a long time to find what I want when you have to go back and rethink search strategies and things like that. The time that it takes to sometimes refine what it is, so that you can get what you need, that I sometimes find frustrating.
20	... it takes so long. It would be better if I could just find exactly what I wanted straight away.

Informants also described their frustration with specific interface design elements that impeded their searching or browsing activities, such as lengthy response times, disorganised content, inconsistent navigation cues, stale links, and pop-up advertisements (see box 4 in Figure 4.1). Table 5.13 provides some examples of the informants' comments. These impediments will be discussed in more detail in Chapter 6.

Table 5.13. Sample comments from informants describing frustration caused by interface design elements that impede their searching or browsing activities.

Informant	Comment
8	Sometimes it can be a bit frustrating when it gets a bit slow ...
13	Twenty or thirty pop-up windows when you're trying to look through a site—I find it very frustrating ... I find that it's difficult to look at the content of the actual site itself with everything else. You kill one pop-up and the next one turns up. So after about five or ten minutes you give up on the site and go somewhere else.
14	... I really lose patience with commercial sites and things like that where they pop-up when you don't want them, and that sort of stuff. It leads to a frustration from that point of view—all the extraneous garbage and all those little pop-up windows.
15	What I dislike is when sites move on and they don't forward you automatically. So all you get is an error message saying URL is incorrect, when you know that it used to be correct. That's frustrating.
17	It gets frustrating opening pages ... they open up a lot of extra windows. And after opening a few pages you get lost because there's like twenty windows open at the bottom. You don't know which one to look at. And when they're all trying to load up, it slows down and only a few of them open.

It is impossible to specify precisely the point at which a feeling of failure or frustration sets in during a fruitless searching or browsing activity, because it depends on the user's sense of time urgency. For example, Informant 8 said that in some circumstances he can spend 'a good fifteen or twenty minutes searching for something' before the search 'starts to get annoying'. A different user searching for a different topic under different circumstances might have a very different tolerance level.

Balance between challenges and skill

The success or failure of a searching or browsing activity depends on the balance between the challenge of the activity and the Web user's skill or capacity to find whatever he or she is seeking (see box 9 in Figure 4.1). Informant 7 recognised this point:

... the thing I find most frustrating is the time it could possibly take to find what I want, and whether or not that's my fault because I don't know how to search properly or if that's because the information I'm trying to find is a little bit harder ... it's a little bit, you know, not too common and people don't really have that much information available for it ... Hopefully I suspect it's the second one. [Laughs] Looking in all the wrong places.

Table 5.14 provides some other comments from informants who recognise that the balance between challenge and skill determines the outcome of a searching or browsing activity. The following propositions describe this relationship.

Proposition 2.4: A Web user will make progress toward attaining an information-seeking goal if the challenge of the activity is matched by the user's skill or capacity to find whatever he or she is seeking.

Proposition 2.5: A Web user will fail to make progress toward attaining an information-seeking goal if the challenge of the activity exceeds the user's skill or capacity to find whatever he or she is seeking.

The important factor in determining flow or frustration is not the absolute challenge of the activity, nor the absolute level of the Web user's skill, but rather the relative balance between the two. In order to achieve flow, the Web user must perceive the challenge to be high in relation to his or her skills, but not so high that it is unreachable.

Since all Web users have different interests and different skill levels, the searching and browsing activities that they find suitably challenging will differ also. An activity that one user finds challenging enough to hold his or her attention may be too challenging for another user, and not challenging enough for yet another user.

Table 5.14. Sample comments from informants referring to the balance between the challenge of a searching or browsing activity and the Web user's skill in meeting that challenge.

Informant	Comment
5	I'm getting a lot better. When I first started here three years ago, I was a little bit daunted to search for things. Like to think of, 'Oh I want to know about holidays. Hmm. How could I search? How could I find that?' I had no idea. But as I use it more and more you pick up ... By using it, you pick up on how to use it better. So yeah, I think I've improved a lot, but there still is a lot I could learn about using the Web.
8	Finding a particular piece of information. Over the years it's become easier as you do it more ...
10	... I'm sure that if I spoke to other people, they may not experience what I do because they probably use it a bit more frequently or something like that. Or they have more experience in searching for specific things.
15	It's all right for someone like me because I use the Web every day and I have been for eight years. But for new people—because I run a lot of the classes here at the Library—new people are just absolutely overwhelmed by something like that.
22	... when you get into really confusing things that I don't know how to use, or things that somebody who is more computer-fluent would know what to do, and because of my experience with it I probably don't know how to do it, I don't like it.

To illustrate this point, consider the challenge associated with typing a URL into a Web browser's address bar. For an experienced Web user, entering a URL might not present much of a challenge at all, but for a novice Web user the challenge could be significant. Informant 21, a Web user with minimal experience, mentioned this point:

... you have to type exactly what they want there. Because if you don't, what frustrates me is it comes back in my face and says, 'This address is not contactable'. And I'm thinking, 'This is what I wrote down'. And then they say it's not ... I haven't put a dot or I haven't put a stroke or I haven't put exactly what ... You know what I mean? What do you call those ditto things? That's what I call them—ditto. They're dots and strokes and all that sort of thing.

For another example, consider search engine results. Most experienced Web users realise that not all of the results generated by a search engine will be relevant to their search. The results are simply pages that happen to contain the search terms supplied by the user. This fact may not be obvious to a novice user, thereby making the interpretation of search engine results very challenging. Here is a relevant comment from Informant 21, referring to the Google results shown in Figure 5.3:

What was I looking for? World Heritage. Great Barrier Reef. ... Why is that there? [Reading a text excerpt from a search engine result] 'This essay talks about the Great Barrier Reef. Platypus. This essay talks about platypus and how they live'. What's that got to do with the Great Barrier Reef? ... What relevance has that got?

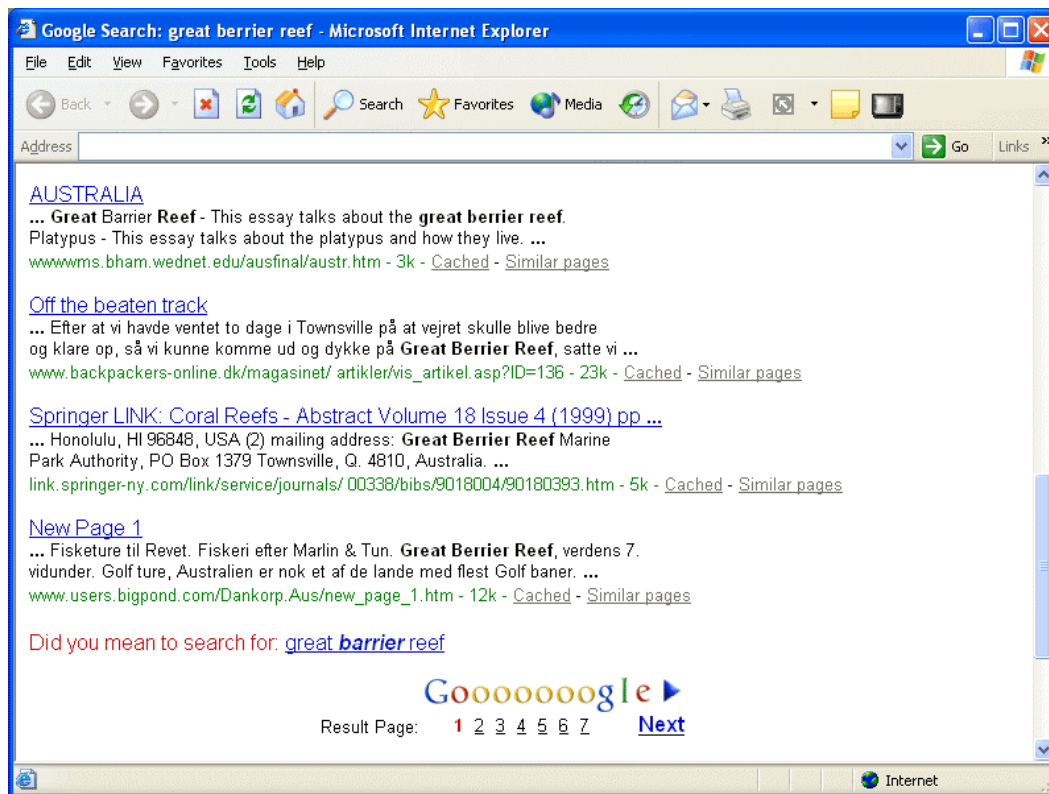


Figure 5.3. Interpreting the search results generated by Google (<http://www.google.com>) was very challenging for Informant 21, a novice Web user.

The reason why both expert and novice Web users can experience flow is the Web's capacity to immediately provide a challenge that matches any individual's interests and level of skill. In some non-Web-related flow activities, the balance between challenge and skill is lost as the participant's ability increases, but that does not happen in the Web environment. For example, a squash player whose game improves faster than her regular opponent may need to seek a more challenging partner to restore balance to the game. This kind of time-consuming obstacle to flow is not an issue for Web users who can quickly adjust their goal or mode of navigation to suit their level of ability. Kubey and Csikszentmihalyi (2002, p. 68) have made a similar comment about experiencing flow while playing computer games:

Many video and computer games minutely increase in difficulty along with the increasing ability of the player. One can search for months to find another tennis or chess player of comparable ability, but programmed games can immediately provide a near-perfect match of challenge to skill. They offer the psychic pleasure—what one of us (Csikszentmihalyi) has called "flow"—that accompanies increased mastery of most any human endeavour.

Summary

Web users face certain mental challenges as they try to attain their goal of finding an item of interest within the shortest time possible. Depending on the nature of their

searching or browsing activity, these challenges may include: negotiating a vast, constantly changing, uncharted information space; selecting suitable key words for a search engine query; using the correct syntax for a search engine query; distinguishing relevant links from irrelevant links; dealing with a large collection of potentially relevant links; scanning a page for relevant information; and understanding the content and non-linear structure of a Web site.

When the challenge of an information-seeking activity is matched by the Web user's skill, the user makes progress toward a successful outcome and the experience has the potential to induce flow. When the challenge exceeds the user's skill, the experience becomes frustrating, either because the user fails to find the item of interest or because the search takes too long. The important factor in determining flow or frustration is not the absolute challenge of the activity, nor the absolute level of the user's skill, but rather the relative balance between the two. In order to achieve flow, the user must perceive the challenge to be high in relation to his or her skills, but not so high that it is unreachable. The reason why both expert and novice users can experience flow is the Web's capacity to immediately provide a challenge that matches any individual's interests and level of skill.

Attention

Continuing the explanation of the theory that was developed during this study, this chapter discusses the important role that focused attention plays in the flow experiences of Web users. Elements that help to attract and maintain attention and elements that distract attention are also discussed.

Focused attention

Before discussing the important role that focused attention plays in the flow experiences of Web users, it is helpful to note some widely accepted theories of attention that support the ideas presented in this chapter. This theory will adopt Gray's (1999, p. 302) definition of attention, which was provided in Chapter 2:

Definition 3.1: Attention is the process by which the mind chooses from among the various stimuli that strike the senses at any given moment, allowing only some to enter consciousness.

Kahneman (1973) has argued that attentional capacity is limited. Attending to information requires mental resources, and people only have a limited—and possibly fixed—pool of mental resources, which can be used flexibly across a wide range of activities (Eysenck & Keane 2000, pp. 138–139).

We know from experience that it is often possible to attend to more than one stimulus at the same time. For example, we may be able to drive a car while holding a conversation, or listen to music while jogging. However, each task consumes a certain amount of mental resources. Allocating more resources to one task will diminish performance on others (Zimbardo & Weber 1994, p. 183).

The extent to which two tasks can be performed together depends on the demands that each task makes on the individual's mental resources. If the combined demands of the two tasks do not exceed the total pool of resources, then the two tasks may not interfere with each other. However, if the resources are insufficient, then performance will be disrupted (Eysenck & Keane 2000, pp. 138–139).

The success of dual-task performance also depends on the similarity of the tasks being performed. The ability to perform two tasks at the same time without interference requires that the tasks do not use the same perceptual resources. For example, we may be able to read while listening to music, but we cannot read while holding a conversation with someone (Zimbardo & Weber 1994, p. 183).

Attention may be described as either focused or divided depending on the number of stimuli being attended to at one time (Eysenck & Keane 2000, p. 120; Preece et al. 1994, p. 101).

Definition 3.2: Focused attention is the process of attending to just one of several competing stimuli.

Definition 3.3: Divided attention is the process of trying to attend to more than one stimulus at the same time.

An example of focused attention would be engaging in conversation with someone and attending to what that person is saying. An example of divided attention would be attempting to hold a conversation with someone while intermittently watching a television program. Individuals typically decide whether to engage in focused or divided attention. Eysenck and Keane (2000, p. 120) say that 'the use of focused or divided attention is often determined by goal-driven or top-down attentional control processes'.

Table 6.1 provides some comments from informants describing the role that attention plays in the flow experiences of Web users. A recurring theme in these comments is that flow requires focused attention, not divided attention (see box 13 in Figure 4.1). The higher-than-average challenges associated with searching and browsing activities in the Web environment require a complete focusing of attention on the task at hand.

Proposition 3.1: Focused attention on an information-seeking activity is a necessary, but not sufficient, condition for flow.

Proposition 3.2: The challenge of an information-seeking activity has a positive influence on a Web user's focused attention on that activity.

Table 6.1. Sample comments from informants describing the focused attention associated with flow experiences.

Informant	Comment
1	It's a total concentration experience. You're so interested in doing what it is you're doing that nothing's interrupting you.
7	I would say that from the moment I got onto the computer I was fairly focused ...
11	I get more and more immersed into this activity ...
18	... it's something you're interested in. When you're interested in something, it keeps your attention. And when your attention is on one thing, you're not thinking of time.
21	If I'm going to go and search on the Web, I've got to set my mind for that task.

Interesting content and links

The previous section discussed the idea that challenges associated with searching and browsing focus the Web user's attention on the task at hand. Interesting content and links (see box 8 in Figure 4.1) also help to attract and maintain the user's attention, as the comments in Table 6.2 testify.

Table 6.2. Sample comments from informants describing the role that interesting content and links play in focusing attention.

Informant	Comment
4	So it was quite interesting. I was caught up in that for two days. It was just so interesting. It had nothing ... directly to do with my work. Indirectly it did. And I mean I'll probably never use any of it in my research. But just the fact that I wandered off on that track, and for two days it was just fascinating trying to research that, or just read it and look into it. It was quite interesting.
7	And when I found a particular site that I was interested in ... I was madly clicking on any information I could find ...
9	I was interested in it. So that's how I guess I managed to spend so much time doing it. Perhaps previously I may have had trouble finding something that perhaps interested me for that long. And I guess I did get a bit lost in it, because I remember that it did get dark.
18	It was just more or less trying to explore the whole site because it was an interesting site. And that's what made me lose track of time. That's what made the time seem to go fast. Because I was interested in it and there was interesting information in it.
22	If you're in something that you've got an interest in, then you sort of get captured up in it. Whereas, I know that when maybe I'm looking through journals and things like that, that I'm maybe not so interested in, I'm always aware of the time.

Chapter 4 discussed the idea that when Web users discover interesting content and links that are not relevant to their current goal, they may get sidetracked as a consequence (see boxes 8 and 1 in Figure 4.1). For example, while demonstrating a search on the Infotrac site (<http://infotrac.galegroup.com>) during her interview, Informant 2 said, 'Now this is when I'd experience flow. This is actually not related to what I want at all, but it's very interesting'. In contrast, when Web users encounter interesting content and links that are relevant to their current goal, the discovery helps to maintain focused attention on the task at hand (see boxes 8 and 13 in Figure 4.1).

Proposition 3.3: Interesting content that is relevant to a Web user's current information-seeking goal has a positive influence on the user's focused attention on that activity.

It is difficult to be precise about what is meant by the term 'relevant' when referring to content and links that are relevant to a Web user's goal. Celsi and Olson (1988, p. 211) suggest that 'a concept is personally relevant to the extent that consumers

perceive it to be self-related or in some way instrumental in achieving their personal goals and values'. Greisdorf (2000, p. 68) recommends that when considering relevance, one should think, not in terms of the simple presence or absence of relevance, but in terms of degrees of relevance:

While the construct of black versus white is composed of mutually exclusive alternatives (just as relevant versus irrelevant is so composed), this does not preclude the use of the construct in a relativistic manner. Thus more grayness versus less grayness as a further abstraction of the construct black versus white is equivalent to partially relevant versus partially not relevant in relation to the construct of relevant versus irrelevant (not relevant).

Just as it is difficult to define 'relevance', it is difficult to be precise about the meaning of the term 'interesting' when referring to interesting content and links. Informants in this study suggested several reasons why they find certain content interesting, besides relevance to their current information-seeking goal. Congruence with personal interests and novelty were two key factors that informants mentioned. Content properties such as credibility, correctness, currency, ease of understanding, rarity, emotional impact and aesthetic appeal also seem to be influential in maintaining a user's attention under some circumstances. Each of these factors will be discussed in the sections that follow.

Definition 3.4: Interesting content is that which arouses or holds a Web user's attention, possibly because of its relevance to the current information-seeking goal, congruence with personal interests or novelty.

Interestingly, Lang (2000, pp. 48–49) identifies information that is relevant to the goals and interests of the individual and information that is novel or unexpected as two major types of stimuli that are likely to attract attention in her limited capacity information-processing model of television viewing:

Two major types of stimuli activate automatic selection processes: (a) information that is relevant to the goals and needs of the individual, and (b) information that represents change or an unexpected occurrence in the environment (Graham, 1997; Ohman, 1997). Automatic selection processes that are related to individual goals and relevance will vary across situations, cultures, and individuals. On the other hand, automatic selection processes related to stimulus characteristics, such as novelty, change, and intensity, are likely to be the same across individuals within a culture, though the standards of what is novel may vary from culture to culture.

Congruence with personal interests

Web users are generally attracted to information that is congruent with their personal interests, even when they are not specifically searching for it. Table 6.3 provides some examples of content that informants found interesting because of its relevance to their health, hobbies, sports or other personal concerns. Lenker (2002, p. 50) makes a similar observation about Web content that matches an individual's interests:

People who are genuinely interested in a subject such as physics, organic foods, horses, entertainment, fashion, etc, are predisposed to tune into messages related to these interests. They will tune in long enough to find out if there's anything new, unique, or that will in some way enhance the condition of their interest.

Table 6.3. Sample comments from informants describing their interest in content that was relevant to personal concerns.

Informant	Comment
3	I typed in a TV show that was on last night—sopranos.com. I looked at that. Up came hundreds of Web sites to do with that. And I printed out the script—well not the whole script—but what the show was about that particular episode. And I've done that often with <i>The Bill</i> and other shows.
11	... I'd be interested in finding out about home brews ... find out different kinds of recipes and equipment that you would need for recipes and that stuff. That's an example of a hobby kind of thing that can keep you occupied for a long time. I like a lot to get away from the hard-to-do every now and then.
16	I can't remember the exact URL address, but it was a Honda Web site. I ride a Honda motorbike ... It was just after they released all their 2003 model motorbikes and all the racing gear and all of that. So I was just having a look at the different models and the weights and what they've changed in the bikes, and comparing them with last year's models. And my bike, being a '99 model, comparing them to current years. And then having a look at the racing gear that they're selling.
18	It's got a lot more pictures in it as well. And it also has good information. For example, gradings. So it tells you about the actual system of Zen Do Kai, not just from that particular Dojo. Because that was just on a particular Dojo, whereas this tells you general things. So it's got good information that's relevant to me. It tells you on each of those. And it answers questions that I wouldn't feel comfortable asking my sensei or someone else who is actually like a Zen Do Kai martial artist.
21	Endometriosis ... This just explains what it's all about. And it says treatments and remedies. And obviously this was wrote by somebody who has had lots of experience ... This is the sort of thing that I look up because I've had it twelve years now. And 'cause you've had it twelve years and you know what it's about, you're always going to search for new information. This is what we're using the Web site for—searching for brand new information that could come up. It's not going to be in a book. And it's not going to come from a doctor and that sort of thing. Well, not one of the old doctors anyway. Not in Mackay.

Novelty

Web users are often attracted to information that is novel and breaks the pattern of the mundane. Table 6.4 provides some examples of content that informants found interesting because it was new, unusual or different. Sluckin, Hargreaves and Colman (1983, p. 245) make the following supporting comment about the link between novelty and curiosity:

It is a view widely held and well supported by evidence that novelty evokes curiosity and fear in animals, both at the same time (Russell, 1973). Repeated exposure to a novel stimulus object can overcome the subject's fear of it, and may result in exposure learning (Sluckin, 1972), that is, in a development of an attachment to, or a

preference for, the object. There is no reason to believe that in this regard human beings are exceptional.

Table 6.4. Sample comments from informants describing their interest in novel content.

Informant	Comment
1	Yeah, that was quite an impressive site. I ended up spending quite some time just poking through to see what he's actually done because it was really different.
3	The thing is, like they say, they always have the news first before the other newspapers. So when an ape gives birth to a human baby, or they find the Loch Ness Monster, or Elvis has appeared somewhere again, these people are the first to tell you.
12	There's one called Fresh Meat. It's just all the latest software. There's quite a few. They're all similar to that. I just like to see what the latest software is, and sometimes I'll download it and try to run it.
13	I hadn't seen that level of interactivity before in a site. It really caught my interest. You could walk through, and there were not just different communities set up, but different worlds set up. So you might step through and you'd be at the Grand Canyon, or on the surface of Mars. There were no limitations. A lot of work had been put into it.
17	I just find it interesting finding new things, and it's a lot better than sitting in front of a computer playing a game ... A game gets really repetitive. It gets boring ... Every time you search for something, there's a different page there, or a few hundred different pages.

Content properties that influence attention

Informants mentioned various content properties that were influential in maintaining their attention while using the Web. Some of these properties are described below.

- *Credibility.* The credibility of a Web site can be an important factor in maintaining a user's attention. Web users may abandon a site if they feel that they are being deceived. Informant 11 said:

... pages that are designed to be mischievous. They're not honest. You feel that the person who designed it is not honest ... He is getting you into something. And I don't like that ... If I'm looking for information it should be shown to me in an honest manner.

- *Correctness.* Closely related to the notion of credibility is that of correctness. Web users find it difficult to trust a site if the content contains inaccuracies. For example, Informant 13 refrained from purchasing an item from a particular online store because of its inaccurate postage calculator:

Checkouts with online shopping. They'll often have a postage calculator. And I've found that some stores—overseas stores—they won't calculate the postage accurately. You'll purchase something—a tiny electronic product—and it will miscalculate it and say that it's \$600 for postage or something ridiculous like that

... It happened just recently and I haven't bought from the site for that particular reason.

- *Currency.* Content that is not up-to-date can have an adverse effect on a Web user's willingness to continue exploring a site. Informant 7 said:

If I can identify straight away that it's out of date then I'll just dismiss it and try and find something else. So I really wouldn't have used this information at all to get an idea.

- *Ease of understanding.* Incomprehensible content is not conducive to maintaining focused attention. Web users appreciate content that is presented in a manner that is easy to understand. Referring to some technical content about the Java programming language, Informant 1 said:

It's pretty easily written in that they have actually got people who don't try and write too complicated. Obviously it's a technical site, but it's a technical site that is relatively easy to read. So, I mean they've put the effort into aiming the site for people who might use it instead of letting the chief engineer of Java write what he wants to write on the site, and in the language that he wants to use. They've actually tailored the language so that it's relatively easy to read, considering the sort of technical subject it is.

- *Rarity.* Information on the Web that is not available from other sources may hold special interest for some users. Informant 13 provided this example:

A lot of it comes down to the knowledge, information. As I said before, information that you wouldn't be able to get at the library. You can't get it from a newsagent. Relating to the internals of a Playstation console or developing the games yourself. Information that you can't normally obtain, freely available when you want it.

- *Emotional impact.* Content that arouses a user's emotions seems to be effective in focusing attention. Informant 5 related how a collection of humorous photographs contributed to a flow experience:

And it had funny pictures linked with it as well ... like some of the e-mail attachments that you get ... They had funny captions ... We got quite engrossed in looking at those as well, and before we knew it, it was time to go home. And we're like, 'God we've been doing this for an hour and a half', and hadn't even realised because it was like, 'Oh let's look at the next one. Let's look at the next one'.

- *Aesthetic appeal.* A Web site's appearance can play an important role in attracting the attention of users, and in determining how much further consideration it will be given. This topic will be discussed in the next section because it deserves further explanation.

Aesthetic appeal

The aesthetic appeal of online content can play an important role in attracting the attention of users, and in determining how much further consideration it will be given. Figure 6.1 presents an example of a Web page that attracted the attention of Informant 5, primarily because of its appearance:

If you've ever been to a Sportsgirl store, they're keeping exactly with that. It's very trendy. Sort of teen scene—young women ... I'm into pink, so that could be it as well. [Laughs] There's a lot of bright stuff and it looks interesting. I think even if you weren't really into shopping and clothes—which I'm not all that much—it really sucks you in and pulls you in to want to have a look and see what's going on.

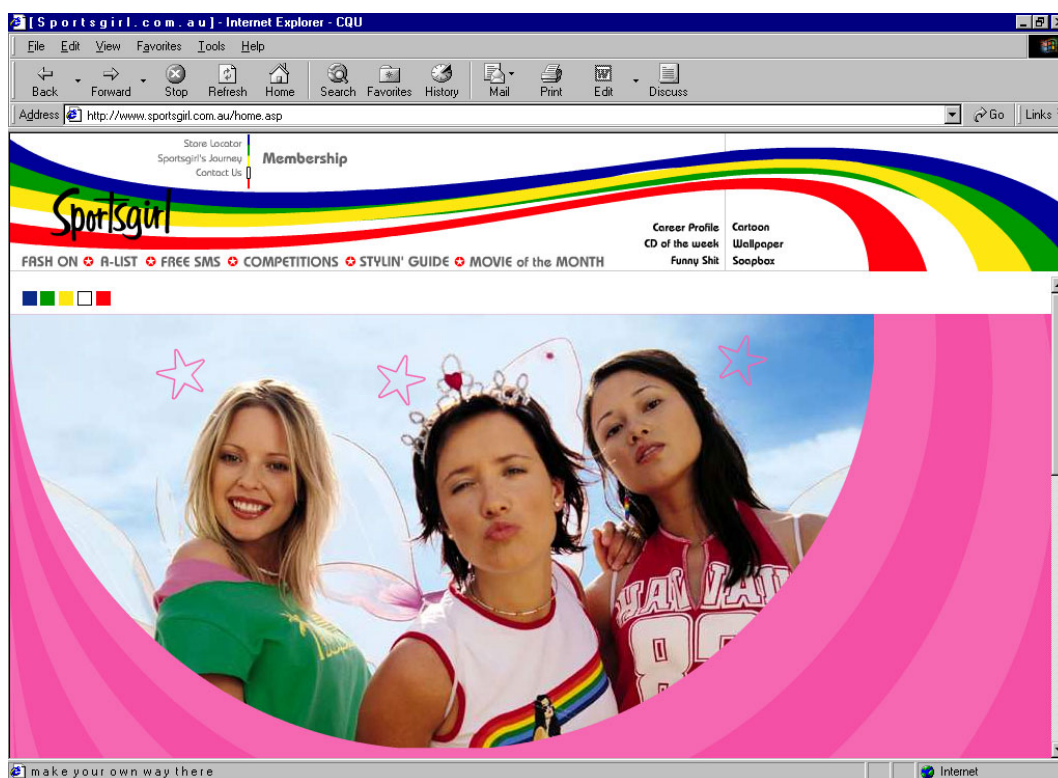


Figure 6.1. The Sportsgirl home page (<http://www.sportsgirl.com.au>) attracted the attention of Informant 5, primarily because of its appearance.

The preceding comment from Informant 5 does not imply that all Web sites should employ bright colours and trendy design styles to attract attention. Rather, it illustrates how visual language, or the look and feel of a site, conveys a message to the user without the use of words. Design elements such as line, type, shape, texture, tone and colour communicate independently of the descriptive content of text and images. Bonnici (1999, p. 77) explains:

Any organisation wishing to communicate through a visual medium needs to realise that, irrespective of the words they use, independent of the descriptive content of the pictures used to illustrate their message, the visual language in which the words and

images are clothed is projecting a message of its own. It projects qualities such as freshness, modernity, stability, responsiveness, care, dependability, flexibility, incisiveness, intelligence ... And the audience subconsciously 'reads' these messages which can sometimes override explicit messages in text and images.

In the case of Informant 5, the ideas conveyed by the design of the Sportsgirl site included 'trendy', 'teen scene' and 'young women'. An alternative page layout, a dull colour scheme, and an inappropriate typeface could have conveyed a very different message. It is not surprising that Web users will make judgements about a site's content and its owner solely on the basis of the site's appearance. Consider the following comment from Informant 7:

... when you're looking at a site, you often use an appearance to help you determine whether or not the site's any good. The appearance would also help you determine, if it's a business, what the quality of the business is from the effort they've put into the Web site ... If I go to a Web site and it looks like they've put no effort into it whatsoever, that would indicate to me ... that obviously if they make a Web page that looks that ugly then maybe the product will be equally as disorganised.

Table 6.5 provides some other comments from informants describing the role that aesthetic appeal plays in focusing attention.

Table 6.5. Sample comments from informants describing the role that aesthetic appeal plays in focusing attention.

Informant	Comment
6	They were fairly technical, but the main reason that I remember them was because they had heaps of animations and really cool graphics.
8	It appeals to me. I like the way that it's sort of tidy, but you can still find everything. And the colours ... They're not offensive. They're not bright. They're not in your face. They're not flashing. So even if you're not in a mood—if you just want to look—you know it's ... I wouldn't say calm, but you know.
10	I don't know if it was just the Web designs of the pages ... I guess it's a bit like a gambling addiction. The lights are flashing and everything looks really quite attractive. And I guess curiosity too.
11	It's not interesting. Not interesting. It's amateur. Poorly designed pages. And what bothers me is you get some very large organisations whom you would expect to have a good Web site have very poor Web sites. Many universities have very poor Web sites. Not here, but in parts of the world—the Pacific, in the West Indies perhaps, and parts of Africa ... The United Nations—many of their Web sites are poorly designed. It does not attract interest. It doesn't have a good interface. It doesn't lure you in ... You look at it and you want nothing to do with it. It's so amateur that you think it's children who have done it. You don't want to look at it. It's low quality. When in fact it doesn't reflect the content—the importance of it.
20	I mainly just go by the general look of it. And then if it looks good, I'll go into the actual page.

Usability experts such as Nielsen (2000) often dismiss the role of aesthetics in interface design, perhaps because it is not easily addressed within the analytical

framework of psychology and computer science. This study suggests that aesthetics and usability should be treated as symbiotic components of interface design rather than irreconcilable opponents. The following comment from Norman (2002, p. 38) supports this idea:

Affect and cognition can both be considered information processing systems, but with different functions and operating parameters. The affective system is judgmental, assigning positive and negative valence to the environment rapidly and efficiently. The cognitive system interprets and makes sense of the world. Each system affects the other: some emotions—*affective states*—are driven by cognition, and cognition is influenced by affect.

Although aesthetic appeal is an important consideration in focusing the attention of Web users, it is of secondary importance when compared to content. A site must have substance—not just style—if it is to hold a user's attention. Table 6.6 provides some comments from informants describing their feelings about text-heavy and text-only sites. It is clear from those comments that the relative importance of a site's appearance to a user depends largely on the user's goals and expectations. Users are generally unperturbed by a site lacking in visual appeal if the content of that site satisfies their goals.

Table 6.6. Sample comments from informants describing their feelings about text-heavy and text-only sites.

Informant	Comment
9	I think it's quite good for what it's meant to be. It's meant to be a news site. So I mean you can't expect it to have lots of pictures and no words kind of thing. I think it's fairly good.
13	I often get caught up in sites that aren't graphically oriented too ... it can be purely text-based and I can still be into it if it had the right stuff, the right information.
14	... for example, my health thing that I was looking for ... that is really just plain text. But I spent hours. Well, like I said, a good half hour longer than I expected to. Because I was finding the information it didn't matter to me what it looked like.
18	If I am looking for something with a lot of pictures, then I will be a bit annoyed that it doesn't have so much on. But normally if I'm just looking for information, I don't really mind whether it's pictures or text.
22	It isn't a pleasing site to look at. There are a lot of things that they could have done to improve it, but I don't think the site is there to visually appeal to its viewers. It's there to provide the information, not to look pretty and attractive. The site achieves what it needs to. There are extra things that they could have done, but they don't really need to for the purpose of what it achieves ... I would like it to look a little bit more interesting. It is very bland. But if I want to look at something visually appealing, I'd go to a different site. This is more mentally appealing.

Distractions

Attention is a vulnerable process. Although people are able to exercise voluntary control over the focus of their attention, on some occasions attention may be drawn involuntarily to stimuli outside the attentive focus. Eysenck and Keane (2000, p. 119) describe these two different modes of attention as active and passive: 'Attention is active when controlled in a top-down way by the individual's goals, whereas it is passive when controlled in a bottom-up way by external stimuli (e.g., a loud noise)'. External stimuli that are irrelevant to the task at hand are commonly known as distractions (see box 7 in Figure 4.1).

Definition 3.5: Distractions are stimuli outside a Web user's attentive focus that compete for the user's attention.

Distractions come in many different forms for Web users. Table 6.7 provides some examples. Broadly, the distractions described by the informants could be categorised as:

- *environmental distractions* such as loud noise or music, people talking, a ringing telephone, or a knock at the door;
- *physiological distractions* such as hunger, thirst, fatigue, a need to use the toilet, eyestrain, back pain, repetitive-strain injury (RSI) or other physical ailments; and
- *computer-related distractions* such as software error messages, a broken Internet connection, a browser that stops responding, or the discovery that access to a particular site has been blocked.

Poor interface usability can also be a distraction, but this topic will be discussed in the next section. Interface usability is one area where Web designers can take steps to minimise the distractions faced by users, and thereby maximise the opportunity to experience flow.

Distractions take attention away from a Web user's searching or browsing activity (see boxes 7 and 12 in Figure 4.1). When sufficient attention has been diverted from the task, the user's flow experience will end. Recall that focused attention, not divided attention, is a necessary condition for flow.

Proposition 3.4: Distractions have a negative influence on a Web user's focused attention on an information-seeking activity.

Web users tend to ignore minor distractions during a flow experience because their attention is focused on the task at hand. But some distractions cannot be ignored. As Informant 20 explained, when 'the kids are adamant that they want something' or the phone starts to ring, 'that just puts you right off'. An external stimulus that has sufficient intensity, frequency or importance to cause a shift in the user's attention will terminate a flow experience.

Table 6.7. Sample comments from informants describing distractions that interfere with flow experiences.

Informant	Comment
2	I think if I didn't have family round me I probably just would go forever until I needed to go to the loo or some physical things that I have to get up and leave it, you know.
8	I'll just get on the Internet and ... I'm just lost until I want a drink or the phone rings or someone knocks at the door or something sort of, I don't know, snaps you out of it. Something happens and you just go, 'Oh', and realise it.
16	It's normally one or two things that get me back and into realising just how much time I've been spending. The first one is normally I start to get tired. I work at Maccas and so I don't finish until midnight or 1.00 a.m. I won't be able to sleep for a couple of hours. But after that couple of hours, I'll start to get tired. And so I start feeling tired, and that's one of the indicators that I normally find that tells me that I've been on for too long and I'm ready to go to bed. The second one is normally hunger. You'll start feeling hungry and obviously want something to eat. That will take you away from the computer, and you'll realise the time and all the rest of it.
20	I do scrapbooking, which is with photos. And I was going through sites looking for ideas. I was only originally going to spend about half an hour on that and it ended up being four hours. And I really only realised when the kids started hassling me for dinner. Otherwise, I probably would have stayed on longer.
22	My eyesight's deteriorated a lot in the last year because of all the up-close computer work, not only that I've done with the Internet, but also with Microsoft programs. And I do get really sore eyes. I have to get up and walk away every now and then, which I suppose you probably get with books and things like that too. But that does prevent me from staying on the Internet longer than I would have to.

Interface usability

The previous section provided examples of various kinds of distractions that can divert a Web user's attention from a searching or browsing activity and possibly terminate a flow experience. One type of distraction that was mentioned, but not discussed, is poor interface usability (see box 4 in Figure 4.1).

Definition 3.6: Interface usability is the ease with which a Web site can be learned or used.

Since attention is a limited resource, the more attention that is demanded by a user interface, the less that is available to focus on the task at hand (see boxes 12 and 13 in Figure 4.1). A poorly designed interface can disrupt a flow experience by demanding an excessive amount of attention. The following propositions describe the effect of poor interface usability.

Proposition 3.5: Poor interface usability has a negative influence on a Web user's focused attention on an information-seeking activity.

Proposition 3.6: Poor interface usability has a positive influence on the challenge of an information-seeking activity.

To illustrate these ideas, consider the following comment from Informant 1:

... as soon as you start hitting a site where you start to think, 'Where the hell have they hidden this?' it [flow] just goes out the window 'cause you're not thinking about what you're doing any more ... there's something wrong ... the navigation isn't intuitive ... I think it [flow] only happens ... when everything's been done right, and it's easy to find, and you're concentrating on what you're doing instead of being distracted all the time. As soon as you're distracted, you come back to reality. I find that if you can't figure out how to get there, it's back to reality, and you think, 'Oh well. I should be doing something else at any rate'.

Ideally, interaction with a Web interface should require minimal attention, thereby freeing the user to concentrate on the task at hand. Mok (1996, p. 137) concurs with this idea, identifying 'transparency' as a desirable characteristic of user interfaces:

A user's focus should be on the content of an interactive product, not on format or navigation. An interface should allow users to concentrate on the task at hand, not remind them that they're working on a computer. Designers shouldn't just package information, they should give users a way to get at it.

The informants in this study identified several examples of design elements that influence the transparency of an interface, and by extension, the focus of a user's attention. These elements include response times, organisation of content, links, navigation cues, page layout, colour and pop-up advertisements. Each of these topics will be discussed in the sections that follow. The discussions do not reveal any new principles of interface design, but they confirm the value of existing principles and demonstrate ways in which poor usability impacts on attention.

Response time

This thesis uses the term 'response time' to refer to the time it takes to download a document from a Web server. Shneiderman (1998, pp. 352–353) defines response time as 'the number of seconds it takes from the moment users initiate an activity ... until the computer begins to present results on the display or printer'. Download times have a bigger influence on the flow experiences of Web users than any other kinds of response times. Slow downloads interfere with a user's ability to maintain focused attention on the task at hand, and may contribute to frustration. Table 6.8 provides some comments from informants describing the distracting effect of slow downloads.

Table 6.8. Sample comments from informants describing the distracting effect of slow downloads.

Informant	Comment
1	It was someone's personal Web site and they had this animated GIF that was 1.3 megabytes. I thought, 'I don't think you've tested that over the Web'. I was wondering, 'What the hell's going on?' It's just downloading and downloading and downloading and downloading. And you know it's this bloody GIF here.
7	If I'm in the zone or know what I want to find, but then I'm sitting there having to wait for something to download, then that's a distraction. Which is why you'll often have four or five browser windows going at the same time trying to do the same thing at different places.
15	I also don't like when you can actually have times when it is a little bit slow. If you're used to a certain standard of speed and time efficiencies ... Particularly when it relates to work. If it holds me up at work, I get very irritated.
17	I find that if you have to wait for everything to load up ... you get sidetracked and don't do what you want to do.
21	It frustrates me because the downloading time is taking a long time ...

Referring to a paper by Miller (1968), Nielsen (2000, p. 44) claims that a response time of 'ten seconds (10.0) is about the limit for keeping the user's attention focused on the dialogue'. Longer delays encourage users to turn to other tasks while waiting for the page to appear. Similar thoughts are expressed in the following extract from an interview between Andy King and Mihaly Csikszentmihalyi (King 2003, pp. 33–34):

Andy King: You talk about immediate feedback being a prerequisite for the flow state. How does speed of interaction influence flow?

Mihaly Csikszentmihalyi: If you mean the speed at which the program loads, the screens change, the commands are carried out—then indeed speed should correlate with flow. If you are playing a fantasy game, for instance, and it takes time to move from one level to the next, then the interruption allows you to get distracted, to lose the concentration on the alternate reality. You have time to think: "Why am I wasting time on this? Shouldn't I be taking the dog for a walk, or studying?"—and the game is over, psychologically speaking.

King: Responsive feedback of an activity and feelings of control go hand in hand. Can you elaborate on that?

Csikszentmihalyi: Actually it's not so much the "feeling" of control, as the fact that you can act without thinking, without interruption, and making your own choices (for example, BEING in control). If a computer program has a mind of its own, is not responsive to your commands, or is so slow as to appear to be a moron, then you are again brought back to "reality" and lose flow.

Organisation of content

The organisation of a Web site's content is an important factor in determining its ease of use. Two sites with similar content could be organised in completely different ways—a difference that makes one very easy to explore and the other very confusing. To illustrate, Informant 12 made the following comment about a software archive that he found easy to navigate because of the manner in which its content was organised:

... it's quite well organised ... They've got it broken down into different categories. And then they've got like a thing here that gives you all the latest software. They've got another category here with the most downloaded programs.

Informant 12 also commented on a software archive that he found difficult to navigate because of the manner in which its content was organised:

It's a bit more disorganised I think ... There's quite a bit there. This one's a bit hard to find exactly what you want ... It just doesn't seem to be as well organised. There's not the categories. You've got to go through a couple of different levels to find exactly what you want.

The remark, 'You've got to go through a couple of different levels to find exactly what you want', reflects a common theme in the informants' feelings about navigation—the desire for an economy of time and action. A well-organised Web site gives users access to the desired content in a minimal number of steps or clicks, like the site described by Informant 5:

I thought it was quite easy ... They've got your headings up there, and as you go in, it brings up exactly what you're looking for. There's not another four sites to get to the one you want. It's sort of straight there, you know.

In contrast, 'a site structure that features layer upon layer of subcategories with many levels to click through can induce "Are We There Yet?" syndrome' (Fleming 1998, p. 21). Informant 15 confirmed this point when she recalled an experience she had on the Australian Bureau of Statistics site (<http://www.abs.gov.au>): 'You had to go through that many menus and drill down that far before you could even get access to the information'. Informant 13 expressed similar frustrations with splash screens that slowed his attempts to reach a site's home page:

Another thing that annoys me is when you go to sites and they don't get to the point. You have to go through five or six start-up screens or introductory screens before you get to the content of the site. I don't have the patience for that.

Rosenfeld and Morville (1998, pp. 22–46) suggest that the key to successfully organising a Web site's content is to find a balance between how the content 'wants' to be organised and how the site's visitors expect it to be organised. The easiest organisation schemes to design and maintain are ones that divide information into well-defined and mutually exclusive sections, such as alphabetical, chronological and geographical organisation schemes. However, these exact organisation schemes are

not necessarily the easiest to use. It is often more appropriate to group content items according to other shared characteristics—by topic, task or audience, for example.

Another aspect of content organisation that deserves attention is 'page chunking' or determining how much content to put on a single page. Informant 1 expressed frustration with long pages, claiming that by the time he scrolled to the bottom he couldn't remember what was at the top. He stressed the need to present content in a form 'that you can digest'. Nielsen (2000, p. 112) supports this advice:

Make text short without sacrificing depth of content by splitting the information into multiple nodes connected by hypertext links. Each page can be brief and yet the full hyperspace can contain much more information than would be feasible in a printed article. Long and detailed background information can be relegated to secondary pages; similarly, information of interest to a minority of readers can be made available through a link without penalizing those readers who don't want it.

Navigation support

Navigation support is an area of interface design where the principle of transparency is particularly important. A transparent navigation system allows users to focus attention on the content of a site and the task at hand, rather than the mechanics of moving through an information space. Informant 1 made the following comment in connection with transparent navigation: 'I can't even remember what the navigation system was, which is probably a good sign, 'cause it means that it was actually quite easy to use'.

One way of achieving a transparent navigation system is through visual consistency. Navigation is inefficient if users have to spend time familiarising themselves with a new layout every time they move to a new page. 'Some Web sites don't have a very uniform layout and it's difficult to find and navigate', said Informant 13. Web designers can build similarity between pages with consistent choices of visual components such as colours and fonts, and consistent placement of repeating page elements such as headings and navigation controls. Informant 18 expressed her appreciation for a site's visual consistency between pages:

It's quite good. They have it set up really good. I like things which have links down the sides and don't disappear when you click on each one. I don't like certain sites which totally take you to a new page ... You can sort of keep track of where you are and how many more you've got to go through.

Similarly, Informant 1 explained how the consistent placement of repeating page elements aided his navigation of a particular site:

One of the things is the consistency. You know, there's always a menu on the left to travel to things. Writing is on the right. A header at the top to always tell you where you are ... If you can know where things are going to be, then you don't even actually have to see them ... If the longest word there is always something you're looking for, or if the word you're looking for is always the shortest word, you'll get used to that

and you won't actually read it. You'll just say, 'Oh you know. That's it' ... The general shape of it ... it's the same technique that speed-readers use, isn't it.

Even more important than visual consistency is the principle of behavioural consistency. Users expect interfaces to respond to their actions in predictable ways. For example, users have confidence that they can return to previously visited pages by clicking the browser's Back button. This behavioural consistency provides a sense of security and helps to reduce disorientation. When a Web site disables the Back button by opening a new browser window or by using an immediate redirect, the user's confidence is diminished. Informant 5 described her frustration with a site that repeatedly bounced her to an undesired location every time she clicked the browser's Back button: 'You just sort of kept getting spat back to where you started rather than progressing through'. The following comment from Mok (1996, p. 135) confirms the importance of behavioural consistency in interface design:

It's more important for a system to interpret user behavior consistently than to appear consistent; in other words, it's more important for interactive products to respond to a user's actions in predictable ways than it is for the elements on a screen to have a uniform appearance.

Page layout

Page layout is another factor that influences the amount of attention required by a user interface. A Web page with a coherent visual structure is readily interpreted and understood because it leads the eye through the composition in a systematic way. In contrast, a Web page with no apparent structure is difficult to interpret and understand because the eye must impose its own organisation onto the design. Informant 8 provided the following contrast between a coherently structured page and a poorly structured one:

... the way it's set up with its downloads and the support and stuff it offers is a bit all over the place and you've got to get used to it. Whereas this is set out nice and clearly. You can find what you're looking for with relative ease.

Mullet and Sano (1995, p. 89–91) affirm the importance of visual structure in interface design and describe some of the benefits it provides. They suggest that a coherent visual structure can:

- make disparate design elements work together toward a common communication goal;
- keep a design focused on a communication goal by creating an emergent form that contributes to the meaning of the ensemble;
- enhance readability by dividing content into manageable subsets that can be processed separately or in parallel; and

- help users to predict areas of interest and guide their navigation through the composition

One example of a technique for giving a page structure is shaping the layout with white space, that is, regions with no content. White space plays a crucial role in directing the user's attention to areas of a page where important information is provided. Pages that are dense with content or devoid of white space often look cluttered and confusing. Referring to one such page, Informant 3 said, 'Well it's sort of like too much information packed in here. You're not quite sure what you want to look at'. Informants 14 and 15 made similar comments about the Yahoo! (<http://www.yahoo.com>) home page, adding that they prefer to search for information with Google (<http://www.google.com>) because its home page is less cluttered (see Figure 6.2). Here is the relevant comment from Informant 14:

... tell the people at Yahoo! if they put one more thing on their screen, it will burst. People who come into the library say, 'Now somebody tells me that Yahoo! is really good'. And I say, 'Have a look at this'. And they go, 'Oh, where do you find anything on the screen?' That annoys me. And that annoys me when I'm showing inexperienced people around Web sites. So I say to them, 'I don't wish to sound prescriptive and everything, but Google really is the best search engine, mainly because you can actually see what's on the screen'. You go to Yahoo! and you just can't find anything because there's just too much garbage. For inexperienced and unsophisticated users, that's really very off-putting.

Not all pages that hold a lot of information are perceived as lacking in visual structure. For example, Informant 9 approved of the appearance of the CNN home page (<http://www.cnn.com>) saying, 'There's a lot of information, but it's fairly well laid out'. Variations in page design can obviously make an enormous difference to a user's perception of a site.

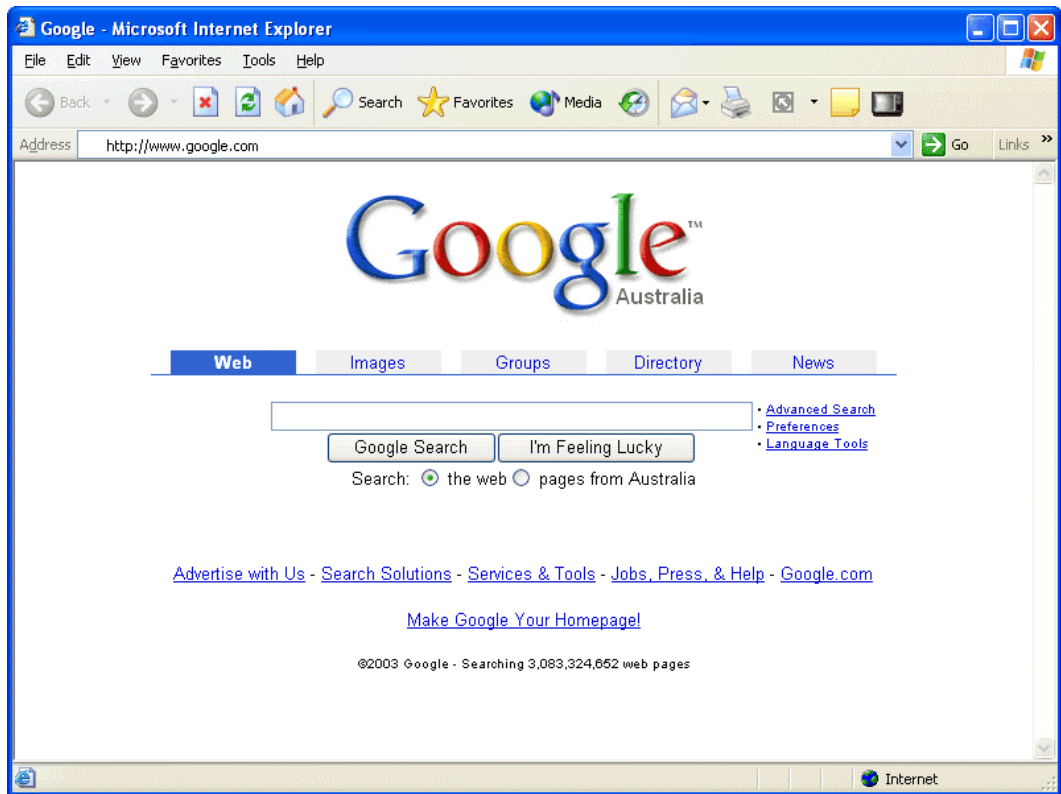


Figure 6.2. Informants 14 and 15 preferred Google (<http://www.google.com>) to Yahoo! (<http://www.yahoo.com>) because the Google home page is not as cluttered.

Colour

Choosing the right colours for a design is both a subjective and technical exercise, complicated by diverse factors such as the way people react to colour and the nature of colour vision. As mentioned in the previous chapter, colour can convey a mood and meaning of its own, regardless of the surrounding content. To illustrate this point, consider the following comment from Informant 8:

And the colours ... They're not offensive. They're not bright. They're not in your face. They're not flashing. So even if you're not in a mood—if you just want to look—you know it's ... I wouldn't say calm, but you know.

Informant 1 made a similar connection between colour and mood:

... they haven't gone overboard on colour. The colour's fairly relaxing. There's just a couple of colours—not a gazillion colours—which is probably suitable for something like that.

Colour selections influence the legibility of a Web page. Some combinations of background and foreground colours will make a page virtually unreadable, as the following comment from Informant 20 indicates:

This one's quite good. On some of the other ones I've found too much background colours and such. I've been on some of the sites with the Playstation cheats, and they always seem to be black, which I find is really annoying ... I just find it's not as easy to read for some reason. But this one's quite good with just the black and the white—the white background with the black writing. 'Cause a lot of the black ones, they use your bright greens and reds.

As Informant 20 suggests, Web designers can enhance the legibility of their pages, and thereby help to maintain the user's focused attention, by striving for as much contrast between the text colour and background colours as possible. Black text on a white background or white text on a black background provides optimal legibility. Nielsen (2000, p. 302) confirms this point:

... always ensure high contrast between foreground and background colors, and avoid busy background patterns that interfere with reading. Anything that reduces the legibility of your text is annoying enough for fully sighted users who definitely don't like to be slowed down when they are on the Web, but textured backgrounds or subtle colors may be the last straw that takes your page below the threshold of what a partially sighted user can read at all.

Links

Hypertext links are obviously an essential part of a Web user's flow experience. Without links there is no navigation. As Informant 3 explained, 'Links tend to keep you going. When you come to sites without any links, you end up back at the search engine. So links play an important part'.

Ideally, the links on a Web page should provide a rich network of relationships without overwhelming the user. Excessive linking clutters a page and increases the user's cognitive load. Informant 6 had that experience while exploring the Learn ASP site (<http://www.learnasp.com>) shown in Figure 5.2: 'It was challenging—because there were so many links everywhere—to try and figure out where to go next'. Her comment is consistent with the following findings reported by Kubey and Csikszentmihalyi (2002, p. 68):

Lang and Shyam Sundar of Pennsylvania State University have been studying how people respond to Web sites. Sundar has shown people multiple versions of the same Web page, identical except for the number of links. Users reported that more links conferred a greater sense of control and engagement. At some point, however, the number of links reached saturation, and adding more of them simply turned people off.

Just as an excessive number of links can contribute to a user's frustration, so can stale links. Links become stale when a site disappears, changes its URL, changes its content or goes out of date. Consider the following comment from Informant 15:

What I dislike is when sites move on and they don't forward you automatically. So all you get is an error message saying URL is incorrect, when you know that it used to be correct. That's frustrating. I don't like it if a site is taken offline for some reason, and you might need that piece of information there and then.

Web administrators can counteract the problem of stale links by regularly testing links to external sites.

Another characteristic of a hypertext link that has the potential to frustrate users is its label. The purpose of a label is to help users predict what they will find if they follow the link, but some labels are ambiguous and fail to provide much guidance. To illustrate, Informant 6 disliked the link labels on the Learn ASP site because they used programming terms like 'array', which novice programmers may not understand:

It doesn't really explain where to go, except for the lesson index if you see that. I was probably lucky that I found that ... And then within that it doesn't really explain too much for what each thing's about. Like, unless you knew what an array was, you probably wouldn't understand what it was going to be about ... especially since it's called Learn ASP, I don't think it would be that great for someone who didn't have too much of a programming background.

Rosenfeld and Morville (1998, pp. 72–98) suggest that link labelling can be made more effective by mirroring the language of the site's users rather than its owners; by using recognised expressions such as 'home' and 'contact us' for navigation link labels; by applying navigation link labels consistently throughout a site; by adding text labels to iconic links; and by supplementing the first appearance of a link label with a brief description if necessary.

A good link label is one that communicates an idea clearly without occupying too much screen space. Sometimes the most effective way to do that is to use an icon.

While it is true that icons without accompanying text labels or universally recognised meanings can be ambiguous, in some situations iconic labels are more effective than text. For example, when the content of a link's destination page is graphical, a thumbnail image of that content makes a very effective link label. Informant 20 made this point when describing her search for scrapbook page layouts:

Basically what I'd do is just go in and have a look first ... That one looks interesting—whippersnapper. That's probably the main thing I use is whether they look interesting ... A lot of the text is what they've used, but it's different products to what I use. So I mainly just go by the general look of it. And then if it looks good, I'll go into the actual page ... Normally if you click on them ... you can enlarge that, and you can have a better look at what the layout is. See when it's enlarged you can see that it's torn down the edge rather than just cut, whereas you can't see that from a little picture.

Pop-up advertisements

The most distracting interface feature mentioned by informants in this study was undoubtedly the pop-up advertisement. Pop-up advertisements are not integrated into Web pages like older inline banner advertisements. Pop-up advertisements appear in new browser windows that 'pop up' in front of the current browser window when a user visits a particular page.

Many informants felt strongly about pop-up advertisements, describing them as rude, intrusive and annoying. For example, Informant 7 said, 'I sort of feel a little bit violated that someone's taken over my computer by creating a popup'. Similarly, Informant 20 said, 'I think it's very rude that they allow it to happen'. Informant 14 expressed her frustration this way:

... I really lose patience with commercial sites and things like that where they pop up when you don't want them, and that sort of stuff. It leads to a frustration from that point of view—all the extraneous garbage and all those little popup windows ... Pop-ups really annoy me.

Some informants said that their level of frustration with pop-up advertisements varied, depending on the importance and urgency of what they were doing at the time. Informant 16 said, 'If I'm doing something fairly important I'll lose my temper pretty quickly. If I'm just browsing recreationally, it does get annoying, but it's only a click of a button and it's gone'. Despite their feelings of frustration, several informants acknowledged that pop-up advertisements are an inevitable part of Web navigation. 'They're just irritating ads that you just have to put up with', said Informant 15.

Web users find pop-up advertisements frustrating for a variety of reasons, one of which is their irrelevance to personal interests and the task at hand. 'If you wanted to look for something like that, you go and look for it', said Informant 8, expressing his displeasure with having content pushed at him. Informant 16 made a similar comment:

I dislike it when you're trying to do something for work or even recreation, and something pops up. And most of the time it won't even be something that interests you, or has anything to do with you really. A lot of the time I get pop-up ads about insurance policies and stuff like that. I'm eighteen years old. I'm not thinking about house insurance policies or anything like that yet.

Pop-up advertisements are designed to be intrusive and to elicit a response from the user. Ignoring pop-up advertisements is difficult because they obscure the content of the underlying Web site when they first appear. Informant 13 said:

Twenty or thirty pop-up windows when you're trying to look through a site—I find it very frustrating ... I find that it's difficult to look at the content of the actual site itself with everything else ... You kill one pop-up and the next one turns up. So after about five or ten minutes you give up on the site and go somewhere else.

Many users have learned to dismiss pop-up advertisements quickly by closing the browser window, but it still takes time to do that—time that could be spent on the searching or browsing activity. Informant 20 said:

... another thing that really annoys me is when all the other sites pop up in boxes. When you go in somewhere and—I don't know what it's called—but you end up with casino gambling and those sort of things. They keep popping up ... It's a real pain ... Just the fact that they come up on your screen, and then you've got to exit out of them and get rid of them.

Particularly frustrating is the case where dismissing a pop-up advertisement takes more than the usual time or thought. Information 16 provided this example:

I can't remember what the actual ad was advertising, but instead of coming up as a browser, it comes up as a full-screen thing. And you've got to really know what you're doing with the computer to get rid of it. A lot of novice users wouldn't have a clue how to close it because you can't see an X in the top corner or anything like that. And you've got to actually use Alt-F4 or something like that to get rid of it. And then some pop-up ads, you'll close it and they'll reopen another window. It won't be the same ad, but it will be something to do with the some company.

This time factor isn't an issue with older inline banner advertisements. Referring to this less intrusive advertising format, Informant 7 said, 'Sometimes the advertisement isn't something which prevents you from reaching the information quickly. That's not a problem for me'.

If left unattended, pop-up advertisements can accumulate to the point that they clutter the screen or slow down the system. Informant 17 described the problem this way:

The other pages, they open up a lot of extra windows. And after opening a few pages you get lost because there's like twenty windows open at the bottom. You don't know which one to look at. And when they're all trying to load up, it slows down and only a few of them open.

After making a similar point, Informant 14 explained how pop-up advertisements can give inexperienced Web users the impression that their Internet connection has broken:

... in the library we are dealing with teaching people who often don't know a whole lot about computers ... And they are often going to commercial sites with these little pop-up windows—things that recur and they can't get rid of. And you'll go and they'll say, 'The computer's stopped'. And you'll go, and you'll look, and they've got fifteen windows open all down the bottom ... they don't know what they've done and they don't know how to get rid of it. And so you say, 'Just close all these'. 'Oh', they say. And so it annoys me. It annoys me on behalf of other people.

Research conducted by Lang et al. (2002) has shown that animated banner advertisements elicit short-term cardiac-orienting responses in attentive computer users. The orienting response is 'an automatic (some say reflexive) physiological and behavioral response that occurs in response to novel or signal stimuli', and is associated with attention and stimulus intake (Lang 2000, p. 52). Reliable signs of an orienting response include a 4–6 second decrease in heart rate, a 1–2 second increase in skin conductance, and a decrease in the alpha frequency of brain waves (Lang et al. 2002). If traditional animated banner advertisements can achieve this effect, then it is not surprising that pop-up advertisements are found to be so distracting.

Summary

Attending to information requires mental resources, and people only have a limited—and possibly fixed—pool of mental resources, which can be used flexibly across a wide range of activities. Although it is often possible to attend to multiple tasks at the same time, allocating more resources to one task will diminish performance on others. Attending to just one of several competing stimuli is referred to as focused attention. Trying to attend to more than one stimulus at the same time is called divided attention.

Flow experiences require focused attention, not divided attention. The higher-than-average challenges associated with searching and browsing activities in the Web environment play a major role in focusing attention on the task at hand. Interesting content and links also help to attract and maintain a Web user's attention.

When Web users encounter interesting content and links that are relevant to their current goal, the discovery helps to maintain focused attention on the task at hand. But when users discover interesting content and links that are not relevant to their current goal, they may get sidetracked as a consequence. Comments from the informants suggested several reasons why users find certain content interesting, besides relevance to their current information-seeking goal. Congruence with personal interests and novelty were two key factors. Content properties such as credibility, correctness, currency, ease of understanding, rarity, emotional impact and aesthetic appeal also seem to be influential in maintaining a user's attention under some circumstances.

Attention is a vulnerable process. Although people are able to exercise voluntary control over the focus of their attention, on some occasions attention may be drawn involuntarily to stimuli outside the attentive focus. Distractions come in different forms for Web users. Informants mentioned environmental distractions such as loud noise or interruptions from family members; physiological distractions such as hunger, fatigue or a need to use the toilet; and computer-related distractions such as software error messages, a broken Internet connection, or a browser that stops responding. Web users tend to ignore minor distractions during a flow experience because their attention is focused on the task at hand. But a distraction that has sufficient intensity, frequency or importance to cause a shift in the user's attention will terminate a flow experience.

A Web site's user interface can also be a distraction. A poorly designed interface can disrupt a flow experience by demanding an excessive amount of attention. Ideally, interaction with a Web interface should require minimal attention, thereby freeing the user to concentrate on the task at hand. Specific examples of interface design elements that can detract from a flow experience include lengthy response times, disorganised content, inconsistent navigation cues, poorly structured page layout, inappropriate use of colour, stale links, ambiguous link labels, and pop-up advertisements. These findings confirm the value of existing principles of interface design.

Dimensions of flow

This chapter concludes the explanation of the theory that was developed in this study by discussing various dimensions of the flow experience that became evident through the comments of informants. These dimensions include the joy of discovery, reduced awareness of irrelevant factors, a distorted sense of time, a merging of action and awareness, a sense of control, mental alertness, and telepresence.

Duration, frequency and intensity

The flow experiences of Web users vary in duration, frequency and intensity. The study's informants recalled flow experiences ranging in duration from a few minutes to several hours. Some informants claimed to experience flow on an almost daily basis, while for others it was a much less frequent occurrence.

Not all flow experiences elicit the same intensity of feelings. Informant 14, a reference librarian, recalled 'leaping around all over the staff room' after the 'exhilaration' of finding the answer to an obscure request from a library patron: Where is the geographic centre of Australia? In contrast, Informant 11 said that his flow experiences in the Web environment rarely matched the 'sense of focus' that he felt while programming. This variation in reported intensity is to be expected. As mentioned in Chapter 2, Csikszentmihalyi (1975, p. 141) suggests that 'flow exists on a continuum from extremely low to extremely high complexity'. The skills and challenges associated with some information-seeking activities could obviously be at a different level of complexity to the skills and challenges associated with other activities.

Joy of discovery

Enjoyment is a common factor in all flow experiences, but among Web users it appears to be linked to discovery—finding, learning or observing something for the first time (see box 16 in Figure 4.1). Table 7.1 provides some comments from

informants that describe the link between enjoyment and discovery in their flow experiences.

Definition 4.1: Joy of discovery is enjoyment associated with finding, learning or observing something for the first time.

Proposition 4.1: Joy of discovery is a dimension of a Web user's flow experience. There is a positive correlation between the two concepts.

Table 7.1. Sample comments from informants describing the link between enjoyment and discovery in their flow experiences.

Informant	Comment
1	It's like going to somewhere new. You're always learning something. You're always finding something. And you don't know what it is you're going to find. There's so much out there that you'll go there one day and then you'll come back, and you'll actually end up on a different path and finding something different. So it's investigation of the unknown really ... It's learning something, and learning something new. I think it's like travelling to a new place, you know. When you travel to somewhere for the first time it's always different. It's always better than the second time because the first time is new, it's fresh.
2	It was a good experience. Ok. It made me feel good. I'm trying to think of the right words to use ... Enlightening.
4	... it's the knowledge that at the end of that day you're going to increase your knowledge on that specific thing that you're trying to research. With me it's, as I said before, Zimbabwe media. And I'm becoming very knowledgeable on Zimbabwe—their politics, their media, what's happening, the general day-to-day running of Zimbabwe. I can almost tell you what's happening before it happens, sort of thing. So it's that knowledge you gain that's the most important thing.
9	... I was really interested in finding out what was going on ... And I did find that rewarding I guess. And I came out knowing something and feeling, not better about something, but feeling more informed about it. And I think knowing what's going on in the world is important I think. It makes you feel better.
19	... I found a site on Mark Knopfler's guitars and I started reading all about his guitars and which ones he played on which songs for the Dire Straits. I found it quite amazing. I thought it was quite good. I was pretty happy that I found it.

As mentioned in Chapter 2, Csikszentmihalyi (1990, pp. 67–69) describes flow activities as 'autotelic', meaning that they are intrinsically rewarding or worth doing for their own sake. His research also suggests that 'the reason we enjoy a particular activity is not because such pleasure has been previously *programmed* in our nervous system, but because of something *discovered* as a result of interaction' (Csikszentmihalyi 1993, p. 189). This relationship between enjoyment and discovery is clearly evident in the preceding comments of the informants. Further evidence of this relationship is found in Gaines' (1997) model of knowledge management in societies of intelligent adaptive agents, which suggests that flow is the optimal state for learning how to perform a task.

Our shared propensity for enjoying discovery could be one reason why the Web has such broad appeal among people of varying age, gender, education and experience. The Web is an ideal environment for learning by discovery. It contains information on almost every conceivable topic. Informant 12 described it as a 'good learning tool' because it can cater to almost anyone's interests. Informant 14 made a similar comment:

I enjoy the fact that there is usually a heap of information about most things. And so, you're almost always assured of finding something. And so it's pretty gratifying from that point of view.

Surprise

Closely related to the notion of discovery is that of surprise. Laurel (1992, p. 90) points out that when we have no particular expectations, discovering new information is a relatively unremarkable experience. But 'discovery becomes more interesting when the new information is not what we might have expected—in other words it is a surprise'. Table 7.2 provide some comments from informants describing surprising discoveries they enjoyed as part of their flow experiences.

Table 7.2. Sample comments from informants describing surprising discoveries they enjoyed as part of their flow experiences.

Informant	Comment
3	... you get into a search engine and you come up with a lot of sites and you're going backwards to these results from the search engine ... And you'll get to a particular site. In this case it was like the link on Friday, farmersdaughters.com ... This is a sex site. And you've got to this site and it was like that sort of woke you up ... And that had links to other sites—sex sites ... After being woken up by it, you sort of got into a drift of looking at sexual images on the screen.
4	... when you sit there and you start going through the Web, you'll come up with something that you've never thought of before. Or it'll give you an idea to what another aspect of your research could be.
5	... to find like free SMSs for your mobile phone and also the funny pictures there for you to have a look at—that was a total surprise. You wouldn't think that had anything to do with a clothing store Web site ... that was kind of a nice surprise. It really kept you in that site for a lot longer. 'Cause I think if they didn't have stuff like that, you would have had a look, had a look at the catalogue, maybe subscribe for a catalogue to be sent to your home address, and then you would have left. But because they had all of these extra things, I think it really did keep you in that site a lot longer. And you did keep reverting back to the clothing aspect of it as well. So I think it was well done.
15	... coming across information that you mightn't have thought of. You might be presented with a site that you didn't know existed, and can give you that extra information that you weren't necessarily looking for, but is a bonus for you. That's what I enjoy about it.
17	I just find it interesting finding new things, and it's a lot better than sitting in front of a computer playing a game ... A game gets really repetitive. It gets boring ... Every time you search for something, there's a different page there, or a few hundred different pages.

Repeated use of the Web

One consequence of flow experiences being enjoyable is that people want to repeat whatever makes them happen (Csikszentmihalyi 1993, p. 186). This compulsion was evident in the experiences of some informants. Consider the following comment from Informant 10, who recalled experiencing flow intermittently over a period of three days when she first got a computer with Internet access: 'I did go to bed—really late. And then as soon as I got up in the morning I was zoom—straight back on there'.

Although the study provided some support for the idea that flow experiences encourage repeated use of the Web, the study did not substantiate Hoffman and Novak's (1996) suggestion that flow encourages repeated visits to a particular site. As Chapters 4 to 7 have explained, flow experiences depend on many more factors than the design or content of a particular Web site. Some of the study's informants had never returned to the sites at which they recalled experiencing flow. Some had not even thought about the sites since their experience. For example, Informant 10 said, 'I don't remember thinking I must go back there and have another look at it again, 'cause it sort of just went out of my head until now'.

Reduced awareness of irrelevant factors

One of the consequences of a Web user's attention being focused on a searching or browsing activity during flow is that there is no room leftover in one's consciousness for irrelevant thoughts (see box 17 in Figure 4.1). Informants in this study reported having a reduced awareness of their physical surroundings, interactions with other people, their usual worries and concerns, their physical needs, the navigation path they followed, and even their original reason for using the Web.

Definition 4.2: Reduced awareness of irrelevant factors is the absence from consciousness of factors that are unrelated to the current information-seeking activity.

Proposition 4.2: Reduced awareness of irrelevant factors is a dimension of a Web user's flow experience. There is a positive correlation between the two concepts.

The aforementioned factors would not disappear from consciousness if they were relevant to the task at hand. For example, Informant 7 pointed out that he is very aware of his physical surroundings when he experiences flow while playing touch football:

It is a bit different in sport as well because you are consciously aware of your environment. If someone's coming to tap you, that's the thing you have to be aware of.

Reduced awareness of physical surroundings

Some informants recalled having a reduced awareness of their physical surroundings during flow experiences. Table 7.3 provides some examples of the informants' comments. Although Web users tend to ignore minor distractions in their physical environment during flow, distractions that have sufficient intensity, frequency or importance can cause a shift in one's attention and terminate a flow experience.

Table 7.3. Sample comments from informants describing their reduced awareness of their physical surroundings during flow.

Informant	Comment
3	... things happen around you, but you're not aware of it.
8	I lose track of everything to be honest. I'm focused on the computer. Like my cat can come in and sleep on the couch, and the windows can blow, and paper can blow around on the floor. Like not major things, but little things like that. And I'll just pretty much be focused on the computer.
12	... you can just sit there and just go into a state of mind where you're unaware of everything around you.
16	... you obviously lose track of your outside environment really—where you're sitting.
20	... maybe I've got a good way of blocking things—happenings around me

Reduced awareness of interactions with other people

One particularly distracting element of the physical environment that some Web users lose awareness of during flow is other people. 'When I'm surfing the Web ... and someone's talking to me, then I will often take perhaps about five seconds of actual talking before I actually acknowledge that they're there', said Informant 7. 'You definitely lose track of your surroundings'. Informant 1 expressed similar sentiments and provided an amusing analogy to illustrate the intensity of his concentration during flow:

It's total concentration. You don't notice anything else ... It happens to me a lot of times. I immerse myself in things. Someone will say, 'Tea's ready. Tea's ready. Tea's ready'. [Increases volume and emphasis with each repetition. Laughs] ... I used to have a dog, and it used to attack little furry animals. And I remember it got into a porcupine one time. And you could stand beside it and yell its name. It had no idea. You'd grab it by the tail, because you know it was a big dog like that. [Gestures to describe the dog's height] You'd grab him by the tail, and the dog would just about crap itself. It had no idea you were there ... because it was so focused on getting here to see a porcupine. I get a bit like that, you know. People can talk to me and they don't get sensible answers. I don't even hear them as a rule.

Informant 12 also provided an example of reduced awareness of other people. He often forgets about chores that his wife asks him to do while he is experiencing flow:

Sometimes my wife will be going to bed, and she may put a load of washing on and she'll say, 'Can you just hang that out when it finishes'. 'Yeah, right'. And then you totally forget all about it. And even like she'll put the sprinkler on and say, 'Can you turn that off in half an hour?' 'Yep, yep, right'. And you just totally ... You know she spoke to you, but you just push it to the back of your mind and carry on. That happens quite a bit. I was thinking I'm just forgetful or something like that.

Reduced awareness of usual preoccupations

It is common for people who experience flow to forget about the unpleasant aspects of life while the experience lasts (Csikszentmihalyi 1990, p. 58). Several informants in the study described how their usual worries and concerns were temporarily suspended while the demands of the flow activity consumed their attention. 'You just want to forget about everything', said Informant 12 when describing his nightly ritual of surfing the Web after work. No doubt, this is one of the reasons why flow experiences are so enjoyable.

Informant 22 made a similar comment about her flow experiences on the Australian Bureau of Statistics Web site (<http://www.abs.gov.au>), which she has often browsed for amusement. 'You can stay on that site for hours and be kept amused without thinking about anything related to your life or issues that you're having', she said. Later in the same interview, she added:

... when I'm doing something that I enjoy, obviously it's a pleasing experience. But in regard to the actual flow, I suppose when you're so focused on something that you're doing that is enjoyable, it's enjoyable also in the fact that you're not having to worry about the exam that you've got next week or any of the other issues.

Reduced awareness of physical needs

One of the most surprising ways in which informants demonstrated reduced awareness of irrelevant factors during flow was the suppression of physical needs such as hunger and thirst. 'You end up skipping meals because you don't realise the time that's gone by', said Informant 17. When asked to elaborate on that comment, he offered the following explanation:

I just find when you get really interested and into something, you don't get hungry. I get hungry when I'm bored. So if I'm out training, having fun, out wakeboarding or something with mates, fishing. When I'm out fishing, I never eat all day. Don't know why. I just never get hungry. As opposed to if I'm sitting at home, or at work or something. I just feel a big appetite. As opposed to when you're on the computer doing something that's really fun. You lose track of time and you just don't get hungry. You skip a meal and you don't realise. You don't really look at the time all

day long because usually you give the day to have a rest, to have some fun on the computer or something.

Reduced awareness of navigation path

Some informants recalled losing track of the navigation path they followed to a particular site of interest during flow. A Web user obviously visits a number of pages during a searching or browsing activity, but remembering all of those pages and the sequence in which they were visited is not usually necessary. Consequently, the navigation path disappears from the user's consciousness along with all other irrelevant factors. Consider the following comment from Informant 11:

Because of its nature, you can easily visit so many places and not realise how you got there. So when you finally get back, you knew there was something there that you found, but you've lost track of it. It's easy to get in there into the Web and navigate around very quickly. But backtracking—because you don't actually pay attention to what you visit at each point—you lose track of how you have got there.

The thought of losing track of interesting content on the Web was a cause for concern for some informants. For example, Informant 1 admitted to hoarding interesting content that he found on the Web, in case he was unable to return to it later. He did not explain why he chose to save the content rather than bookmark it:

Embedded applets. Quite a few of them get saved to my hard drive too. You think, 'PDF. Oh, I might want that later' ... If you see something like that you think, 'I might reference that later'. I've got more CDs than I know what to do with. I've got an eight-gigabyte partition that I just store things on. You know, just used files and that. And when that starts to fill up a little bit, you go and burn a CD of all the interesting stuff. You get this stuff. I wonder what I wanted this for? You know. You've got the specifications of the heating arrangements of some CPU. Ah, won't worry about that. You hoard things because sometimes you've no idea how you've got there and you think, 'Well, am I going to come back to this place?'

Reduced awareness of original goal

Earlier in this thesis it was suggested that getting sidetracked from a searching or browsing activity could prolong a Web user's flow experience. Each time a user decides to pursue a new topic of interest, he or she moves seamlessly from one phase of the flow experience to another. Sometimes this process of repeatedly getting sidetracked continues to the point where the user forgets his or her original goal. As Informant 4 explained, 'You lost all sense of perspective of what you should have been doing'. Informant 19 described a similar experience:

You go looking for something—for one thing—and ... you'll see ... another option ... And you think, 'Oh, I'll just click on that first and have a quick read, and then I'll go back to it'. Usually you just end up reading and by the time you realise, the time's gone. It's like, 'Oops, I was supposed to research the other thing, not that one'.

Informant 1 recalled flow experiences that consumed his attention to the point where he walked away from the computer before remembering his original reason for using the Web:

Sidetracked so many times. Sometimes you get to the end of it and you think, 'Now what was I looking for?' It's completely gone ... you hang up and you walk away from the computer and you think, [Snaps his fingers] 'Oh gee, that's what I was doing'.

Informant 18 became so tired of getting sidetracked from her information-seeking goals that she adopted the habit of writing down what she needed to find before going online:

I write down what I need to find on the Net before I go on, and if I start getting sidetracked, I look down. What was it I needed to find? And so I still have that there to find out. And I just put aside everything until I find that. If I've got extra time, then I'll go and search the other things ... I have to write things down a lot. If I don't write it down, I'll forget it.

Distorted sense of time

One of the most common dimensions of the flow experience described by the informants in this study was a distorted sense of time (see box 18 in Figure 4.1). In each case, informants reported that time seemed to pass much faster than usual during flow. Presumably the thought of time passing doesn't enter a Web user's consciousness during flow because it is irrelevant to the task at hand, just like the factors that were discussed in the previous section. Table 7.4 provides some examples of the informants' comments.

Definition 4.3: A distorted sense of time is the feeling that time seems to pass much faster than usual.

Proposition 4.3: A distorted sense of time is a dimension of a Web user's flow experience. There is a positive correlation between the two concepts.

Table 7.4. Sample comments from informants describing their distorted sense of time during flow.

Informant	Comment
1	There's a lot of stuff on the site. And this is one particular one I remember spending a long time on. It's the sort of thing where you sort of start looking for something at ten o'clock at night and then you look at your watch and think, 'Oh, I think I'd better go to bed. I'm getting up tomorrow morning to go to school you know. 'Cause it's half past three'.
2	Well, I'd like to say I get on for an hour and a half, but that's exactly when flow starts. Sometimes it's four hours, and I've just forgotten. Especially if I get on after we've had dinner, so nobody needs me for anything specific, like to feed them or pick them up. They'll just come and say, 'We're going to bed now. We've brushed our teeth'. And I'll say, 'Ok. Good night. See you'. And then I'll look up, and I have time on here [Gestures toward the Windows clock on the screen], and it will be half past twelve at night.
8	... I'll say I'll use the Internet for an hour and she'll come in an hour and a half later and say, 'Get off'. I do lose track of time just with music playing in the background, just looking.
18	I kept exploring the links in this site and it was very interesting—the information I was finding. Before I knew it, easily half an hour was gone, and I thought it was only five minutes.
20	I do scrapbooking, which is with photos. And I was going through sites looking for ideas. I was only originally going to spend about half an hour on that and it ended up being four hours. And I really only realised when the kids started hassling me for dinner. Otherwise, I probably would have stayed on longer.

The informants' variable experience of the passage of time is what Damasio (2002, p. 50) calls 'mind time'. He contrasts this with 'body time' or the biological clock in the brain's hypothalamus that regulates processes within the body. Mind time can seem fast or slow, short or long, and 'this variability can happen on different scales, from decades, seasons, weeks and hours, down to the tiniest intervals of music'. Informant 12 demonstrated an awareness of this fact with the following comment:

Every now and then I'll go for a bike ride or something with the kids ... At the time you're not thinking of the time. You're just doing what you're doing ... And then later on you think, 'Oh, I better get on and do something else'. And they say, 'What's the time?' And you have a look. And you just don't realise how long it's gone ... Even like ... looking at the whole year. Everyone says it to you, 'Oh gee, I can't believe how quick the year's gone', and stuff like that ... I reckon it must happen to everyone ... Years and everything seem to go so quick I reckon ... Say for example you're a child and your birthday is in a month's time, it just seems like that month takes forever ... But if you're not consciously thinking about it, and all of a sudden it's there, you don't realise. Probably your state of mind has got a lot to do with it.

Some informants pointed to attention as the key factor affecting the variability of their time judgements. For example, Informant 18 said, 'When you're interested in something, it keeps your attention. And when your attention is on one thing, you're not thinking of time'. Informant 19 provided a similar explanation:

I suppose it's because you're enjoying what you're doing, and the fact that you're not really being made aware of what the time is—how long you've spent on it. I think the main thing is that you enjoy what you're doing. Otherwise it's quite the opposite. Like if you're bored or something, time seems to be really long. You think you've been there for like a minute, and it's like five seconds.

Brown and Boltz (2002, p. 600) agree that 'attention is one of the most important psychological processes that regulate the experience of time'. Our experience of time changes with the amount of attention that we direct towards it. When one is attentive to time, as in the case of waiting for a boring lecture to finish, time seems to pass relatively slowly. In contrast, when one is inattentive to time, as in the case of being absorbed in some activity, time seems to pass relatively quickly.

These common observations about the relationship between time and attention have been confirmed in controlled experiments conducted by various researchers. Brown and Boltz (2002) and Grondin (2001) describe a dual-task strategy that has been employed in some experiments. Individuals are asked to perform a temporal task and a non-temporal task simultaneously. The temporal task involves keeping track of time for an upcoming time estimate. The non-temporal task acts as a distraction. Many of these dual-task experiments show what is known as the *interference effect*. The non-temporal distracter task disrupts the temporal task, making time judgements shorter, more inaccurate or more variable in comparison with a single task control. Many researchers interpret the interference effect in terms of the limited-capacity model of attention described in the previous chapter. Both tasks compete for a common pool of mental resources, with the result that timing receives a sub-optimal level of attention.

Variations of this experiment involving distracter tasks with different levels of difficulty indicate that time judgement performance deteriorates as greater amounts of attentional resources are diverted away from the temporal task. Other studies in which participants are instructed to devote specified amounts of attention to simultaneous temporal and non-temporal tasks have shown that the less attention that is devoted to timing, the greater the underestimation error in time judgements will be.

According to Stix (2002, p. 23), neurological studies are 'closing in on areas of the brain that produce the sensation of time flying when we're having fun'. Many studies point to the existence of a temporal processor that determines one's subjective sense of time—the so-called *interval timer*. Wright (2002, p. 41) says that the interval timer 'enlists the higher cognitive powers of the cerebral cortex, the brain center that governs perception, memory and conscious thought'. Collections of striatal spiny neurons that oscillate on their own schedules in this area of the brain are central to the developing interval-timing theory.

Guilt

The distorted sense of time described by the informants in this study helps to explain the paradox of why Web users with a sense of time urgency will spend much longer searching or browsing for information than they plan to. While they experience flow,

time seems to pass relatively quickly. They are unaware of exactly how much time they are devoting to the activity.

What happens when a flow experience ends and the user becomes conscious of how much time has passed? Some informants reported feeling guilty. As Table 7.5 shows, informants felt guilty about other responsibilities that could have been attended to during that time, about using an employer's time or facilities for personal activities, and about spending so much time on a 'non-productive' activity.

Table 7.5. Sample comments from informants describing the guilt they felt after a flow experience.

Informant	Comment
1	I spent a lot of time with that. Yeah, that was one time I spent quite a long time with that. Far longer than I should have. I should have been writing some low-level networking stuff. It was probably what I was looking for in the first place.
2	... when I have other commitments then the feeling of guilt when I get off. I think, 'Oh, I've just wasted so much time'. I mean, while it's been good, I've wasted a lot of time ... I won't just go, 'Oh well. Doesn't matter. We'll go without dinner', or, 'Doesn't matter that I was late picking somebody up'. No. That makes me feel really guilty. I'm very aware of my responsibilities and commitments.
3	It's very hard because certain institutions have set rules against using the network for entertainment. But you feel as though ... it's a facility that's there. And you feel as though it's available if you want to have a look through some sites that are probably very little to do with your studies.
10	... thinking back to what didn't get done, as far as what should have gotten done on those days didn't because I was sitting in front of the computer.
11	I come at about nine o'clock every day and I stay until five. I don't go home at lunch. It's surprising how I spend eight hours—doing my work at the same time—but I find that inadvertently, without realising it, I'm sidetracked into spending a lot of time on these things ... wasting time in the sense that I will not get anything new out of it for the work that I'm doing. It's not productive work. It's information for me personally because I get updated, but it does not really help what I'm supposed to be doing—productive work. That's why I describe it as a waste of time.

None of the informants felt guilty during their flow experiences—only afterwards. Presumably guilt doesn't enter a Web user's consciousness during flow because it is irrelevant to the task at hand, just like the factors that were discussed in the previous section. Consider the following comment from Informant 7:

I knew that time was passing I guess, but I didn't stop to think or look at the clock and say, 'Hey I started ten minutes ago', or stop to think that maybe I shouldn't be doing this perhaps.

The guilt experienced by some Web users is similar to the guilt experienced by television viewers who spend a great deal longer in front of the set than they plan to. Kubey and Csikszentmihalyi (2002, p. 65) reported that, for some television viewers, 'a twinge of unease or guilt that they aren't doing something more productive may also accompany and depreciate the enjoyment of prolonged viewing'.

Further evidence of the guilt experienced by Web users is provided by the Eighth Job Futures/Saulwick Opinion Poll of Employee Sentiment (Saulwick & Muller 2003), which revealed that more than 91 per cent of Australian workers believe that surfing the Net and playing computer games at work is inappropriate. This study was based on a national survey of 1 000 Australians who were either in the workforce or seeking employment.

No formal propositions are made about guilt in this theory because the study did not identify all of the relationships pertaining to this concept. For example, the study did not reveal why some informants feel guilty about their flow experiences when others do not. The relationship between flow and guilt could be an interesting area for future research.

Justification

Many informants who recalled feeling guilty after their flow experiences needlessly tried to justify their actions during their interviews. Some informants described their flow experiences on the job as stress relief to help them contend with work pressures and inadequate breaks. Others emphasised the fact that they were learning from their searching and browsing activities. Table 7.6 provides some examples of the informants' comments.

Table 7.6. Sample comments from informants justifying the amount of time they spend on flow experiences.

Informant	Comment
3	Sometimes it's like a bit of stress management too when you just go to them and it's either funny, or it's nothing to do with your studies. So it sort of helps you to kick back for a little bit.
4	... other people do exactly the same. Other people at the end of the week just sit down in front of the computer and just have a bit of fun for a couple of hours, feel really refreshed and go home. Not very constructive. Not very—how do you say it—earning the money. But, you need that sometimes.
7	I might have had a busy morning and be coming up for a break. We don't usually actually have much of a break. It's just eating food at your computer. So I'll consider having a break actually eating while doing something a little bit more enjoyable—going on the Web and searching for a few things.
12	A lot of times a lot of the shows on TV—I don't particularly enjoy them. They're just rubbish. So you do something constructive. Not really constructive, but you know, sort of. I think it's a good learning tool, the Internet.
22	... there's things I should have been doing that are of more importance than finding out irrelevant statistics. [Giggles] ... But I mean, even useless information is information you're gaining.

The following comment from Agarwal and Karahanna (2000, p. 676) offers some explanation for the informants' attempts to justify their flow experiences:

Self-perception theory (Bem 1972) argues that individuals will seek to rationalize their actions and reduce cognitive dissonance (Festinger 1976). Cognitive dissonance as a psychological state arises when an individual holds two inconsistent cognitive structures at the same time. While in a state of cognitive absorption, the individual is experiencing gratification and pleasure from the task of software interaction. To the extent that a majority of social environments reward instrumental outcomes, cognitive dissonance arises. Therefore, there is likely to be a natural propensity to overlook the hedonistic or pleasurable aspects of an activity and to account for the time spent on the activity by attributing instrumental value.

In the informants' case, cognitive dissonance arose from a sense of time urgency on one hand, and the enjoyment associated with their time-consuming flow experiences on the other. The informants tried to rationalise their actions by explaining how the time spent on the activity contributed to stress relief, learning or some other meaningful outcome. They apparently did not consider enjoyment to be sufficient justification for the time that was spent.

Merging of action and awareness

In a discussion about the general dimensions of the flow experience, Csikszentmihalyi (1990, p. 53) comments that sometimes 'people become so involved in what they are doing that the activity becomes spontaneous, almost automatic; they stop being aware of themselves as separate from the actions they are performing'. This merging of action and awareness (see box 19 in Figure 4.1) is evident in the following comment from Informant 7:

I could probably even say a period of flow is just when ... you don't stop to think of what you were doing in the process ... you also definitely forget the fact ... that you're using a computer ... If you want to get philosophical about it, you and the computer become one I guess ... as you're thinking about things, you're directly connected to the computer to make it do and bring up what you want.

Informant 8 provided a similar comment, saying that he isn't fully aware of his actions while experiencing flow:

I'll just get on the Internet and ... I don't sort of realise what I'm doing, like I'm just lost until I want a drink or the phone rings or someone knocks at the door or something sort of, I don't know, snaps you out of it.

According to Csikszentmihalyi (1990, p. 54) the reason he called optimal experience 'flow' is that the word captures the seemingly effortless activity often described by his informants. 'The action carries us forward as if by magic', he says. Although the flow experience appears to be effortless, it is far from being so. Focused attention is required before action follows action seamlessly. Csikszentmihalyi's description of flow is reflected in the following comment from Informant 3 who experienced its 'hypnotic' effect while navigating back and forth between a search engine's page of results and the linked pages:

... you get into a search engine and you come up with a lot of sites and you're going backwards to these results from the search engine. Bang, bang, to the site. See if it's suitable. Back to the next one. Bang. And you might skip only a few sites, so you're covering lots of sites. It seems sort of hypnotic. Back, and then see the next one, see the next one, see the next one, see the next one.

For the purposes of this study, the merging of action and awareness described by these informants, and its relationship with flow will be defined as follows:

Definition 4.4: A merging of action and awareness is the feeling that an activity has become spontaneous or automatic, and the usual dualism between the individual and his or her actions has disappeared.

Proposition 4.4: A merging of action and awareness is a dimension of a Web user's flow experience. There is a positive correlation between the two concepts.

Sense of control

The flow experiences of some informants involved a sense of control (see box 20 in Figure 4.1). In some cases, this feeling manifested itself as an absence of any concerns about failure. For example, the following comment from Informant 14 suggests that the possibility of failure did not enter her mind during the particular flow experience being described. She was convinced that she would be able to find the information she was searching for, even though it was a very specific and uncommon topic:

That was one of those ones where I said, 'Right, I'm going to spend half an hour doing this'. But I was so tantalisingly close in so many of these sites I thought, 'It's got to be here somewhere'. And I ended up spending more time on it than I expected. It got me in. And so I guess that's the flow that you're talking about ... You are so close and you can see that it's got to be here somewhere in one of these sites ... I could see that ... in there somewhere, I was going to be able to find an answer.

Experienced Web users like Informant 14 are not the only ones who feel a sense of control while in flow. Informant 2, who had very little experience using the Web, described flow as 'empowering'. Flow gave her confidence in her ability to use the Web, and displaced her usual feelings of inadequacy around computers:

I find it quite empowering ... Hey, I'm not as silly as I think ... If I just concentrate on this I could use this much better ... For a person of my age—and I'm well into middle age—sometimes this [Gestures toward the computer] is disempowering to you, 'cause it's very much a modern generational thing. And you think to yourself ... I'm just never going to be up with this, and I'm just never going to keep up with it fast enough in the way it's changing ... And I just don't understand this. And it's scaring me. And then all this [flow] takes away that feeling of scariness. Hey, believe in yourself a bit. You're quite capable. This is not scary. This is not scary. It's just your lack of knowledge that you think it's scary. And it's not ... So it is an empowering thing.

The tremendous freedom of choice offered by the Web was a factor in some informants' comments about their sense of control. 'I can choose what I want to see and where I want to go', said Informant 18. 'If I was just directed by this program or something, I probably wouldn't get on as much. So, that's a very important thing'. Informant 12 contrasted the enormous variety of content offered by the Web with the comparatively limited offerings of television:

Every person I believe has certain interests in life. With TV, for example, you've got to watch what they present to you, whereas on the Web you can find stuff that you're interested in ... That's what I don't like about TV. Somebody thinks, 'Oh this show's funny. You should watch it'. They've got the canned laughter in the background, telling you when to laugh and stuff. It's just they're pushing the stuff to you. But I find with the Net you might have a certain interest and you can just concentrate on that.

When describing the sense of control that accompanies flow, some informants referred to the fact that their activity was just between them and the computer. Nobody else was involved. They were pleased to be free from the influence, guidance or control of others. Consider the following comment from Informant 18:

There's no one there. You don't have to waste anyone else's time. It's just you and the computer. So no one's there holding the information, waiting for you to access it.

Informant 2 made a similar remark about the autonomy afforded by the Web. She appreciated the fact that nobody was around to make judgements about her activities, or to observe the difficulties she encountered while using the Web:

... this is very empowering for me, because it's between me and the computer. Nobody knows who I'm talking to. Nobody's making any judgements about what I'm reading or what I'm seeing or having to help me.

For the purposes of this study, the sense of control described by these informants, and its relationship with flow will be defined as follows:

Definition 4.5: A sense of control is a feeling of empowerment or an absence of any concerns about failure.

Proposition 4.5: A sense of control is a dimension of a Web user's flow experience. There is a positive correlation between the two concepts.

Mental alertness

Some informants recalled feeling mentally alert during their flow experiences (see box 21 in Figure 4.1). For example, Informant 2 pointed to her fast navigation as evidence of fast thinking during flow:

... it's also speeding up my flow of thought a little ... I don't know whether that's an age thing, but with a book, I tend to read it, then think about it, and then read it again,

and then look for keywords. With this, [Gestures toward the computer] it makes me go much faster [Snaps her fingers] ... I'm thinking. I'm absorbing the information much faster. Therefore, of course, I can move from one page much faster to the other.

Some informants recalled feeling mentally alert during flow, even though they were physically tired when they started using the Web. Informant 12 made the following comment about flow experiences that occur late in the evening, before bedtime:

... I just come home from work and I just want to relax and I'll sit in front of the computer. You know, I'm tired and I'll think, 'I'll just surf the Web for a half hour or something and go to bed'. And before you know it, it's like two or three hours have gone ...

This comment from Informant 12 suggests that flow experiences actually prolong his waking hours, but fatigue eventually overtakes him, as he explains: 'All of a sudden you just feel tired or you realise it's time to go to bed or whatever'. Informant 16 provided a similar account of flow experiences that occur when he returns home from work at 1.00 am and starts using the Web:

I'll get home and I'll know that my body wants to sleep, but I don't feel tired. I assume it's because my mind's just active and I can't sleep. And it's not uncommon for me not to go to bed until about four thirty in the morning.

The mental alertness that these informants experience while using the Web is a marked contrast to the relaxed and passive feelings that people experience while watching television. Kubey and Csikszentmihalyi (1990, 2002) describe experiments in which researchers have monitored the brain waves (using an electroencephalograph or EEG), heart rate and skin conductance of people watching television. The EEG studies showed less mental stimulation, as measured by alpha brain-wave production, during viewing than during reading. Even when the TV set is turned off, 'the sense of relaxation ends ... but the feelings of passivity and lowered alertness continue' (Kubey & Csikszentmihalyi 2002, p. 64). Contrast this finding with the following comment from Informant 2, who is so stimulated by the Web that she has difficulty falling sleep when she uses it immediately before bedtime:

... it really stimulates me. It keeps me really wide awake. I don't feel tired, unlike a book, when I get to a point where I think, 'Oh, I've got to go to bed now' ... You can actually read books in bed and they send you to sleep ... I don't know about my body. It may tire. But my brain is going. So, even when I turn it off, I'll go to bed, and there'll be things going round and round. I'm lying there with a tired body and my brain, and I just can't get to sleep. And then I feel like getting back up and getting on again, but I don't for this very reason. 'Cause I know it will be five o'clock in the morning and I'll still be sitting there.

Although a feeling of mental alertness is not one of the dimensions of flow described by Csikszentmihalyi (see Chapter 2), it is consistent with the other dimensions, particularly the condition of focused attention on a particular task. The decision to include mental alertness in this theory as a dimension of flow seemed problematic when Informant 3 likened the flow experience to 'daydreaming with a focus'.

Daydreaming is not an activity that one normally associates with mental alertness. However, closer analysis of the informant's comments indicated that he was not comparing flow to a sleep-like state. Rather, he was demonstrating an awareness of the fact that flow, like daydreaming, is an altered state of consciousness. It feels distinctly different to ordinary waking consciousness. The informant's qualification that flow feels like daydreaming *with a focus* reinforces the suggestion that persons in flow feel focused and mentally alert.

For the purposes of this study, the feeling of mental alertness described by these informants, and its relationship with flow will be defined as follows:

Definition 4.6: Mental alertness is the feeling of being mentally responsive, perceptive, attentive or quick.

Proposition 4.6: Mental alertness is a dimension of a Web user's flow experience. There is a positive correlation between the two concepts.

Telepresence

One of the informants (13) who participated in the study recalled experiencing flow while exploring the Active Worlds site (<http://www.activeworlds.com>), a network of three-dimensional (3D) virtual worlds created by individuals and organisations. As illustrated in Figure 7.1, the form and appearance of these virtual worlds is limited only by the builder's imagination. They include houses, castles, spaceships, shopping malls, distant planets and other environments too numerous to mention. Users are represented by a 3D avatar of their choice as they explore Active Worlds and interact with others. Avatars can be made to walk, run, jump, fly and express a range of emotions.

In describing his experience at the Active Worlds site, Informant 13 said that he felt as though he was present in the environment generated by the computer. He forgot that he was just looking at pixels on a screen:

I hadn't seen that level of interactivity before in a site. It really caught my interest. You could walk through, and there were not just different communities set up, but different worlds set up. So you might step through and you'd be at the Grand Canyon, or on the surface of Mars. There were no limitations. A lot of work had been put into it. I think for me, with flow, when I forget that it's just a group of pictures, when I forget that it's just text and a bit of HTML code in the background—that for me is flow ... I'm envisioning boxes. When I download I'm grabbing things out of boxes. It's not just coding anymore ... I think I get a sense of depth too. It's not just the screen there. There's so much more behind it.

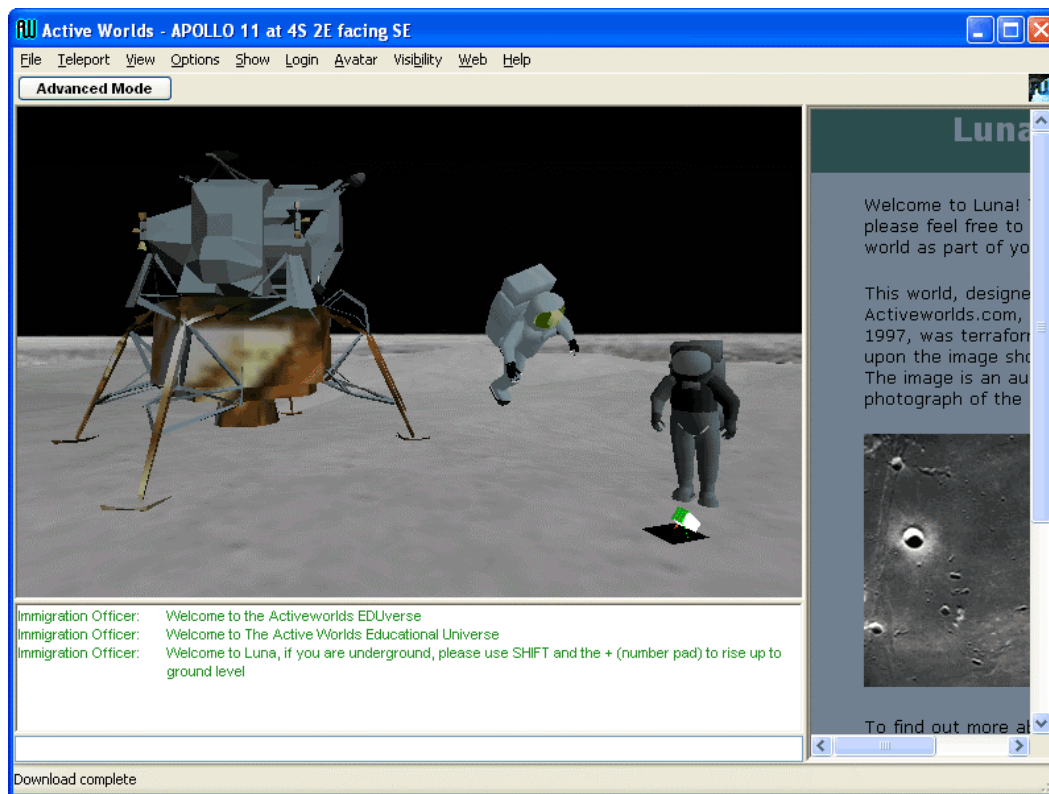


Figure 7.1. The Active Worlds site (<http://www.activeworlds.com>) allows users to explore a network of 3D virtual worlds such as the surface of the Moon.

The sense of 'being there' described by Informant 13 is known in the literature as telepresence (see box 22 in Figure 4.1). This theory will adopt Steuer's (1992, p. 76) definition of telepresence, which was provided in Chapter 2:

Definition 4.7: Telepresence is the experience of presence in an environment by means of a communication medium.

The environment referred to in this definition may be a real environment such as a distant space viewed through a video camera, or a non-existent environment such as an animated world in a video game.

Draper, Kaber and Usher (1998) note that various terms are used in the literature to describe the displacement of a user's self-perception into a computer-mediated environment—presence, telepresence, synthetic presence, virtual presence, social presence and ego presence—but all of these terms refer to the same phenomenon. They recommend using telepresence as a general term.

As mentioned in Chapter 2, Steuer (1992) suggests that two key technological variables help to induce a sense of telepresence: vividness and interactivity. Vividness is the sensory richness of a mediated environment. Interactivity is the extent to which users can modify the form and content of a mediated environment in real time. Naimark (1990), Sheridan (1992) and Zeltzer (1992) identified similar variables in their discussions of telepresence determinants. It is interesting that Informant 13

referred to both vividness and interaction when discussing his fascination with the Active Worlds site. 'This mainly appealed to me through the level of graphics and the interaction', he said.

One seemingly important determinant of telepresence that is not mentioned in Steuer's model is focused attention. Draper, Kaber and Usher (1998, p. 365) remarked that 'attentional concepts have been largely neglected as explanations of telepresence'. This neglect seems odd, given that presence, or the natural perception of one's physical environment, depends so much on attention. Fontaine (1992, p. 483) discussed the relationship between presence and attention:

When engaged in tasks ... we are often much less than 100% "present" psychologically. Our mind may be occupied by events that happened on the way to the task, a previous task, the next one, the narrow range of ecological characteristics of the task that have proven to be important in the past, characteristics of the people or facility unrelated to the task, a problem at home, how badly we need a vacation, and so forth. We are not "tuned-in" to the ecology of the immediate task. Because so many tasks are routine and predictable, we do not need to be. We can get by on being 25% "present."

When individuals use the Web they perceive two separate environments simultaneously: the real environment in which they are physically present, and the virtual environment presented by the computer. As explained earlier in this chapter, a Web user's awareness of his or her physical surroundings is reduced during flow because attention is focused on the task at hand. All irrelevant thoughts—including awareness of one's surroundings—disappear from consciousness. If the strength of a telepresence experience depends on the extent to which an individual feels present in the computer's virtual environment, as opposed to his or her physical environment, then focused attention must be a key determinant of telepresence. The following comment from Witmer and Singer (1998, p. 226) provides strong support for the argument that the experience of telepresence in a virtual environment (VE) requires the ability to focus on a particular set of stimuli, to the exclusion of unrelated stimuli:

Presence in a VE depends on one's attention shifting from the physical environment to the VE, but does not require the total displacement of attention from the physical locale. In fact, humans experience varying degrees of presence in a physical locale; typically attention is divided between this physical world and the mental world of memories, daydreams, and planned activities. The mental world may also include information portrayed in books, movies, or via a VE. Thus, individuals experiencing a VE can concurrently attend to aspects of the VE and events in their physical environment. How sharply users focus their attention on the VE partially determines the extent to which they will become involved in that environment and how much presence they will report. Whether there is a threshold for the allocation of attentional resources that must be reached before presence is experienced remains an open question, but is it reasonable to assume there is a threshold, and that the increased allocation of attentional resources beyond this threshold will result in a heightened sense of presence. That is, presence may vary across a range of values that depends *in part* on the allocation of attentional resources.

Draper, Kaber and Usher (1998, p. 366) also agree that 'telepresence can be interpreted as a state arising from commitment of attentional resources to the computer-mediated environment'. They go so far as to suggest that telepresence may simply be a by-product of focusing one's attention on a coherent, meaningful set of stimuli, rather than an important phenomenon in its own right:

The most important hypothesis that can be drawn from the attentional model is that telepresence is not, in fact, a very important phenomenon. It appears that it may be a by-product of attentional resource allocation and may have no clear impact on either performance or workload. It may even be an attentional phenomenon packaged in a demand characteristic; one wonders what responses a researcher might elicit by asking about attentional focus rather than perceptions of presence. This is a troubling proposition, given the wide use of the term and general acceptance of the merit of telepresence as a design goal. Such a hypothesis certainly demands empirical verification (Draper, Kaber & Usher 1998, p. 369).

The important role that focused attention plays in determining telepresence may explain why some of the informants in this study recalled experiencing feelings that resembled telepresence at sites that were not particularly vivid or interactive. For example, while describing a flow experience, Informant 1 said, 'You only see this little nineteen-inch diagonal world in front of you, and nothing else matters'. He also spoke about coming 'back to reality' when the flow experience ended:

... you're concentrating on what you're doing instead of being distracted all the time. As soon as you're distracted you come back to reality. I find that if you can't figure out how to get there it's back to reality, and you think, 'Oh well. I should be doing something else at any rate'.

Informant 7 also spoke about entering his 'own little world' while experiencing flow:

It's also difficult to stand outside and look at yourself while you're doing it because if you were looking at yourself doing it, you might think I'm in my own little world maybe.

These comments are curious because the Web sites that the informants were talking about contained plain text and images, not virtual 3D environments. The sites did not exhibit the high levels of vividness or interactivity that Steuer identified as determinants of telepresence, but the informants' experiences at those sites did involve focused attention. Whether these experiences could be described as telepresence under current definitions is debatable. Perhaps it would be more fitting to refer to them as states of 'immersion' or 'involvement' (Witmer & Singer 1998, p. 227). It is very difficult to be precise about such concepts when 'at present we have no theory of presence, let alone a theory of telepresence or virtual presence' (Sheridan 1992, p. 120). Nevertheless, it seems appropriate that telepresence should at least be identified as a dimension of the flow experiences of Web users interacting with virtual 3D environments.

Proposition 4.7: Telepresence is a dimension of a Web user's flow experience when the user's information-seeking activity involves interacting with a three-dimensional

environment by means of a computer. There is a positive correlation between the concepts of telepresence and flow.

Although telepresence is not one of the general dimensions of flow described by Csikszentmihalyi (see Chapter 2), the suggestion that it is a possible dimension of flow in the Web environment is not without precedent. Novak, Hoffman and Yung (2000) included telepresence as a construct in their structural equation model of the flow experiences of Web users. Draper, Kaber and Usher (1998, p. 363) also hypothesised about the relationship between flow and telepresence. Having observed the common 'attentional foundation' and other characteristics shared by the two phenomena, they suggested that 'it may even be that telepresence is a flow experience that occurs during teleoperation'. Clearly, the relationship between flow and telepresence deserves recognition and further investigation.

Summary

The flow experiences of Web users vary in duration, frequency and intensity. The study's informants recalled flow experiences ranging in duration from a few minutes to several hours. Some informants claimed to experience flow on an almost daily basis, while for others it was a much less frequent occurrence. Not all flow experiences elicit the same intensity of feelings.

Enjoyment is a common factor in all flow experiences, but among Web users it appears to be linked to discovery—finding, learning or observing something for the first time. The study provided some support for the idea that flow experiences encourage repeated use of the Web, but it did not substantiate the suggestion that flow encourages repeated visits to a particular site.

One of the consequences of a Web user's attention being focused on a searching or browsing activity during flow is that there is no room leftover in one's consciousness for irrelevant thoughts. Informants reported having a reduced awareness of their physical surroundings, their interactions with other people, their usual worries and concerns, their physical needs, the navigation path they followed, and even their original reason for using the Web.

Informants reported that time seemed to pass much faster than usual during their flow experiences. Hours slipped by as if they were minutes. Focused attention appears to be the key factor affecting the variability of a Web user's time judgements. Presumably the thought of time passing doesn't enter a user's consciousness during flow because it is irrelevant to the task at hand, just like the factors that were mentioned in the previous paragraph.

The distorted sense of time described by the informants helps to explain the paradox of why Web users with a sense of time urgency will spend much longer searching or browsing for information than they plan to. While they experience flow, they are unaware of exactly how much time they are devoting to the activity. Afterwards they

may feel guilty about other responsibilities that could have been attended to during that time, about using an employer's time or facilities for personal activities, or about spending so much time on a 'non-productive' activity. Many informants who recalled feeling guilty after their flow experiences needlessly tried to justify their actions during their interviews.

A few informants recalled becoming so involved in their flow experiences in the Web environment that their activities became almost automatic; they stopped being aware of themselves as separate from the actions they were performing.

The flow experiences of some informants involved a sense of control. In some cases, this feeling manifested itself as an absence of any concerns about failure, even when searching for very specific and uncommon information. In other cases, informants experienced a sense of empowerment that displaced their usual feelings of inadequacy around computers.

Some informants recalled feeling more mentally alert during their flow experiences, even if they were physically tired when they started using the Web.

Finally, one informant who experienced flow while exploring a network of 3D virtual worlds, said that he felt as though he was present in the environment generated by the computer. Focused attention appears to be a key determinant of feelings of telepresence. Curiously some informants recalled experiencing feelings that resemble telepresence while engaged with sites that contained plain text and images, not virtual 3D environments. The relationship between flow and telepresence deserves recognition and further investigation.

Personal characteristics of Web users

This chapter discusses personal characteristics that influence an individual's propensity to experience flow while seeking information on the Web: curiosity and personal interests, time urgency, navigation skill and absorption. This chapter also discusses various personal characteristics that were purposely investigated during the study, but which did not emerge as important factors: gender, age, educational attainments, occupation, Web experience, locus of control and need for cognition.

Curiosity and interest

Chapter 4 discussed the important role that curiosity plays in the formation of a Web user's information-seeking goals. Curiosity and the tendency to engage in information-seeking behaviour depend on individual differences. Mikulincer (1997, p. 1218) says that 'although some persons are eager to know new things and to explore surroundings, other persons are reluctant to seek new data and avoid exploration of unknown places, persons, or objects'. Evidently, curiosity can be understood as both a state and a trait. According to Loewenstein (1994, p. 78), 'state curiosity refers to curiosity in a particular situation, whereas trait curiosity refers to a general capacity or propensity to experience curiosity'.

No attempt was made to measure or compare the curiosity of informants who participated in this study. Investigations that compare the curiosity of individuals who differ demographically have produced a highly contradictory pattern of findings. Loewenstein (1994, p. 79) suggests that the reason for these inconsistent results could be that 'curiosity scales almost inevitably measure curiosity toward particular topics'. Clearly, an individual's level of curiosity as measured on a scale will depend on the match between the individual's own areas of curiosity and the particular topics included in the scale. For example, if females are generally more curious about childbirth than males, then a scale that includes items related to this particular topic will rank females higher in curiosity.

Curiosity arises from the landscape of an individual's pre-existing interests. According to Loewenstein (1994, p. 93), no psychological theory provides much insight into individual differences in interests—why certain people become interested in certain topics. All we know is that 'interests arise from a number of situational and dispositional factors associated with culture, socialization, age, sex, and genes'. Table 8.1 attempts to categorise the topics that this study's informants recalled seeking during their flow experiences. It provides some indication of the interests of this particular group of Web users.

Table 8.1. Topics that informants recalled searching or browsing for during flow experiences.

Category	Example topics
Computer hardware	memory, modems, motherboards, video cards
Computer software	newly released software, open source software, programming tutorials, shareware, software libraries, software utilities
Entertainment	jokes, magazines, music, pornography, television shows, movies
Health	cancer, mineral supplements, pregnancy
Hobbies	cars, fashion, guitar tablature, home brewing, motorbikes, scrapbooking, song lyrics, travel
News	background information on news stories, current affairs, international news, IT industry news, national news, opinions on news stories, tabloid news
Real estate	builders, house plans, properties for sale
Solutions to problems	computer-related problems, work-related problems, programming errors, questions from library patrons
Sports	boxing, fishing, fitness programs, motor racing, Tai Chi, Zen Do Kai
Web design	counters, design ideas, guest books, page layouts, pictures, sounds
Miscellaneous	bulletin boards, cheap flights, DVD players, exhibiting beef cattle, film reviews, freedom of the press, Great Barrier Reef, legal acts, queer theory, statistics

Time urgency

As discussed in Chapter 4, another factor that plays an important role in the formation of a Web user's information-seeking goals is time urgency. Time urgency, like curiosity, can depend on individual differences. It was certainly more evident in the comments of some informants than others in this study. For example, the number of references to time urgency made by Informant 15 was significantly higher than the number of references made by some other informants (see Table 8.2).

Table 8.2. References to time urgency made by Informant 15.

I want the information and I want it straight away.
I enjoy the fact that if the information I'm looking for is there and it's correct information, I can get it straight away.
... if I know it's online and I can get that document in five minutes that's what I like the best about it.
I also don't like when you can actually have times when it is a little bit slow.
I don't like it when because of the Internet being a bit slow ... that holds you up from doing whatever it is you need to do on the Web.
The speed of access to information, and coming across information that you mightn't have thought of.
If I have a topic in mind and I'm on a deadline or a tight schedule, then I need to keep to that core information I'm looking for.
This is going to save me some time down the track, getting this information now.
I've normally got such a tight schedule that I can't afford to let myself get too sidetracked.
I've usually got a time scheduled for everything.
But do I have the time to look at that now?
I think some people view it as fun or entertaining or something else that they can do with their time, whereas I never have enough time.
I find it as a handy tool for getting access to information fast, really. That's what I find.
It's there. It's a convenient product. It gives me access to fast information. I get what I'm looking for. And I've finished with it.

Time urgency has been a topic of interest in psychology for many years. It is a central component of the well-known Type A behaviour pattern (TA or TABP) that was introduced in the 1950s as a complex clinical syndrome believed to be related to coronary heart disease (Friedman & Rosenman 1974). Day and Jreige (2002, p. 109) provide the following description of a Type A individual:

TABP may involve behavioral dispositions (e.g., aggressiveness, competitiveness, and lack of patience) as well as specific and observable behaviors (e.g., muscle tenseness and accelerated rate of speech; Lee, Ashford, & Jamieson, 1993). Type A individuals tend to strive to achieve as much as they can in the least amount of time (Matthews & Haynes, 1986), to self-impose an overload of work (Dembroski & McDugall, 1978), and to have a sense of time urgency (M. Friedman & Ulmer, 1984; Organ & Hui, 1995). Individuals with TABP tend to be very critical of themselves (M. Friedman & Ulmer, 1984), tend to set high expectations for themselves, and may believe others have these same high expectations of them as well (Smith, 1986). Ganster, Sime, and Mayes (1989) found that Type A individuals tended to work longer hours and more overtime hours.

TABP can be measured using various self-report instruments such as the Bortner scale, the Framingham scale, and the Jenkins Activity Scale, but no attempt was made to measure TABP for the informants who participated in this study. Doing so seemed pointless because, as Thoresen and Powell (1992, p. 595) argue, 'research on the Type A behavior pattern (TA) has been plagued by inadequate theory, insensitive

assessment, and insufficient interventions'. Enthusiasm for TABP has been waning since the 1980s as contrary research findings have stimulated concern about basic conceptual issues and assessment issues.

Edwards, Baglioni, and Cooper (1990) recommend replacing dubious global measures of TABP with measures of specific TABP dimensions, but even this suggestion is not easily applied. Time urgency has traditionally been viewed as a one-dimensional construct in measures of TABP, but Landy et al. (1991) concluded that it is a multidimensional construct with seven distinct facets. A follow-up study conducted by Conte, Landy and Mathieu (1995) confirmed these findings and suggested a more parsimonious time urgency construct with five dimensions: time awareness, scheduling, list making, eating behaviour, and deadline control.

According to Landy et al. (1991, p. 648), the suggestion that time urgency is a multidimensional construct is important because 'it implies that relationships between various facets of time urgency and other variables of interest ... may differ'. For example, there may be little or no relationship between flow and eating-related time urgency, but the relationship between flow and task-related time urgency may be substantial.

Skill

A Web user's skill is an influential factor in determining flow or frustration during information-seeking activities. When the challenge of the activity is matched by the user's skill, the user makes progress toward a successful outcome and the experience has the potential to induce flow. When the challenge exceeds the user's skill, the experience becomes frustrating, either because the user fails to find the item of interest or because the search takes too long. This topic was discussed in detail in Chapter 5.

Absorption

Chapter 6 identified focused attention as a necessary, but not sufficient, condition for the occurrence of flow during information-seeking activities. Individuals vary in their ability to focus attention. Tellegen and Atkinson (1974, p. 268) defined a trait known as *absorption*, which is described as 'a disposition for having episodes of "total" attention that fully engage one's representational (i.e., perceptual, enactive, imaginative, and ideational) resources'. Some of the informants who participated in this study demonstrated an awareness of their propensity to engage in episodes of focused attention. For example, Informant 12 said:

When you're really concentrating on one thing, you just don't retain any information about another thing. I think I've been like that for quite a while. Even before I started using the Internet.

Tellegen (1981) refined the operational definition of the absorption trait variable and developed a widely used measure called the Tellegen Absorption Scale (TAS). Agarwal & Karahanna (2000, p. 667) state that 'there is substantial agreement in the literature that TAS represents a useful and adequate measure of the trait of absorption'. No attempt was made to measure or compare the trait of absorption for informants who participated in this study because I was unaware of this trait during the data collection and analysis phase.

Sampling dimensions

The theoretical sampling procedure for this study involved consciously varying the gender, age, educational attainments, occupations and Web experience of the selected informants, with the aim of uncovering a broad range of perspectives. These personal characteristics were compared with other data for patterns and relationships through the process of open coding. The data displays described in Chapter 3 were particularly useful for this activity.

None of these personal characteristics emerged as important categories in the study. We cannot say conclusively that these factors play no role in the flow experiences of Web users, but the data analysis provided no grounds for including them in the theory. Categories and properties must earn their way into a grounded theory (Glaser 1998, p. 148).

Locus of control and need for cognition

Two aspects of the informants' personalities that were purposely investigated during this study were locus of control and need for cognition. As mentioned in Chapter 3, each informant was asked to complete two questionnaires measuring these factors after their interviews.

Locus of control

Locus of control is a personal view about how much external forces control and influence events in one's life. Individuals with a high *internal* locus of control believe for the most part that the rewards and punishments they experience are contingent upon their own actions. In contrast, individuals with a high *external* locus of control believe for the most part that the rewards and punishments they experience are contingent upon unstable forces such as luck, chance, or the control of powerful others.

Locus of control was investigated in this study because Wallace (1999, pp. 172–173) has suggested that people with a high internal locus of control may enjoy the sense of control that the Internet affords, and consequently spend significant amounts of time online. Table 8.3 lists each informant's score on Rotter's (1973) internal-external

locus of control scale together with the number of hours they spent using the Web each week. The rows of the table are sorted in ascending order of the locus of control scores, which potentially range from 0 (most internal) to 23 (most external).

Table 8.3. The informants' locus of control scores and corresponding weekly Web usage values.

Informant	Locus of control score	Hours of Web use per week
17	2	1–5
11	3	10–20
14	4	10–20
1	6	20–40
3	8	1–5
5	8	10–20
10	8	1–5
6	9	5–10
16	9	20–40
8	10	5–10
19	10	1–5
21	10	1–5
7	11	5–10
18	11	5–10
2	12	1–5
12	12	20–40
15	12	20–40
13	12	10–20
20	12	5–10
22	13	5–10
9	15	1–5
4	16	10–20

A two-way chi-square test was conducted to determine whether the locus of control scores and the weekly Web usage values were independent or related. Informants were nominally categorised as either 'most internal' or 'most external' depending on whether their locus of control scores were less than or greater than the median (10). Informants were also nominally categorised as either 'low usage' or 'high usage' depending on whether they used the Web for less than or more than 10 hours per week. A 2×2 contingency table was constructed on the basis of these categories (see Table 8.4). The observed frequencies (o) were placed in the appropriate cells and the corresponding expected frequencies (e) were calculated.

Table 8.4. Contingency table for the informant's locus of control scores and weekly Web usage values.

Weekly Web usage	Locus of control score		
	Most internal ($\leq$ median)	Most external ($>$ median)	
Low (≤ 10 hours)	o = 7 e = $13 \times 12 \div 22 = 7.09$	o = 6 e = $13 \times 10 \div 22 = 5.91$	Row total = 13
High (> 10 hours)	o = 5 e = $9 \times 12 \div 22 = 4.91$	o = 4 e = $9 \times 10 \div 22 = 4.09$	Row total = 9
	Column total = 12	Column total = 10	Total = 22

The χ^2 statistic was calculated using the following formula:

$$\chi^2 = \sum_i \frac{(|o_i - e_i| - 0.5)^2}{e_i}$$

The result was 0.127. The formula for the χ^2 statistic includes Yate's correction for continuity because the contingency table was a 2×2 table with only 1 degree of freedom.

Shaughnessy and Zechmeister (1997, p. 392) recommend that in contingency tables with only 1 degree of freedom, the χ^2 statistic should not be used if any expected frequencies are less than 10. However, Runyon et al. (1996, p. 598) report that some researchers have found that ' χ^2 is very robust against a violation of this requirement'.

The tabulated critical χ^2 value for $\alpha = 0.05$ and 1 degree of freedom was 3.841. The calculated χ^2 value of 0.127 was considerably smaller than the critical value, suggesting that the informants' locus of control scores and weekly Web usage values were not significantly related. Comparing the locus of control scores with other data by means of two-way chi-square tests and qualitative data displays failed to reveal any relationships worth investigating further.

Need for cognition

Need for cognition refers to 'an individual's tendency to engage in and enjoy effortful cognitive endeavors', that is, thinking (Cacioppo & Petty 1982, p. 116; Cacioppo, Petty & Kao 1984, p. 306). Need for cognition was investigated in this study because Verplanken, Hazenberg and Palen wen (1992) have demonstrated that individuals with a high need for cognition are motivated to expend more cognitive effort on information searches than individuals with a low need for cognition. Table 8.5 lists each informant's score on Cacioppo, Petty and Kao's (1984) need for cognition scale together with the number of hours they spent using the Web each week. The rows of the table are sorted in ascending order of the scores, which potentially range from 1 (lowest need) to 7 (highest need).

Table 8.5. The informants' need for cognition scores and corresponding weekly Web usage values.

Informant	Need for cognition score	Hours of Web use per week
22	3.78	5–10
21	3.89	1–5
5	4.06	10–20
19	4.11	1–5
15	4.56	20–40
3	4.67	1–5
18	4.78	5–10
4	4.83	10–20
9	4.94	1–5
10	5.17	1–5
6	5.39	5–10
12	5.44	20–40
17	5.44	1–5
8	5.50	5–10
20	5.50	5–10
7	5.56	5–10
2	5.67	1–5
1	5.71	20–40
11	5.78	10–20
16	5.78	20–40
13	6.33	10–20
14	6.50	10–20

A two-way chi-square test was conducted to determine whether the need for cognition scores and the weekly Web usage values were independent or related. Informants were nominally categorised as either 'low need' or 'high need' depending on whether their need for cognition scores were less than or greater than the median (5.415). Informants were also nominally categorised as either 'low usage' or 'high usage' depending on whether they used the Web for less than or more than 10 hours per week. A 2×2 contingency table was constructed on the basis of these categories (see Table 8.6). The observed frequencies (o) were placed in the appropriate cells and the corresponding expected frequencies (e) were calculated.

Table 8.6. Contingency table for the informant's need for cognition scores and weekly Web usage values.

Weekly Web usage	Need for cognition score		
	Low need ($\leq$ median)	High need ($>$ median)	
Low (≤ 10 hours)	$o = 8$ $e = 13 \times 11 \div 22 = 6.5$	$o = 5$ $e = 13 \times 11 \div 22 = 6.5$	Row total = 13
High (> 10 hours)	$o = 3$ $e = 9 \times 11 \div 22 = 4.5$	$o = 6$ $e = 9 \times 11 \div 22 = 4.5$	Row total = 9
	Column total = 11	Column total = 11	Total = 22

The χ^2 statistic was calculated to be 0.752 using the formula provided in the previous section. The tabulated critical χ^2 value for $\alpha = 0.05$ and 1 degree of freedom was 3.841. The calculated χ^2 value was considerably smaller than the critical value, suggesting that the informants' need for cognition scores and weekly Web usage values were not significantly related. Comparing the need for cognition scores with other data by means of two-way chi-square tests and qualitative data displays failed to reveal any relationships worth investigating further.

Theorising with quantitative data

The two-way chi-square tests described in the preceding sections were not conducted with the aim of proving or disproving the existence of any relationships between the individuals' weekly Web usage and their locus of control or need for cognition. Rather, the primary aim of these tests was to determine whether there was any potential for exploring these concepts further through interviews and subsequent coding. Recall from Chapter 3 that the grounded theory method is for building theory, not verifying it. Grounded concepts are suggested, not proven. The resulting theory is an integrated set of propositions, not findings.

Some readers may wonder why the locus of control scores and need for cognition scores were not compared with some quantitative measure of the informants' flow experiences. No suitable quantitative measure of flow was available for that purpose. Consideration was given to the idea of quantifying the informants' comments about the intensity or frequency of their flow experiences, but the comments were too imprecise to be quantified. For example, when asked how often he experienced flow while using the Web, Informant 7 provided the following response:

It's difficult to tell, but I would say with me it would probably happen fairly regularly, even if it's just from the sense of I'll be in the flow, searching for something that I want, and if it only happens for a minute and I find what I want, then I go back to the task I was doing before.

The development of a quantitative measure of flow that incorporates the dimensions identified by this study is an opportunity for future research.

Other flow activities

All of the informants in this study recalled experiencing flow while engaged in activities other than seeking information on the Web. Table 8.7 attempts to categorise these activities. Not surprisingly, leisure activities featured prominently in the examples provided by the informants. According to Csikszentmihalyi (1990, p. 72), activities such as sports, games, art and hobbies are conducive to flow because 'they have rules that require the learning of skills, they set up goals, they provide feedback, they make control possible'. In short, they are designed to facilitate concentration and to make optimal experience easier to achieve.

Table 8.7. Activities that produced flow experiences for informants.

Category	Example activities
Work activities	closing up a restaurant, doing housework, teaching school children, writing a computer program
Web activities	building Web sites, chatting online
Sporting activities	basketball, bodysurfing, boxing, cycling, fishing, golf, karate, running, squash, surfing, swimming, touch football, wakeboarding, walking
Musical activities	playing flute, playing guitar, playing piano, song-writing
Other leisure activities	conversing with friends, cooking, creating scrapbook pages, gardening, playing computer games, playing with one's children, repairing computers, reading novels, sewing, tap-dancing, watching television, writing short stories

As expected, when informants described their non-Web-related flow experiences they mentioned many of the same concepts that emerged in this study. For example, Informant 1 experiences flow while playing the flute. His description of the experience, which follows, refers to challenge, skill, a clear goal, immediate feedback, focused attention and a distorted sense of time.

I play flute. I've spent many hours playing five-finger exercises ... There's some very complicated finger movements you get, you know. [Demonstrates finger movements] One note's that, the next note's that, you know, that, that, then that, that. And you get quite complicated finger exercises ... Many times I've sat there and started at the bottom note. By the time you've worked your way to the top note, you think, 'Oh that's good. Ooh'. [Gives a look of surprise] You've spent three hours doing it. You've allocated yourself an hour to practise these things and three hours later you get through. 'Cause you'll do it once and you'll say, 'Oh no, that's not quite even enough'. Do it again a couple of times and slow it down and you get it even. You try to get each note even. So, yeah. Many a time, flute practice has turned into three hours when I'm supposed to be half an hour or an hour.

Summary

This study identified several personal characteristics that influence an individual's propensity to experience flow while seeking information on the Web: curiosity and personal interests, time urgency, navigation skill and absorption. Data was gathered about other personal characteristics of the informants, such as gender, age, educational attainments, occupation, Web experience, locus of control and need for cognition, but these factors did not emerge as important categories in the study.

All of the study's informants recalled experiencing flow while engaged in activities other than seeking information on the Web. Not surprisingly, leisure activities featured prominently in the examples they provided. When informants described their non-Web-related flow experiences they mentioned many of the same dimensions that were discussed in Chapter 7.

Evaluation

This chapter assesses the quality of this study against three, somewhat overlapping, sets of evaluation criteria. They include four principles that have been proposed by various scholars as appropriate criteria for judging a qualitative study, four principles that were proposed by Glaser (1978, pp. 4–5; 1992, p. 15; 1998, pp. 236–238) for evaluating theory, and seven principles that were proposed by Klein and Myers (1999) for evaluating interpretive field studies in information systems.

As explained in Chapter 3, this study was designed to be consistent with the assumptions of the postpositivist research paradigm, as defined by Guba and Lincoln (1994), and the interpretive research paradigm, as defined by Orlikowski and Baroudi (1991). There are recognisable similarities between Guba and Lincoln's description of postpositivist research and Orlikowski and Baroudi's description of interpretive research. The terms *postpositivist* and *interpretive* may be used interchangeably in this thesis.

It is very important to use appropriate criteria when assessing the quality of a study. Chapter 3 explained how the nature and purpose of interpretive research differs from research guided by other paradigms such as positivism or critical theory. Markus and Lee (1999, p. 36) report that in their experience as authors and editors they have found that 'some readers inappropriately use positivist criteria to judge interpretivist intensive research, and others inappropriately use interpretivist criteria to judge positivist intensive research'. Glaser and Strauss (1967, p. 224) encountered the same problem with critics of grounded theory more than thirty-five years ago:

This criticism stems from sociologists taking as their guide to credibility the canons of rigorous quantitative verification on such issues as sampling, coding, reliability, validity, indicators, frequency distributions, conceptual formulation, hypothesis construction, and presentation of evidence. But in this book we have raised doubts about the applicability of these canons of rigor as proper criteria for judging the credibility of theory based on flexible research.

Principles for evaluating qualitative research

Twenty years ago 'qualitative researchers shared no canons, decision rules, algorithms, or even any agreed-upon heuristics to indicate whether findings were valid and procedures robust' (Miles & Huberman 1994, p. 262). That situation has changed somewhat. Today, concepts such as internal validity, external validity, reliability and objectivity are widely acknowledged as appropriate criteria for judging a qualitative study (Creswell 1994, p. 157–159; Merriam 1998, pp. 198–212; Miles & Huberman 1994, pp. 277–280; Minichiello et al. 1995, p. 175–188; Yin 1994, pp. 32–38), although they are sometimes referred to by different names such as 'credibility (paralleling internal validity), transferability (paralleling external validity), dependability (paralleling reliability), and confirmability (paralleling objectivity)' (Guba & Lincoln 1994, p. 114).

Internal validity

Internal validity is the degree to which a study's findings correctly map the phenomenon in question (Creswell 1994, p. 158; Merriam 1998, pp. 201–205; Miles & Huberman 1994, p. 279; Minichiello et al. 1995, pp. 175–178; Yin 1994, p. 33). Do the study's findings make sense? Are they credible to the study's informants and its readers? Are the findings an authentic portrait of the phenomenon in question?

The semi-structured in-depth interviews that were used for data collection in this study allowed me to 'stay close to the empirical world in order to ensure a close fit between the data and what people actually say and do' (Minichiello et al. 1995, p. 176). By probing for the informants' perceptions and cross-checking for discrepancies, I obtained as accurate an understanding of the informants' words as I could. The following comment from Merriam (1998, p. 203) indicates that internal validity should be viewed as a strength of this study:

Reality, according to Lincoln and Guba (1985), is "a multiple set of mental constructions ... made by humans; their constructions are on their minds, and they are, in the main, accessible to the humans who make them" (p. 295). And because human beings are the primary instrument of data collection and analysis in qualitative research, interpretations of reality are accessed directly through their observations and interviews. We are thus "closer" to reality than if a data collection instrument had been interjected between us and the participants.

The constant comparative method of analysis that was used during this study also lends support to its claim of internal validity. Concepts (categories and properties) were generated by comparing incidents in the data and looking for patterns. As concepts emerged, they were compared with other incidents for verification, and with other concepts for establishing the best fit with the data. The resulting theory is congruent with reality because it emerged from the data; it was not imposed or forced upon it.

Of course, there is always the possibility that new data may reveal a significant concept or relationship that was overlooked during the course of this study. In that event, the theory would be modified to accommodate the variation. It would not be discarded entirely. The topic of modifiability is discussed later in this chapter.

External validity

External validity is the degree to which a study's findings can be generalised to other settings similar to the one in which the study occurred (Creswell 1994, p. 158; Miles & Huberman 1994, p. 279; Merriam 1998, pp. 207–212; Minichiello et al. 1995, pp. 177–178; Yin 1994, p. 33). Do the study's findings have any larger import? Are they transferable to other contexts? How far can they be generalised?

Strauss and Corbin (1998, p. 267) suggest that the external validity of theory-building research should be discussed in terms of 'explanatory power' rather than generalisability. The more systematic and widespread the theoretical sampling, the more conditions and variations will be discovered, and the greater the explanatory power of the theory will be. The theoretical sample for this study was large enough and diverse enough to saturate the emerging concepts and produce a rich, integrated theory with no obvious unexplained exceptions. It meets the test of external validity 'in its ability to speak specifically for the populations from which it was derived and to apply it back to them' (Strauss & Corbin 1998, p. 267).

Reliability

Reliability is the extent to which a study's findings can be replicated, or reproduced, by another researcher (Creswell 1994, p. 159; Merriam 1998, pp. 205–207; Miles & Huberman 1993, p. 278; Minichiello et al. 1995, pp. 178–179; Yin 1994, pp. 36–38). The qualitative notion of reliability is quite different to the quantitative view because, unlike experiments in a laboratory, social phenomena are very difficult to reproduce. It is often impossible to replicate the original conditions under which data were collected or to control all of the variables that affect the findings. Strauss and Corbin (1998, pp. 266–267) provide the following definition of reliability or 'reproducibility' in the context of qualitative research:

Given the same theoretical perspective of the original researcher, following the same general rules for data gathering and analysis, and assuming a similar set of conditions, other researchers should be able to come up with either the same or a very similar theoretical explanation about the phenomenon under investigation.

One prerequisite for allowing other researchers to repeat an investigation is that the original researcher must document his or her procedures (Yin 1994, p. 36). Chapter 3 of this thesis is written in such a manner that 'any reader or prospective researcher can find details of how and why the researcher made certain decisions in the research process; their perceived impact on researcher and informant/s; how the data were collected ... and how they were analysed' (Minichiello et al. 1995, p. 178).

The high level of intercoder agreement that was achieved during this study also provides some evidence that the theory is reliable and 'not just a figment of the investigator's imagination' (Ryan & Bernard 2000, p. 785). As discussed in Chapter 3, during the open coding phase of the study a second researcher was employed to independently code three of my interview transcripts and to compare her renditions with mine. Intercoder reliability was measured using a formula provided by Miles and Huberman (1994, p. 64). The results for all three comparisons were better than the 70% agreement that Miles and Huberman recommend.

Objectivity

Objectivity is the extent to which a study's findings are free from bias (Miles & Huberman 1994, p. 278; Minichiello et al. 1995, pp. 175–176). In short, do the conclusions depend on the subjects and conditions of the research, rather than on the researcher? In qualitative research, objectivity does not mean controlling variables, since social phenomena in natural settings follow a natural course. Rather, objectivity means:

... openness, a willingness to listen and to "give voice" to respondents, be they individuals or organizations. It means hearing what others have to say, seeing what others do, and representing these as accurately as possible. It means having an understanding, while recognizing that researchers' understandings often are based on the values, culture, training, and experiences that they bring to the research situations and that these might be quite different from those of their respondents (Strauss & Corbin 1998, p. 43).

During this study I attempted to limit the intrusion of bias by applying the following suggestions from Strauss and Corbin (1998, pp. 43–46):

- Think comparatively. Compare both incidents in the data and emerging concepts, looking for similarities and differences among them.
- Obtain multiple viewpoints to determine how different individuals view the phenomenon in question. The more persons that are interviewed, the more the researcher is able to build variations into the evolving theory, and to check his or her interpretations against alternative explanations.
- Question whether the findings fit the reality of the data.
- Maintain an attitude of scepticism. Treat all theoretical explanations, categories and hypotheses as provisional, and validate them against data in subsequent interviews.
- Follow the essential features of the research method: making comparisons against incoming data, asking questions, sampling on the basis of emerging concepts, and alternating data collection with analysis.

Principles for evaluating theory

According to Glaser (1978, pp. 4–5; 1992, p. 15; 1998, pp. 236–238) a well-constructed theory will satisfy four essential criteria: fit, work, relevance and modifiability. These criteria engender trust because when a theory fits the data, works, has relevance to people in the area of study, and can be readily modified, it has 'grab'. People feel like they can use such a theory meaningfully because it makes sense to them. This section will compare the theory that was developed in this study against each of these criteria.

Fit

The first criterion for a credible theory is that it must fit the data it purports to represent. The theory that was developed in this study satisfies this criterion because, like all grounded theories, it was generated systematically from the data. Data were not forced to fit a preconceived theory. The concepts and relationships that comprise this theory are readily applicable to and indicated by the data that was collected. The numerous direct quotes from informants that serve as exemplars of concepts and relationships throughout Chapters 4 to 7 provide the reader with some evidence of this fit (Glaser 1978, p. 4; 1992, p. 15; 1998, p. 236).

Workability

A theory that works is able to explain what happened or what is happening in an area of substantive or formal inquiry. The theory that was developed in this study satisfies this criterion because it accounts for the variation in the experiences of the informants with no obvious unexplained exceptions. When the theory is compared against the raw data, it is able to explain the individual cases (Glaser 1978, pp. 4–5; 1992, p. 15; 1998, p. 237).

Relevance

The third criterion for a well-constructed theory is that it must be relevant to people associated with the area of study—informants, practitioners, researchers and others. The theory that was developed in this study satisfies this criterion because the semi-structured in-depth interviews that served as the primary source of data focused on what was important from the informants' perspective. The informants would have had difficulty engaging with the interviews if the subject matter was abstract, trivial or irrelevant to them (Glaser 1978, p. 5; 1992, p. 15; 1998, p. 236).

The study's relevance to researchers and practitioners in the field of human-computer interaction is evidenced by the *International Journal of Human-Computer Studies'* acceptance and subsequent publication of the results (Pace in press). The study was very well received by the journal. One reviewer's response to my paper commenced

with the following words: 'This is a well-presented and useful study on an important topic for human-computer studies and I recommend unreservedly that it be published'.

Modifiability

Theory must be readily modifiable so that when new data reveal variations in certain concepts or relationships, one is not forced to discard the theory entirely. The theory that was developed in this study satisfies this criterion because a key element of the constant comparative method of analysis is the progressive modification and refinement of the evolving theory. Whenever new data presented variations in emerging concepts during analysis, the theory was modified to accommodate those variations. The resulting theory is so intimately linked to the data that it is destined to last even if new data reveal necessary modifications (Glaser 1978, p. 5; 1992, p. 15; 1998, p. 237).

Principles for evaluating interpretive field studies

Klein and Myers (1999) have proposed a set of seven principles for conducting and evaluating interpretive field studies in information systems. This section assesses the study against each of those principles. The nature of interpretive research was discussed in Chapter 3 within the context of Orlikowski and Baroudi's (1991) system for classifying major research paradigms. Klein and Myers (1999, p. 69) provide the following definition of interpretive research:

IS research can be classified as interpretive if it is assumed that our knowledge of reality is gained only through social constructions such as language, consciousness, shared meanings, documents, tools, and other artifacts. Interpretive research does not predefine dependent and independent variables, but focuses on the complexity of human sense making as the situation emerges (Kaplan and Maxwell 1994); it attempts to understand phenomena through the meanings that people assign to them (Boland 1985, 1991; Deetz 1996; Orlikowski and Baroudi 1991).

Fundamental principle of the hermeneutic circle

The fundamental principle of the hermeneutic circles suggests that 'we come to understand a complex whole from preconceptions about the meanings of its parts and their interrelationships' (Klein & Myers 1999, p. 71). In the case of this investigation, 'a complex whole of shared meanings' emerged from my interaction with the study's informants. Both the informants and I commenced the study with preliminary understandings about the nature of flow and the experiences of Web users, but through our interviews and subsequent analysis, a cohesive theory emerged.

During the course of the study I moved back and forth between the stories of individual informants (the parts), and the emerging theory that captured the full meaning of those separate stories (the whole). As explained in Chapter 3, the concepts and relationships that emerged during analysis are abstractions in the sense that they represent elements of not one informant's story, but rather the stories of many informants. Their relevance to all informants in the study gives them explanatory power.

Principle of contextualisation

The principle of contextualisation 'requires critical reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged' (Klein & Myers 1999, p. 72). The researcher seeks meaning in context. In studies of organisations this could involve setting each case in its social, historical, political or economic context.

The subject matter of this study was not discussed within a social or historical setting because the analysis focused on specific experiences of individual informants. Individuals rather than organisations were the units of analysis. It could be argued that this study sought meaning in context by asking the informants to relate specific flow experiences and the circumstances surrounding those experiences—what information they were searching or browsing for, which sites they visited, what those sites looked like, and so on. Klein and Myers (1999, p. 88) acknowledge that their proposed principles 'cannot be applied mechanistically', and that 'it is incumbent upon interpretive scholars to appropriate them and use their own judgement as to their specific application'.

Principle of interaction between the researcher and the subjects

The principle of interaction between the researcher and the subjects 'requires critical reflection on how the research materials (or "data") were socially constructed through the interaction between the researchers and participants' (Klein & Myers 1999, p. 72). Application of this principle involves recognising the influence that a study's informants have on the researcher, and conversely the influence that the researcher has on the informants.

In the case of this investigation, the semi-structured in-depth interviews that were used for data collection undoubtedly affected how the informants viewed their experiences in the Web environment and how they related those experiences to me. Consequently, that interaction influenced the type of data I obtained. Chapter 3 documented my awareness of these effects by discussing practices such as:

- formulating interview questions in the language of the informants;

- sorting the interview questions into an order that avoided 'coming on too strong' early in the interviews;
- setting the right tone for the interviews by discussing the contents of the project information sheet with the informants;
- relating to informants on their own terms and creating an atmosphere in which they felt comfortable talking openly about their experiences;
- minimising any potential discomfort for the informants by using a small unobtrusive recorder during the interviews;
- improvising follow-up questions, probes, prompts and other interventions during the interviews to pursue topics that were of importance to the informants;
- being sensitive to how my words and gestures affected the informants' responses; and
- analysing changes in the interpersonal climate during interviews, such as the occasions when informants who recalled feeling guilty after their flow experiences needlessly tried to justify their actions.

Principle of abstraction and generalization

The principle of abstraction and generalization 'requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that describe the nature of human understanding and social action' (Klein & Myers 1999, p. 72). In other words, although the preceding principles highlight the situated nature of interpretive research, interpretive researchers can and do make abstractions and generalisations from their work.

This study related the particulars of the informants' stories to abstract concepts and relationships that apply to the experiences of many Web users. As explained in Chapter 3, informants were selected according to their potential for developing emerging concepts, through a process known as theoretical sampling. The gender, age, educational attainments, occupations and Web experience of the selected informants were deliberately varied with the aim of uncovering a broad range of perspectives. Similarities that were found in the data while attempting to maximise differences among the informants indicated general uniformities within the theory.

Principle of dialogical reasoning

The principle of dialogical reasoning 'requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings ("the story which the data tell") with subsequent cycles of revision' (Klein & Myers 1999, p. 72). The application of this principle involves making transparent the

fundamental philosophical assumptions of the research and any other preconceptions or prejudices that guided it.

Chapter 3 made the intellectual basis of this study transparent by discussing topics such as:

- the assumptions of the postpositivist or interpretive research paradigm that guided this study (Guba & Lincoln 1994; Lincoln & Guba 2000; Orlikowski & Baroudi 1991);
- the factors that influenced my decision to use the grounded theory research method for this study;
- the philosophical roots of grounded theory;
- my position in relation to current debates about grounded theory;
- preconceptions that I absorbed from my review of the literature prior to entering the field of study;
- my views about the extent to which grounded theory researchers can avoid preconceived ideas;
- evidence that I suspended my knowledge of the literature and allowed a theory to emerge from the data, rather than trying to substantiate a preconceived model; and
- my professional experience as a Web designer and lecturer in multimedia, and the influence it had on my theoretical sensitivity.

Principle of multiple interpretations

The principle of multiple interpretations 'requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study' (Klein & Myers 1999, p. 72). The researcher must confront apparent contradictions in the data, and revise his or her understanding accordingly.

As discussed in Chapter 3, the data for this study primarily consisted of semi-structured in-depth interviews with multiple informants of varying gender, age, educational attainments, occupations and Web experience. Concepts (categories and properties) were generated by comparing incidents in the data and looking for patterns. As concepts emerged, they were compared with other incidents for verification, and with other concepts for establishing the best fit with the data. When new data presented variations in emerging concepts, the theory was modified to accommodate them. As Glaser (1998, p. 237) explains, accounting for variation in the data is a critical step in the development of grounded theory: 'The theory does not force the data, the theory gets modified by it'.

Principle of suspicion

The principle of suspicion 'requires sensitivity to possible "biases" and systematic "distortions" in the narratives collected from the participants' (Klein & Myers 1999, p. 72). The principle of suspicion was not applied to the comments of the informants in this study because the key to understanding their flow experiences was taking their recollections at face value, not imposing my assumptions and preconceived ideas on their words. As explained in Chapter 3, experiences are subjective phenomena and therefore cannot be externally verified. The only way a researcher can get at what goes on in the minds of his or her informants is to rely to some degree upon their testimony. Klein and Myers (1999, p. 78) acknowledge that the principle of suspicion may be inappropriate for some studies:

The application of the principle of suspicion appears to be one of the least developed in the IS research literature. However, since there is considerable disagreement among interpretive researchers concerning the extent to which social research can (or should be) critical (Deetz 1996), we leave open the possibility that some interpretive researchers may choose not to follow this principle in their work.

It could be argued that the principle of suspicion was applied to this study in the sense that I maintained an attitude of scepticism toward the developing theory, rather than the comments of the informants. All theoretical explanations, concepts and hypotheses were treated as provisional, and validated against data in subsequent interviews.

Summary

This chapter reinforced the credibility of this study by demonstrating how it satisfied the following evaluation criteria:

- four principles that are widely acknowledged as appropriate criteria for judging a qualitative study: internal validity, external validity, reliability and objectivity (Creswell 1994, p. 157–159; Merriam 1998, pp. 198–212; Miles & Huberman 1994, pp. 277–280; Minichiello et al. 1995, p. 175–188; Yin 1994, pp. 32–38);
- four principles proposed by Glaser (1978, pp. 4–5; 1992, p. 15; 1998, pp. 236–238) for evaluating theory: fit, work, relevance and modifiability; and
- seven principles proposed by Klein and Myers (1999) for evaluating interpretive field studies in information systems: the fundamental principle of the hermeneutic circle; the principle of contextualisation; the principle of interaction between the researcher and the subjects; the principle of abstraction and generalization; the principle of dialogical reasoning; the principle of multiple interpretations; and the principle of suspicion.

Discussion

This chapter compares the theory that was developed during this study with the general dimensions of flow proposed by Csikszentmihalyi (1975, pp. 35–54; 1990, pp. 48–70; 1993, pp. 178–187; 1996, pp. 110–123) and the structural model of the flow experiences of Web users developed by Novak, Hoffman and Yung (2000). This chapter also discusses the theory's implications for practitioners.

Comparing Csikszentmihalyi's dimensions of flow

Chapter 2 recounted Csikszentmihalyi's (1975, pp. 35–54; 1990, pp. 48–70; 1993, pp. 178–187; 1996, pp. 110–123) discovery of a set of structural characteristics that distinguish flow activities from the rest of everyday life: clear goals and feedback; a balance between the challenges of an activity and the skills required to meet those challenges; concentration on the task at hand; a sense of control; a merging of action and awareness; a loss of self-consciousness; a distorted sense of time; and the autotelic experience. This section compares each of these general dimensions of flow with the theory that emerged during this study.

Clear goals and feedback

Csikszentmihalyi's (1993, p. 178) first dimension of flow is described as follows:

Clear goals: an objective is distinctly defined; immediate feedback: one knows instantly how well one is doing.

The concepts of goals and feedback featured prominently in this study. This theory proposes that regardless of whether a Web user is engaged in directed searching or exploratory browsing, the individual has a goal of finding some item of interest quickly. The item of interest may be as specific as the answer to a particular question or as vague as somebody's definition of a 'cool site', but the fundamental goal is the same in each case.

The feedback on a Web user's actions is the appearance of a new page. Every time a Web user clicks a link, he or she can quickly tell how well the current search is progressing by inspecting the new page that appears. The speed at which a new page appears depends on the time it takes to download the document from the host Web server. Slow downloads interfere with the user's ability to maintain focused attention on the task at hand, and may even lead to frustration.

Balance between challenges and skills

Csikszentmihalyi's (1993, p. 178) second dimension of flow is described as follows:

The opportunities for acting decisively are relatively high, and they are matched by one's perceived ability to act. In other words, personal skills are well suited to given challenges.

The concepts of challenge and skill featured prominently in this study. This theory proposes that Web users face certain mental challenges as they try to attain their goal of finding an item of interest within the shortest time possible. Depending on the nature of their searching or browsing activity, these challenges may include: negotiating a vast, constantly changing, uncharted information space; selecting suitable key words for a search engine query; using the correct syntax for a search engine query; distinguishing relevant links from irrelevant links; dealing with a large collection of potentially relevant links; scanning a page for relevant information; and understanding the content and non-linear structure of a Web site.

When the challenge of the activity is matched by the Web user's skill, the user makes progress toward a successful outcome and the experience has the potential to induce flow. When the challenge exceeds the user's skill, the experience becomes frustrating, either because the user fails to find the item of interest or because the search takes too long. The important factor in determining flow or frustration is not the absolute challenge of the activity, nor the absolute level of the user's skill, but rather the relative balance between the two. In order to achieve flow, the user must perceive the challenge to be high in relation to his or her skills, but not so high that it is unreachable. The reason why both expert and novice users can experience flow is the Web's capacity to immediately provide a challenge that matches any individual's interests and level of skill.

Concentration on the task at hand

Csikszentmihalyi's (1993, p. 178) third dimension of flow is described as follows:

Concentration on the task at hand; irrelevant stimuli disappear from consciousness, worries and concerns are temporarily suspended.

This theory identifies concentration or focused attention on the task at hand as a necessary condition for the flow experiences of Web users. This point was evident in

many of the informants' comments. The close relationship between focused attention and flow was also evident in the fact that some informants recalled feeling mentally alert during their flow experiences.

The higher-than-average challenges associated with searching and browsing activities in the Web environment play a major role in focusing attention on the task at hand. Interesting content and links also help to attract and maintain a Web user's attention.

Web users face various distractions that have the potential to shift their attention and terminate a flow experience. Informants mentioned environmental distractions such as loud noise or interruptions from family members; physiological distractions such as hunger, fatigue or a need to use the toilet; and computer-related distractions such as software error messages, a broken Internet connection, or a browser that stops responding. A poorly designed user interface can also be a distraction.

Merging of action and awareness

Csikszentmihalyi's (1993, p. 178) fourth dimension of flow is described as follows:

Action and awareness merge; one-pointedness of mind.

This theory identifies a merging of action and awareness as a dimension of the flow experiences of Web users. A few informants in this study recalled becoming so involved in their flow experiences in the Web environment that their activities became almost automatic; they stopped being aware of themselves as separate from the actions they were performing.

Sense of control

Csikszentmihalyi's (1993, p. 178) fifth dimension of flow is 'a sense of potential control'.

This theory identifies a sense of control as a dimension of the flow experiences of Web users. In the case of some informants this feeling manifested itself as an absence of any concerns about failure, even when searching for very specific and uncommon information. In other cases, informants experienced a sense of empowerment that displaced their usual feelings of inadequacy around computers.

Loss of self-consciousness

Csikszentmihalyi's (1993, p. 178) sixth dimension of flow is described as follows:

Loss of self-consciousness, transcendence of ego boundaries, a sense of growth and of being part of some greater entity.

Although none of this study's informants specifically mentioned losing awareness of their own being or identity during flow, they did recall experiencing a reduced awareness of factors that were irrelevant to the task at hand, including some factors that were closely related to the self. These factors included the informants' physical surroundings, their interactions with other people, their usual worries and concerns, their physical needs, the navigation path they followed, and even their original reason for using the Web. This theory identifies reduced awareness of irrelevant factors as a dimension of the flow experiences of Web users.

Distorted sense of time

Csikszentmihalyi's (1993, p. 179) seventh dimension of flow is an 'altered sense of time, which usually seems to go faster'.

This theory identifies a distorted sense of time as a dimension of the flow experiences of Web users. It was one of the most common dimensions of flow described by the informants in this study. In each case, informants reported that time seemed to pass much faster than usual during flow. Presumably the thought of time passing doesn't enter a Web user's consciousness during flow because it is irrelevant to the task at hand.

Autotelic experience

Csikszentmihalyi's (1993, p. 179) eighth and final dimension of flow is described as follows:

Experience becomes autotelic: If several of the previous conditions are present, what one does becomes autotelic, or worth doing for its own sake.

Although this theory does not use the term 'autotelic experience', it does identify enjoyment as a dimension of the flow experiences of Web users. The enjoyment that this study's informants derived from their flow experiences appeared to be linked to discovery—finding, learning or observing something for the first time. The study provided some support for the idea that flow experiences encourage repeated use of the Web, but did not substantiate the suggestion that flow encourages repeated visits to a particular site. The flow experiences of Web users depend on many more factors than the design or content of a particular Web site.

Compatible theories

This comparison has demonstrated the high level of agreement that exists between the general dimensions of flow proposed by Csikszentmihalyi and the theory that emerged during this study. All of Csikszentmihalyi's general dimensions of flow feature in this theory of the flow experiences of Web users.

Comparing Novak, Hoffman and Yung's model

Chapter 2 described a conceptual model of the flow experiences of Web users that was developed by Hoffman and Novak (1996) on the basis of their understanding of the literature. This conceptual model laid the groundwork for a structural equation model that was later developed, refined and validated by Novak, Hoffman and Yung (2000). This section compares and contrasts the grounded theory that emerged during this study with the hypotheses that were tested through Novak, Hoffman and Yung's structural model.

Hypotheses 1 and 2

Novak, Hoffman and Yung's (2000, p. 27) study supported the following hypotheses: (H1) 'greater skill at using the Web and greater perceived control during the Web interaction correspond to greater flow while using the Web'; and (H2) 'greater challenge and arousal correspond to greater flow'. To understand the full import of these statements, it is necessary to examine the definitions of the constructs that are involved: skill, control, challenge, arousal and flow.

Novak, Hoffman and Yung (2000, p. 27) described challenge as 'the consumer's opportunities for action on the Web', and skill as 'the Web consumer's capacity for action during the online navigation process'. As Chen, Wigand and Nilan (1999) correctly pointed out, challenge was not defined in terms of a specific Web activity, but rather as a general experience of Web users. This point is evident from the survey items that Novak, Hoffman and Yung (2000, p. 28) used to measure the challenge construct. Their survey instrument asked participants to respond to each of the following statements on nine-point rating scales:

- C1: Using the Web challenges me.
- C2: Using the Web challenges me to perform to the best of my ability.
- C3: Using the Web provides a good test of my skills.
- C4: I find that using the Web stretches my capabilities to my limits.
- C5: How much does the Web challenge you, compared to other things you do on the computer?
- C6: How much does the Web challenge you, compared to the sport or game you are best at?

The constructs of control and arousal in the hypotheses come from Massimini and Carli's (1988) eight-channel flow model, which was discussed in Chapter 2 (see Figure 2.2). Control corresponds to a state of high skill and moderate challenge.

Arousal corresponds to a state of high challenge and moderate skill. Novak, Hoffman and Yung's (2000, p. 25) structural model treats skill and control as 'multiple indicators of one higher-order construct', and challenge and arousal as 'multiple indicators of a second higher-order construct'.

Novak, Hoffman and Yung (2000, p. 22) defined flow as 'a cognitive state experienced during online navigation that is determined by (1) high levels of skill and control; (2) high levels of challenge and arousal; and (3) focused attention; and (4) is enhanced by interactivity and telepresence'. Like challenge, flow was not defined in terms of a specific Web activity. Instead, the survey instrument asked participants to respond to questions about the frequency of their flow experiences on nine-point rating scales:

- F1: Do you think you have ever experienced flow on the Web?
- F2: In general, how frequently would you say you have experienced flow when you use the Web?
- F3: Most of the time I use the Web I feel that I am in flow.

Consequently references to 'greater flow' in hypotheses 1 and 2 actually refer to increased frequency of flow experiences.

The theory that is presented in this thesis does not treat flow as a general experience of Web users like Novak, Hoffman and Yung's study. Since different activities present different challenges and call for different skills, this study focused on the flow experiences of Web users engaged in a specific activity—information-seeking.

This theory does not include any relationships involving the frequency of an individual's flow experiences. During this study frequency was identified as a property of flow, along with intensity and duration. Some informants claimed to experience flow on an almost daily basis, while for others it was a much less frequent occurrence. But nothing in the data pointed to a relationship between the frequency of a person's flow experiences and the challenges or skills associated with that individual's flow activities. This theory suggests that when the challenge of an information-seeking activity is matched by a Web user's skill, the user makes progress toward a successful outcome and the experience has the potential to induce flow, but this relationship does not involve frequency.

This study did not treat challenge as a general experience of Web users like Novak, Hoffman and Yung's investigation. In contrast, this study identified specific mental challenges that Web users face as they try to attain their information-seeking goals. Depending on the nature of their searching or browsing activity, these challenges may include: negotiating a vast, constantly changing, uncharted information space; selecting suitable key words for a search engine query; using the correct syntax for a search engine query; distinguishing relevant links from irrelevant links; dealing with a large collection of potentially relevant links; scanning a page for relevant information; and understanding the content and non-linear structure of a Web site.

The theory that was developed during this study did not include concepts of control and arousal as defined by Novak, Hoffman and Yung. In this study, the term control referred to one of the dimensions of the flow experience—a feeling of empowerment or an absence of any concerns about failure.

Hypothesis 3

Novak, Hoffman and Yung's (2000, p. 27) study supported the hypothesis that 'greater telepresence and time distortion correspond to greater flow' (H3). The theory that was developed during this study lists both telepresence and a distorted sense of time as dimensions of the flow experience, but does not treat them as antecedents of flow like Novak, Hoffman and Yung's structural model. Furthermore, this study does not relate either telepresence or a distorted sense of time to an increased frequency of flow experiences. As explained in Chapter 7, both telepresence and a distorted sense of time are consequences of the focused attention that a Web user in flow devotes to the task at hand.

Hypothesis 4

Novak, Hoffman and Yung's (2000, p. 30) study provided mixed support for the hypothesis that 'greater focused attention corresponds to greater flow, telepresence and time distortion' (H4). Their results did not support the idea that greater focused attention corresponds to greater flow. However, focused attention did correspond to greater telepresence and time distortion.

The theory that is presented in this thesis suggests a very important relationship between focused attention and flow. The lack of support for this relationship in Novak, Hoffman and Yung's study could be because, as mentioned earlier, their measure of flow actually measured the frequency of an individual's flow experiences. This theory agrees with the suggestion that focused attention is an antecedent of both telepresence and a distorted sense of time.

Hypothesis 5

Novak, Hoffman and Yung's (2000, p. 30) study supported the hypothesis that 'greater importance corresponds to greater focused attention' (H5). They described importance as 'enduring involvement' formed by the presence of 'situational and/or intrinsic self-relevance'. The theory that is presented in this thesis agrees with the suggestion that importance or involvement is an antecedent of focused attention. As discussed in Chapter 6, when Web users encounter interesting content and links that are relevant to their current goal, the discovery helps to maintain focused attention on the task at hand.

Hypothesis 6

Novak, Hoffman and Yung's (2000, p. 30) study provided mixed support for the hypothesis that 'greater speed of interaction corresponds to greater focused attention, telepresence and time distortion, and flow' (H6). Their results indicated that greater speed of interaction corresponds to greater flow, but does not correspond to greater focused attention, telepresence or time distortion.

In contrast, the theory that was developed during this study suggests that short response times help a Web user maintain focused attention during information-seeking activities, which in turn influences feelings of telepresence and a distorted sense of time—two dimensions of the flow experience. As discussed in Chapter 6, lengthy response times interfere with a Web user's ability to maintain focused attention on the task at hand, and may even lead to frustration. This study does not relate speed of interaction to an increased frequency of flow experiences.

Hypothesis 7

Novak, Hoffman and Yung's (2000, p. 30) study supported the hypothesis that 'the longer the respondent has been using the Web, the greater the skill and control' (H7). In this new study, years of experience using the Web was employed as an indicator of a Web user's skill, along with confidence using the Web, frequency of Web use and hours of Web use per week. However, the level of a Web user's experience does not feature directly in the theory that emerged from the data.

Hypothesis 8

Novak, Hoffman and Yung's (2000, p. 30) study provided mixed support for the hypothesis that 'greater flow corresponds to greater exploratory behaviour' (H8). Exploratory behaviour was measured on an eight-item scale modified from Baumgartner and Steenkamp's (1996) 20-item exploratory buying behaviour tendencies scale. Novak, Hoffman and Yung's base model supported the hypothesis, but their revised model did not.

In this new study, exploratory browsing was acknowledged as one of two common modes of navigation behaviour—the other being directed searching. However, exploratory browsing does not feature directly in the theory that emerged from the data.

Hypothesis 9

Novak, Hoffman and Yung's (2000, p. 30) study did not support the hypothesis that 'greater flow corresponds to greater positive affect' (H9). Positive affect was dropped from their model in the measurement purification process. Novak, Hoffman and Yung (2000, p. 30) described the construct of positive affect as 'positive subjective

experiences' and measured it with a four-item scale from Havlena and Holbrook (1986). The survey instrument asked participants to indicate, on a nine-point rating scale, which items in the following pairs of adjectives best describe how they feel when using the Web. Items labelled with an R were reverse-scored.

- PA1: Happy/unhappy (R)
- PA2: Annoyed/pleased
- PA3: Satisfied/unsatisfied (R)
- PA4: Melancholic/contented

The theory that is presented in this thesis doesn't specifically refer to positive affect, but it identifies enjoyment as an important dimension of the flow experience. The lack of support for this relationship in Novak, Hoffman and Yung's study could be because they treated positive affect as a general experience of Web users, and because their measure of flow actually measured the frequency of an individual's flow experiences.

Hypothesis 10

Novak, Hoffman and Yung's (2000, p. 30) study supported the hypothesis that 'flow, and closely related constructs such as telepresence, time distortion, and exploratory behaviour, will be greater for respondents who use the Web for "Experiential" uses, such as online chat, and entertainment, than for "Task-Oriented" uses such as work, searching for specific reference information, or online job listings' (H10).

Commenting further on this result, they said:

These results suggest that online shopping and task-oriented activities involving product search do not yet offer the requisite levels of challenge and arousal, nor do they induce the sense of telepresence and time distortion, necessary to create a truly compelling online experience (Novak, Hoffman & Yung 2000, p. 40).

In stark contrast to this result, this new study documented the comments of Web users who have experienced flow while engaging in both kinds information-seeking activities—directed searching (task-oriented) and exploratory browsing (experiential).

Hypothesis 11

Novak, Hoffman and Yung's (2000, p. 30) study supported the hypothesis that 'consumers who more recently started using the Web are more likely to use it for experiential activities; those who have been using the Web for a long time are more likely to use it for task-oriented activities' (H11).

As mentioned earlier, the level of a Web user's experience does not feature directly in the theory that is presented in this thesis. The informants included both experienced

and inexperienced Web users, but data analysis provided no grounds for integrating that particular factor into the theory.

Informants were not asked whether they spent more time engaged in directed searching (task-oriented) or exploratory browsing (experiential) activities while using the Web, because it seemed unlikely that they could answer the question reliably. As explained in Chapter 4, directed searching and exploratory browsing are closely interrelated forms of navigation behaviour. Web users move back and forth between the two modes, often many times within the same session.

Hypothesis 12

Novak, Hoffman and Yung's (2000, p. 31) study supported the hypothesis that 'flow, and closely related constructs such as telepresence, time distortion, and exploratory behaviour, have a negative relationship with the length of time the respondent has used the Web' (H12).

As mentioned earlier, the level of a Web user's experience does not feature directly in the theory that is presented in this thesis. The informants included both experienced and inexperienced Web users, but data analysis provided no grounds for integrating that particular factor into the theory.

Both expert and novice Web users recalled past flow experiences during this study. As explained in Chapter 5, the important factor in determining flow appeared to be not the absolute challenge of an information-seeking activity, nor the absolute level of a Web user's skill, but rather the relative balance between the two. In order to achieve flow, a Web user must perceive the challenge to be high in relation to his or her skills, but not so high that it is unreachable. The reason why both expert and novice users can experience flow is the Web's capacity to immediately provide a challenge that matches any individual's interests and level of skill.

Rival theories

The theory that was developed during this study disagrees with many of the findings of Novak, Hoffman and Yung (2000). Many of the disagreements can be attributed to the manner in which Novak, Hoffman and Yung (2000) defined and measured the constructs in their structural model. Of particular note is their decision to treat challenge, flow and positive affect as general experiences of Web users rather than define and measure these constructs in terms of specific Web activities. Novak, Hoffman and Yung's (2000) decision to measure flow solely in terms of the frequency of a user's flow experiences is also problematic.

Implications for practice

Chapter 9 mentions that one of the requirements of a well-constructed theory is relevance to people associated with the area of study (Glaser 1978, p. 5; 1992, p. 15; 1998, p. 236). Thus, it is appropriate that this section discusses some implications for practitioners that arise from the theory developed during this study.

The theory suggests that the flow experiences of Web users depend on a complex network of factors, many of which are beyond the influence of individual Web designers. However, the theory also identifies certain characteristics of Web site design and content that can maximise opportunities to experience flow, or at least minimise obstructions to flow.

Exploiting curiosity

Chapter 4 discusses the important role that specific and diversive curiosity play in the formation of a Web user's information-seeking goals. Specific curiosity is the desire for a particular piece of information, and diversive curiosity is a more general seeking of stimulation or novelty. Web designers can encourage exploration of their sites by trying to arouse the curiosity of their visitors or potential visitors. For example, Informant 9 mentioned that some women's print magazines try to arouse the curiosity of their readers by publishing a password that provides access to a 'sealed section' on the magazine's Web site:

... if you buy the magazine it has a secret word and you can get into a sealed section, which I haven't ever done because I don't normally buy the magazine. But I've been to the site of this magazine and it says, 'Enter the password and you can see whatever'.

This marketing strategy encourages readers of the print magazine to visit the Web site to see the hidden content, and it encourages Web site visitors to purchase the magazine to obtain the password.

Being conscious of time urgency

Like curiosity, time urgency plays an important role in the formation of a Web user's information-seeking goals. Web designers can facilitate their visitors' need for speed by avoiding interface design elements that are unnecessarily time-consuming. Optimising navigation speed is an underlying principle of many common usability principles such as:

- minimising file sizes with the aim of reducing download times;
- organising content in a manner that is accessible in a minimal number of steps or clicks;

- using a consistent page layout to save users from having to familiarise themselves with a new layout every time they move to a new page; and
- presenting text in a manner that is easy to scan, rather than read word for word.

Matching challenges to the skills of users

Chapter 6 describes certain mental challenges that Web users face as they try to attain their goal of finding an item of interest quickly. These challenges play a major role in focusing attention on the task at hand, and some of them can be influenced by the decisions of Web designers. To improve the experiences of users, designers must ensure that the challenges presented by a site are at an appropriate level for the site's target audience.

To illustrate this idea, one of the challenges mentioned in Chapter 6 is understanding the content and non-linear structure of a Web site. Web designers can help users to successfully meet this challenge by providing a clear place to latch onto the content of a site, and by providing guidance in how to navigate through it. When a site contains difficult content, the designer needs to ensure that each new concept that is presented is within easy reach of a concept the user has already understood. A site's content and structure should be challenging enough to hold the attention of the target audience, but not so challenging that it frustrates them.

Focusing attention with interesting content

Chapter 6 discusses how interesting content and links help to attract and maintain a Web user's attention, which is a necessary condition for flow. The chapter identifies several reasons why Web users find certain content interesting, besides relevance to their current information-seeking goal. Congruence with personal interests and novelty are two key factors. Content properties such as credibility, correctness, currency, ease of understanding, rarity, emotional impact and aesthetic appeal also seem to be influential in maintaining a user's attention under some circumstances. Web designers who wish to make their sites more interesting can assess their content against these criteria.

Prolonging flow with sidetracks

Chapters 4 and 6 discuss how getting sidetracked can effectively prolong a Web user's flow experience. The expression 'getting sidetracked' refers to occasions when a Web user engaged in an information-seeking activity decides to pursue a different goal because his or her curiosity is aroused by interesting content or links that are not directly relevant to the task at hand. Getting sidetracked does not necessarily disrupt a flow experience. When Web users are sidetracked, their fundamental goal of finding an item of interest in the shortest time possible remains unchanged; it is only the item

of interest that changes. The user may move seamlessly from one phase of the flow experience to another.

Web designers who wish to hold users at their sites for as long as possible can consider increasing opportunities for getting sidetracked by selectively adding links to other content within the site that is likely to appeal to users. The recommendation services used by sites like Amazon.com (<http://www.amazon.com>) illustrate the application of this principle. Amazon attempts to ascertain the interests of its customers by examining the products they search for, view, purchase and rate. By comparing the activities of customers with similar profiles, the site's recommendation system is able to identify products that may be of interest to specific customers. Amazon's personalised pages present these recommendations in the form of links to product pages with labels like 'Customers who bought items in your recent history also bought such-and-such'.

Avoiding distracting interface elements

Chapter 6 explains how a poorly designed interface can disrupt a Web user's flow experience by taking attention away from the task at hand. The chapter identifies several examples of design elements that can interfere with the transparency of an interface, and by extension, the focus of a user's attention. These elements include lengthy response times, disorganised content, inconsistent navigation cues, poorly structured page layout, inappropriate use of colour, stale links, ambiguous link labels, and pop-up advertisements.

Rather than revisit these topics again, consider just one interface design element that is purposely intrusive and distracting—the pop-up advertisement. Asaravala (2003) reports that pop-up advertisements are popular with advertisers because their average click-through rates (6.5%) are considerably higher than those of traditional banner advertisements (0.3%). However, if pop-up advertisements are detrimental to the flow experiences of Web users, then they are likely to have a similarly detrimental effect on the amount of time that people spend on the host Web site. When considered in this light, site owners may wish to examine the impact that popup advertisements have on the attractiveness and long-term viability of their sites.

Enhancing discovery with surprise

Chapter 7 discusses an important and commonly reported characteristic of the flow experiences of Web users—the joy of discovery. Web designers may be able to enhance this feeling in users by building pleasant surprises into their sites. Laurel (1992, p. 90) points out that when we have no particular expectations, discovering new information is a relatively unremarkable experience. But 'discovery becomes more interesting when the new information is not what we might have expected—in other words it is a surprise'. Surprises in real life can be nasty as often as they are pleasant, but within the controlled environment of the Web they can be designed to always be pleasurable and safe from real-world consequences (Laurel 1992, p. 91).

Looking beyond usability

In recent years, an increasing number of scholars have called for the field of human-computer interaction to move beyond traditional human factors and usability, and to address design issues such as the psychology of emotion and aesthetic gratification (Cloninger 2002; Jordan 2000; Lenker 2002; Marcus 2002; Monk et al. 2002; Norman 2002; Shedroff 2001). Lenker (2002, p. 7), for example, writes about a 'tremendous backlash' that is currently working its way through the design community against the role that usability standards play in Web design. He suggests that current design principles based on usability ignore the needs of the whole person, and calls for the development of principles that address our multidimensionality:

The foundation of usability as a field has traditionally been based on the laudable desire to make software applications, such as word processors, easier for people to use ... Unfortunately, these principles have been overextended and have often been applied to the Web in inappropriate ways. More than being conglomerations of mere interfaces for tools such as car dashboards or microwave ovens ... the Web as a medium has come to primarily be a vehicle for human communication and interaction. It, therefore, should be treated as such, and new Web design standards should be developed that support this more sophisticated role (Lenker 2002, p. 4).

Rather than focus solely on usability, this study has taken a more holistic approach to understanding the experiences of Web users, exploring concepts such as enjoyment, frustration, discovery, surprise, curiosity, aesthetic gratification and guilt. The resulting theory presents a broader view of Web users than that which is found in most published research in the fields of information systems and human-computer interaction.

Taking this alternative view has not required a radical departure from the norms that characterise research within the fields of information systems and human-computer interaction. Usability has remained an important part of this study's approach. One need only consider the numerous references to traditional usability principles that appear throughout this thesis. As Jordan (2000, p. 6) notes, holistic or 'pleasure-based approaches' to human-computer interaction do not dispute the benefits of designing for usability:

It is important to note that pleasure-based approaches to human factors are not an alternative to usability-based approaches. Although usable products will not necessarily be pleasurable, products that are not usable are unlikely to be pleasurable. Usability, then, should be seen, in many cases, as a key component of pleurability. After all, what is the point of providing a user with a beautiful product with a vast array of functions if the design of the product makes it difficult to use to its full advantage?

Nevertheless, usability-based approaches are inherently limited because they tend to view people as 'little more than cognitive and physical processors' (Jordan 2000, p. 7). Clearly there are benefits to be had by investigating the relationships between people and computers in a more holistic manner.

Summary

The theory that was developed during this study is compatible with the general dimensions of flow proposed by Csikszentmihalyi (1975, pp. 35–54; 1990, pp. 48–70; 1993, pp. 178–187; 1996, pp. 110–123), but disagrees with many of the findings of Novak, Hoffman and Yung (2000). Many of the disagreements can be attributed to the manner in which Novak, Hoffman and Yung (2000) defined and measured the constructs in their structural model. Of particular note is their decision to treat challenge, flow and positive affect as general experiences of Web users rather than define and measure these constructs in terms of specific Web activities. Novak, Hoffman and Yung's (2000) decision to measure flow solely in terms of the frequency of a user's flow experiences is also problematic.

Practical suggestions for Web designers that have emerged from this theory include: encouraging site exploration by arousing the curiosity of users; avoiding interface design elements that slow users down; matching a site's challenges to the skills of its users; focusing the attention of users with interesting content; prolonging flow experiences by increasing opportunities for getting sidetracked; avoiding interface design elements that distract attention from the task at hand; enhancing discovery by building pleasant surprises into sites; and taking a more holistic view of users than the view encouraged by traditional usability approaches.

Conclusion

This chapter revisits the study's research questions and summarises the major components of the theory that was developed.

Revisiting the research questions

The aim of this study was to answer the question: What is the nature of flow, as experienced by Web users engaged in information-seeking activities? This central research question had eight associated research questions. This section revisits each of those research questions in the light of the theory that emerged from the data.

Question 1

Research question 1 asked: What are the salient features and dynamics of the flow experiences of Web users? The theory described in Chapters 4 to 7 provides a comprehensive explanation of the features and dynamics of the flow experiences of Web users engaged in information-seeking activities. While there are too many details to summarise here, this is probably an appropriate point at which to provide a constitutive definition of flow.

Definition 4.8: Flow is a state of consciousness that is experienced when one's attention is intently focused on an enjoyable activity that is challenging, but achievable. For Web users with an information-seeking goal, the flow experience is characterised by a joy of discovery, a reduced awareness of factors that are irrelevant to the task at hand, a distorted sense of time, a merging of action and awareness, a sense of control, mental alertness, and in some circumstances, telepresence.

An important distinction between this study and other investigations into the flow experiences of Web users is the way it has gone beyond sheer associations to propose explanations for how and why certain events occur—explanations that are grounded in the data rather than deduced from the literature. The grounded theory research method, with its close-up look, deals well with the complex network of concepts and relationships in a human-computer system. It provides researchers with powerful

tools for identifying abstract concepts, discerning their interaction and determining the flow of connected events over time. The method has revealed shortcomings in other theoretical approaches that have been used to study the flow experiences of Web users.

Question 2

Research question 2 asked: Under what conditions are Web users likely to experience flow? The theory that was developed during this study identifies two conditions that are necessary for a Web user to experience flow during an information-seeking activity: (1) focused attention on the activity; and (2) a balance between the challenge of the activity and the user's skill in meeting that challenge. Chapter 5 discussed specific mental challenges that Web users face when searching or browsing for information. Chapter 6 identified various factors that contribute to a user's focused attention, such as interesting content and links, an absence of distractions, and a usable interface.

Question 3

Research question 3 asked: How do the flow experiences of Web users compare with the general dimensions of flow proposed by Csikszentmihalyi? Chapter 10 highlighted the consistency between the theory that was developed during this study and the general dimensions of flow proposed by Csikszentmihalyi, namely: clear goals and feedback; a balance between the challenges of an activity and the skills required to meet those challenges; concentration on the task at hand; a sense of control; a merging of action and awareness; a loss of self-consciousness; a distorted sense of time; and the autotelic experience. All of these dimensions were evident in the flow experiences of the Web users who participated in this study.

Question 4

Research question 4 asked: What makes information-seeking on the Web an activity that is conducive to experiencing flow? Information-seeking activities in the Web environment contain key elements that are necessary for experiencing flow: goals, challenges that focus the attention of users, and feedback that tells users how close they are to achieving their goals. A Web user's goal is to find some item of interest quickly. Web users engaged in directed searching have a clearly defined goal, and those engaged in exploratory browsing have an ill-defined goal, but the important point is the presence of a goal in each case. The challenges that a Web user may face while searching or browsing for information will be summarised in the next section. Both expert and novice Web users can experience flow while seeking information because of the Web's capacity to immediately provide a challenge that matches any individual's interests and level of skill. A Web user's feedback is the appearance of a new page, which he or she judges to be either interesting or uninteresting, relevant or irrelevant.

Question 5

Research question 5 asked: What challenges do Web users perceive when seeking information and what skills do they employ in dealing with those challenges? Chapter 5 identified specific mental challenges that Web users face as they try to attain their goal of finding an item of interest quickly. Depending on the nature of their searching or browsing activity, these challenges may include: negotiating a vast, constantly changing, uncharted information space; selecting suitable key words for a search engine query; using the correct syntax for a search engine query; distinguishing relevant links from irrelevant links; dealing with a large collection of potentially relevant links; scanning a page for relevant information; and understanding the content and non-linear structure of a Web site.

Question 6

Research question 6 asked: Does a Web user's skill level influence his or her propensity to experience flow, and if so how? Chapter 5 identified a Web user's skill as a determining factor in his or her flow experiences. When the challenge of an information-seeking activity is matched by the user's skill, the user makes progress toward a successful outcome and the experience has the potential to induce flow. When the challenge exceeds the user's skill, the experience becomes frustrating, either because the user fails to find the item of interest or because the search takes too long. The important factor in determining flow or frustration is not the absolute challenge of the activity, nor the absolute level of the user's skill, but rather the relative balance between the two. In order to achieve flow, the user must perceive the challenge to be high in relation to his or her skills, but not so high that it is unreachable.

Question 7

Research question 7 asked: What characteristics of individual Web users influence their propensity to experience flow? Chapter 8 identified several personal characteristics that influence an individual's propensity to experience flow while seeking information on the Web: curiosity, personal interests, time urgency, navigation skill and absorption. Data was gathered about other personal characteristics of the informants, such as gender, age, educational attainments, occupations, Web experience, locus of control and need for cognition, but these did not emerge as important categories in the study.

Question 8

Research question 8 asked: What characteristics of individual Web sites influence the flow experiences of Web users? Chapter 6 identified several characteristics of Web sites that influence a Web user's ability to focus attention on an information-seeking activity—a necessary condition for flow experiences.

The interest generated by a site's content is one important factor, particularly its relevance to the user's information-seeking goal, congruence with personal interests and novelty. Other content properties that can be influential in maintaining a user's attention include credibility, correctness, currency, ease of understanding, rarity, emotional impact and aesthetic appeal.

A site's usability is also an important factor. A poorly designed interface can disrupt a flow experience by demanding an excessive amount of attention. Specific examples of interface design elements that can detract from a flow experience include lengthy response times, disorganised content, inconsistent navigation cues, poorly structured page layout, inappropriate use of colour, stale links, ambiguous link labels, and pop-up advertisements.

Summary of definitions and propositions

This section summarises the concept definitions and relational propositions that were provided throughout Chapters 4 to 7 to formalise the theory. As mentioned in Chapter 4, the concept definitions are constitutive rather than operational, which means they state what the concepts mean, but they do not state how they can be measured empirically. Similarly, the propositions are not referred to as hypotheses because they do not contain the empirical indicators found in operational definitions of concepts. To convert these propositions into empirically testable hypotheses, one must substitute appropriate empirical indicators for each term that needs to be tested (Dubin 1978).

These definitions and propositions provide a skeletal view of the theory. They do not convey all of the rich insights that were described in Chapters 4 to 7—insights such as the effect that getting sidetracked has on a Web user's flow experience; the specific challenges that Web users face when searching and browsing for information; the reasons why both expert and novice Web users experience flow; the reasons why Web users find content interesting; the various kinds of distractions that compete for a Web user's attention; the factors that contribute to poor interface usability; the role that discovery and surprise play in the enjoyment Web users experience during flow; the specific factors that disappear from a Web user's consciousness during flow; the reason why Web users with a sense of time urgency will spend much longer searching or browsing for information than they plan to; the reason why flow experiences are followed by guilt for some Web users; and the personal characteristics that influence an individual's propensity to experience flow while seeking information on the Web.

Goals and navigation behaviour

Table 11.1 summarises the concept definitions related to goals and navigation behaviour. Table 11.2 summarises the relational propositions related to goals and navigation behaviour.

Table 11.1. Concept definitions related to goals and navigation behaviour.

Number	Definition
1.1	Directed searching is a navigation mode in which a Web user is motivated to find a particular piece of information.
1.2	Exploratory browsing is an experiential navigation mode that is characterised by diffuse motives such as passing time or seeking stimulation.
1.3	A Web user's goal is to find some item of interest quickly.
1.4	Curiosity is a desire to know something.
1.5	Specific curiosity is the desire for a particular piece of information, as typified by an attempt to solve a problem or puzzle.
1.6	Diversive curiosity is a more general seeking of stimulation or novelty, as typified by a bored television viewer flipping between channels.
1.7	Time urgency is an individual's tendency to consider time as a scarce resource and to plan its use carefully.

Table 11.2. Relational propositions related to goals and navigation behaviour.

Number	Proposition
1.1	A Web user's information-seeking goal is determined by his or her curiosity in a particular topic and sense of time urgency.
1.2	Specific curiosity corresponds to well-defined goals and directed searching.
1.3	Diversive curiosity corresponds to ill-defined goals and exploratory browsing.
1.4	Interesting content that is not relevant to a Web user's current information-seeking goal is positively related to changes in the focus of the user's curiosity.
1.5	Frustration with an information-seeking activity has a negative influence on a Web user's curiosity or interest in the information being sought.

Challenges and skills

Table 11.3 summarises the concept definitions related to challenges and skills. Table 11.4 summarises the relational propositions related to challenges and skills.

Table 11.3. Concept definitions related to challenges and skills.

Number	Definition
2.1	A Web user's challenge is an opportunity to use certain skills in working towards the attainment of an information-seeking goal.
2.2	A Web user's skill is his or her capacity to meet the challenges associated with an information-seeking goal.
2.3	Frustration is a feeling of discouragement or dissatisfaction associated with the inability to achieve an information-seeking goal.
2.4	Successful attainment of an information-seeking goal occurs when the information being sought is found within a reasonable amount of time from the user's perspective.
2.5	Failure to achieve an information-seeking goal occurs when either the information being sought is not found, or the search takes too much time from the user's perspective.

Table 11.4. Relational propositions related to challenges and skills.

Number	Proposition
2.1	The existence of a goal is a necessary condition for a Web user to perceive challenges within the context of information-seeking.
2.2	Successful attainment of an information-seeking goal, or progress toward that outcome, is a necessary, but not sufficient, condition for flow.
2.3	Failure to attain an information-seeking goal, or to progress toward that outcome, is a sufficient condition for frustration.
2.4	A Web user will make progress toward attaining an information-seeking goal if the challenge of the activity is matched by the user's skill or capacity to find whatever he or she is seeking.
2.5	A Web user will fail to make progress toward attaining an information-seeking goal if the challenge of the activity exceeds the user's skill or capacity to find whatever he or she is seeking.

Attention

Table 11.5 summarises the concept definitions related to attention. Table 11.6 summarises the relational propositions related to attention.

Table 11.5. Concept definitions related to attention.

Number	Definition
3.1	Attention is the process by which the mind chooses from among the various stimuli that strike the senses at any given moment, allowing only some to enter consciousness.
3.2	Focused attention is the process of attending to just one of several competing stimuli.
3.3	Divided attention is the process of trying to attend to more than one stimulus at the same time.
3.4	Interesting content is that which arouses or holds a Web user's attention, possibly because of its relevance to the current information-seeking goal, congruence with personal interests or novelty.
3.5	Distractions are stimuli outside a Web user's attentive focus that compete for the user's attention.
3.6	Interface usability is the ease with which a Web site can be learned or used.

Table 11.6. Relational propositions related to attention.

Number	Proposition
3.1	Focused attention on an information-seeking activity is a necessary, but not sufficient, condition for flow.
3.2	The challenge of an information-seeking activity has a positive influence on a Web user's focused attention on that activity.
3.3	Interesting content that is relevant to a Web user's current information-seeking goal has a positive influence on the user's focused attention on that activity.
3.4	Distractions have a negative influence on a Web user's focused attention on an information-seeking activity.
3.5	Poor interface usability has a negative influence on a Web user's focused attention on an information-seeking activity.
3.6	Poor interface usability has a positive influence on the challenge of an information-seeking activity.

Dimensions of flow

Table 11.7 summarises the concept definitions related to the dimensions of flow.

Table 11.8 summarises the relational propositions related to the dimensions of flow.

Table 11.7. Concept definitions related to the dimensions of flow.

Number	Definition
4.1	Joy of discovery is enjoyment associated with finding, learning or observing something for the first time.
4.2	Reduced awareness of irrelevant factors is the absence from consciousness of factors that are unrelated to the current information-seeking activity.
4.3	A distorted sense of time is the feeling that time seems to pass much faster than usual.
4.4	A merging of action and awareness is the feeling that an activity has become spontaneous or automatic, and the usual dualism between the individual and his or her actions has disappeared.
4.5	A sense of control is a feeling of empowerment or an absence of any concerns about failure.
4.6	Mental alertness is the feeling of being mentally responsive, perceptive, attentive or quick.
4.7	Telepresence is the experience of presence in an environment by means of a communication medium.
4.8	Flow is a state of consciousness that is experienced when one's attention is intently focused on an enjoyable activity that is challenging, but achievable. For Web users with an information-seeking goal, the flow experience is characterised by a joy of discovery, a reduced awareness of factors that are irrelevant to the task at hand, a distorted sense of time, a merging of action and awareness, a sense of control, mental alertness, and in some circumstances, telepresence.

Table 11.8. Relational propositions related to the dimensions of flow.

Number	Proposition
4.1	Joy of discovery is a dimension of a Web user's flow experience. There is a positive correlation between the two concepts.
4.2	Reduced awareness of irrelevant factors is a dimension of a Web user's flow experience. There is a positive correlation between the two concepts.
4.3	A distorted sense of time is a dimension of a Web user's flow experience. There is a positive correlation between the two concepts.
4.4	A merging of action and awareness is a dimension of a Web user's flow experience. There is a positive correlation between the two concepts.
4.5	A sense of control is a dimension of a Web user's flow experience. There is a positive correlation between the two concepts.
4.6	Mental alertness is a dimension of a Web user's flow experience. There is a positive correlation between the two concepts.
4.7	Telepresence is a dimension of a Web user's flow experience when the user's information-seeking activity involves interacting with a three-dimensional environment by means of a computer. There is a positive correlation between the concepts of telepresence and flow.

Summary

The theory that was developed during this study has comprehensively answered the central research question: What is the nature of flow, as experienced by Web users engaged in information-seeking activities? The concept definitions and relational propositions summarised in this chapter formalise the theory and provide a concise outline of the rich narrative that has unfolded throughout this thesis.

An important distinction between this study and other investigations into the flow experiences of Web users is the way this study has gone beyond sheer associations to propose explanations for how and why certain events occur—explanations that are grounded in the data rather than deduced from the literature. This study is the first of its type on this subject, and as such, it provides a useful counterpoint to previous quantitative studies. In particular, it is a significant advance on the work of Novak, Hoffman and Yung (2000), whose structural model appears to have some shortcomings.

This theory is compatible with the general dimensions of flow proposed by Csikszentmihalyi, and draws support from diverse theories on many other topics, such as television viewing, curiosity, time urgency, attention, aesthetics, time perception, cognitive dissonance, telepresence and pleasure-based approaches to human-computer interaction. These connections to other fields provide some intriguing opportunities for future research.

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Interview schedule

Pre-interview procedure

Replace the batteries in the cassette recorder and test it.

Disconnect the phone.

Engage the informant in some small talk to relax him or her.

Seat the informant at the computer.

Close the office door and put up a sign asking people not to interrupt the interview.

Review the project information sheet with the informant and answer any questions he or she may have about it.

Collect the consent form from the informant and check that it has been signed.

Ask the informant which Web browser he or she generally uses, and start it on the computer.

Press the record button on the cassette recorder.

Introductory comments

As we have already discussed, the purpose of this interview is to learn about some of your experiences using the Web. I'm currently conducting interviews with many people like yourself. I record the interviews on tape, transcribe them, and then analyse them, looking for common themes that emerge.

Navigation skill and experience

I'd like to start by getting an idea of how experienced or inexperienced you are when it comes to using the Web.

- IQ: How comfortable do you feel using computers in general?
- IQ: People employ different strategies when they're learning to use new software. When you want to learn how to use a new program, how do you go about it?
- IQ: How comfortable do you feel using the Web in general?
- IQ: How satisfied are you with your current skills for using the Web?
- IQ: Some Web activities could be described as challenging in the sense that they take more mental effort than others. What aspects of using the Web do you find most challenging?
- IQ: When did you first start using the Web?
- IQ: On average, how often do you use the Web now? (Daily? Weekly? Monthly? Less than once per month?)
- IQ: How many hours do you spend using the Web each week?

Navigation behaviour

Perhaps now we can change our focus and talk about some of the ways you use the Web.

- IQ: What do you enjoy most about using the Web?
- IQ: What do you dislike most about using the Web?
- IQ: Do you ever use search engines to track down specific information on the Web?
- IQ: Do you enjoy searching for information on the Web?
- IQ: What do you enjoy/dislike about searching for information on the Web?
- IQ: Do you ever get sidetracked when you're searching for information on the Web?
- IQ: Do you ever use the Web to casually browse for interesting sites—maybe for fun or relaxation?

Flow experience

Let's change our focus again now and talk about a specific flow experience.

IQ: When I first introduced you to the term *flow*, you told me that you had experienced that same feeling while using the Web. Think about one of your flow experiences now and tell me what you can remember about it. I'm interested in anything that you can recall.

IQ: What were you doing on the Web during your flow experience?

IQ: How did your flow experience feel?

IQ: Was there anything that you found particularly challenging about your Web activities on the occasion when you experienced flow?

IQ: How often do you experience flow while using the Web? (Every time you use the Web? Most times? Very rarely?)

Site inspection

I'd like to take a closer look at one of the sites you visited on the occasion that you have just described.

IQ: Show me a Web site that you spent a significant amount of time at during your flow experience. Guide me through some of the pages that you visited on the site. Show me where you went and what you did.

IQ: What was your purpose or motivation for visiting this site?

IQ: What do you enjoy about visiting this site?

IQ: How often do you visit this Web site on average?

IQ: How do you feel about this site's content?

IQ: How do you feel about this site's appearance?

IQ: How easy or difficult is it to find your way around this site?

IQ: How would you rate the download speed of this Web site? (Faster than most? Slower than most?)

Other flow activities

We've spoken a lot about flow experiences while using the Web.

IQ: Can you think of any other activities you engage in, besides using the Web, that have given you this feeling of flow?

Demographics

Before we finish, I'd like to gather a few demographic details.

IQ: Note the informant's gender.

IQ: What is your date of birth?

IQ: What is the highest level of education you have completed? (Primary school? High school? TAFE course? Undergraduate university degree? Postgraduate university degree?)

IQ: What is your main occupation?

Closing comments

We've discussed all of the topics that I wanted to cover. Is there anything that you would like to ask me about the study?

Post-interview procedure

Ask the informant to complete the two questionnaires.

Remove the cassette from the recorder, label it and store it securely.

Inspect the browser's history list and save copies of the Web pages that were discussed during the interview.



Questionnaire for potential informants

The questionnaire in this appendix was used to determine whether potential informants could recall experiencing flow while using the Web. Central Queensland University's logo appears at the top of the document because my PhD candidature began at CQU and I am currently employed there as an academic.

Questionnaire

Understanding the Flow Experiences of Web Users

The word *flow* has been used by psychologists to describe a state of mind experienced by people who are deeply involved in an activity. For example, sometimes while surfing the Net, people become so focused on their pursuit that they lose track of time and temporarily forget about their surroundings and usual concerns. Flow is not only experienced by Web users. Many people have reported experiencing this state of mind while playing games, participating in sport, engaging in hobbies, or working. Flow has been described as an intrinsically enjoyable experience.

Think about your own use of the Web for a moment. Have you ever experienced flow while using the Web?



Project information sheet

The information sheet in this appendix provided informants with essential details about their participation in the study—details which had already been explained verbally. Central Queensland University's logo appears at the top of the document because my PhD candidature began at CQU and I am currently employed there as an academic.

Project Information Sheet for Participants

Understanding the Flow Experiences of Web Users

Objective

You have been invited to participate in a research project that is being conducted by Steven Pace, a doctoral candidate within the Faculty of Informatics and Communication at Central Queensland University. The aim of the study is to gain a better understanding of the nature of flow, as experienced by persons engaged in Web navigation. The term *flow* comes from the field of psychology and refers to a state of mind that is sometimes experienced by people who are deeply absorbed in an enjoyable activity.

Interview

The primary source of data for the study will be interviews with individuals who recall experiencing flow while using the Web. The date, time and location of your interview are provided below as a reminder.

Date: _____ Time: _____

Location: _____

Your interview will take less than one hour to complete. It will be tape-recorded and later transcribed to provide accurate records for analysis.

Preparation for the interview

In preparation for the interview, please try to recall a time when you experienced flow while using the Web. What were you doing on the Web on that occasion? For example, some Web users have reported experiencing flow while planning a vacation, researching a topic, looking for software, or simply 'fooling around'.

Please bring to the interview the addresses of any Web sites that you can recall visiting during your flow experience so that we can look at those sites. If you need help remembering the sites that you visited on that occasion, your browser's History list might be able to jog your memory.

Confidentiality

Any information that you supply for this study will be treated in a confidential manner. Your identity will not be revealed in any project reports. Neither the tape-recording nor the transcript of your interview will contain any identifying information. Any documents linking your identity to your interview will be treated confidentially, and will not be stored with either the tape-recording or the transcript.

Consent

Participation in this study is entirely voluntary. You may withdraw from the study at any time. If you are a student at Central Queensland University, your participation or non-participation in the study will have no influence on your academic standing. Prior to your interview you will be asked to complete the attached consent form, which gives you an opportunity to request a summary of the results of the study.

Please contact Central Queensland University's Research Services Office (Tel: 07 4930 9828) if you have any concerns about the nature and/or conduct of this research project. Thank you for your cooperation and participation.

Regards,



Steven Pace
Faculty of Informatics & Communication
Central Queensland University

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Participant consent form

The consent form in this appendix was used to obtain assurance from informants that they understood the nature of their participation in the study. Central Queensland University's logo appears at the top of the document because my PhD candidature began at CQU and I am currently employed there as an academic.



Participant Consent Form

Understanding the Flow Experiences of Web Users

I have read the information sheet for this research project. I understand that my participation in the study is entirely voluntary and that I may withdraw from it at any time. I also understand that my comments will be treated in a confidential manner and that my identity will not be revealed in any project reports. I confirm that I am over eighteen years of age.

Name: _____

Signature: _____ Date: _____

If you are willing to read and comment on the results of this study or if you would simply like to receive a copy of the results, please print your contact details below:

Phone: _____ E-mail: _____

Postal address: _____

Questionnaire for measuring internal-external locus of control

The questionnaire in this appendix was used to measure an informant's internal-external locus of control. Developed by Rotter (1973), the instrument consists of 29 questions, each of which pairs an internal statement with an external statement. Six of the questions are fillers: 1, 8, 14, 19, 24 and 27. To calculate a respondent's score, allocate one point for each external statement selected: 2a, 3b, 4b, 5b, 6a, 7a, 9a, 10b, 11b, 12b, 13b, 15b, 16a, 17a, 18a, 20a, 21a, 22b, 23a, 25a, 26b, 28b, 29a. Scores can range from 0 (most internal) to 23 (most external).

Each of the following questions presents a pair of statements. Please tick the box next to the statement that is closest to your opinion.

1. ☐ Children get into trouble because their parents punish them too much.
☐ The trouble with most children nowadays is that their parents are too easy with them.
2. ☐ Many of the unhappy things in people's lives are partly due to bad luck.
☐ People's misfortunes result from the mistakes they make.
3. ☐ One of the major reasons why we have wars is because people don't take enough interest in politics.
☐ There will always be wars, no matter how hard people try to prevent them.
4. ☐ In the long run, people get the respect they deserve in this world.
☐ Unfortunately, an individual's worth often passes unrecognised no matter how hard he tries.
5. ☐ The idea that teachers are unfair to students is nonsense.
☐ Most students don't realise the extent to which their grades are influenced by accidental happenings.
6. ☐ Without the right breaks one cannot be an effective leader.
☐ Capable people who fail to become leaders have not taken advantage of their opportunities.
7. ☐ No matter how hard you try some people just don't like you.
☐ People who can't get others to like them don't understand how to get along with others.
8. ☐ Heredity plays the major role in determining one's personality.
☐ It is one's experience in life which determine what one is like.
9. ☐ I have often found that what is going to happen will happen.
☐ Trusting fate has never turned out as well for me as making a decision to take a definite course of action.
10. ☐ In the case of the well prepared student there is rarely if ever such a thing as an unfair test.
☐ Many times exam questions tend to be so unrelated to course work that studying is really useless.
11. ☐ Becoming a success is a matter of hard work; luck has little or nothing to do with it.
☐ Getting a good job depends mainly on being in the right place at the right time.

12. ☐ The average citizen can have an influence in government decisions.
☐ This world is run by the few people in power, and there is not much the little guy can do about it.
13. ☐ When I make plans, I am almost certain that I can make them work.
☐ It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.
14. ☐ There are certain people who are just no good.
☐ There is some good in everybody.
15. ☐ In my case getting what I want has little or nothing to do with luck.
☐ Many times we might just as well decide what to do by flipping a coin.
16. ☐ Who gets to be the boss often depends on who was lucky enough to be in the right place first.
☐ Getting people to do the right thing depends upon ability; luck has little or nothing to do with it.
17. ☐ As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.
☐ By taking an active part in political and social affairs the people can control world events.
18. ☐ Most people don't realise the extent to which their lives are controlled by accidental happenings.
☐ There really is no such thing as 'luck'.
19. ☐ One should always be willing to admit mistakes.
☐ It is usually best to cover up one's mistakes.
20. ☐ It is hard to know whether or not a person really likes you.
☐ How many friends you have depends on how nice a person you are.
21. ☐ In the long run the bad things that happen to us are balanced by the good ones.
☐ Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.
22. ☐ With enough effort we can wipe out political corruption.
☐ It is difficult for people to have much control over the things politicians do in office.
23. ☐ Sometimes I can't understand how teachers arrive at the grades they give.
☐ There is a direct connection between how hard I study and the grades I get.
24. ☐ A good leader expects people to decide for themselves what they should do.
☐ A good leader makes it clear to everybody what their jobs are.

25. ☐ Many times I feel that I have little influence over the things that happen to me.
- ☐ It is impossible for me to believe that chance or luck plays an important role in my life.
26. ☐ People are lonely because they don't try to be friendly.
- ☐ There's not much use in trying too hard to please people; if they like you, they like you.
27. ☐ There is too much emphasis on athletics in high school.
- ☐ Team sports are an excellent way to build character.
28. ☐ What happens to me is my own doing.
- ☐ Sometimes I feel that I don't have enough control over the direction my life is taking.
29. ☐ Most of the time I can't understand why politicians behave the way they do.
- ☐ In the long run the people are responsible for bad government on a national as well as on a local level.

Questionnaire for measuring need for cognition

The questionnaire in this appendix was used to measure an informant's need for cognition. Developed by Cacioppo, Petty & Kao (1984), the instrument consists of eighteen items, which are measured on seven-point Likert scales. Nine of the items are negatively worded and must be reverse-scored: 3, 4, 5, 7, 8, 9, 12, 16 and 17.

Please indicate your level of agreement or disagreement with each of the following statements by ticking the appropriate box.

	Strongly agree	Agree	Slightly agree	Neutral or uncertain	Slightly disagree	Disagree	Strongly disagree
1. I prefer complex to simple problems.	☐	☐	☐	☐	☐	☐	☐
2. I like to have the responsibility of handling a situation that requires a lot of thinking.	☐	☐	☐	☐	☐	☐	☐
3. Thinking is not my idea of fun.	☐	☐	☐	☐	☐	☐	☐
4. I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.	☐	☐	☐	☐	☐	☐	☐
5. I try to anticipate and avoid situations where there is likely chance I will have to think in depth about something.	☐	☐	☐	☐	☐	☐	☐
6. I find satisfaction in deliberating hard and for long hours.	☐	☐	☐	☐	☐	☐	☐
7. I only think as hard as I have to.	☐	☐	☐	☐	☐	☐	☐
8. I prefer to think about small, daily projects to long-term ones.	☐	☐	☐	☐	☐	☐	☐
9. I like tasks that require little thought once I've learned them.	☐	☐	☐	☐	☐	☐	☐
10. The idea of relying on thought to make my way to the top appeals to me.	☐	☐	☐	☐	☐	☐	☐

	Strongly agree	Agree	Slightly agree	Neutral or uncertain	Slightly disagree	Disagree	Strongly disagree
11. I really enjoy a task that involves coming up with new solutions to problems.	☐	☐	☐	☐	☐	☐	☐
12. Learning new ways to think doesn't excite me very much.	☐	☐	☐	☐	☐	☐	☐
13. I prefer my life to be filled with puzzles that I must solve.	☐	☐	☐	☐	☐	☐	☐
14. The notion of thinking abstractly is appealing to me.	☐	☐	☐	☐	☐	☐	☐
15. I prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.	☐	☐	☐	☐	☐	☐	☐
16. I feel relief rather than satisfaction after completing a task that required a lot of mental effort.	☐	☐	☐	☐	☐	☐	☐
17. It's enough for me that something gets the job done; I don't care how or why it works.	☐	☐	☐	☐	☐	☐	☐
18. I usually end up deliberating about issues even when they do not affect me personally.	☐	☐	☐	☐	☐	☐	☐



Codes and their meanings

This appendix provides a list of the codes that were created during this study, along with their meanings. Related codes are grouped together in tables. Since NVivo allows researchers to use phrases as codes rather than abbreviations, in some cases the meanings are the same as the codes.

Goals and navigation behaviour

Table G.1. Codes related to goals and navigation behaviour.

Code	Meaning
Directed searching	Searching for specific information on the Web
Exploratory browsing	Browsing for information on the Web in an exploratory, experiential way
Goal	A Web user's information-seeking goal
Curiosity, interest	Curiosity or interest in something
Time urgency	A sense of time urgency
Easy access to information	Desire or appreciation for easy access to information
Getting sidetracked	Getting sidetracked from an information-seeking goal by interesting content or links

Challenges and skills

Table G.2. Codes related to challenges and skills.

Code	Meaning
Challenge of vast, changing space	The challenge of negotiating a vast, constantly changing, uncharted information space
Challenge of selecting key words	The challenge of selecting suitable key words for a search engine query
Challenge of query syntax	The challenge of using the correct syntax for a search engine query
Challenge of link relevance	The challenge of distinguishing relevant links from irrelevant links
Challenge of many links	The challenge of dealing with a large collection of potentially relevant links
Challenge of scanning content	The challenge of scanning a page for relevant information
Challenge of understanding	The challenge of understanding the content and non-linear structure of a Web site
Skill	Skill using the Web
Confidence	Confidence using the Web
Experience	Experience using the Web
Balance	Balance between the challenge of an activity and the skill required to meet that challenge

Success and failure

Table G.3. Codes related to success and failure in information-seeking activities.

Code	Meaning
Success	Successful attainment of an information-seeking goal or progress toward that outcome
Failure	Failure to achieve an information-seeking goal or to progress toward that outcome
Frustration	The experience of frustration during an information-seeking activity
Tedium	The experience of tedium during an information-seeking activity

Attention

Table G.4. Codes related to attention.

Code	Meaning
Attention on activity	Attention focused on the current information-seeking activity
Attention on interface	Attention focused on a user interface or something other than the current information-seeking activity
Environmental distractions	Elements of the physical environment that distract attention from the task at hand
Physiological distractions	Bodily functions and ailments that distract attention from the task at hand
Computer-related distractions	Computer-related events that distract attention from the task at hand

Interesting content and links

Table G.5. Codes related to interesting content and links.

Code	Meaning
Personally interesting content	Content that is congruent with personal interests
Novel content	Content that is novel
Credible content	Content that is credible or honest
Correct content	Content that is correct or accurate
Current content	Content that is current or up-to-date
Understandable content	Content that is easy to understand
Rare content	Content that is rare or not available from sources other than the Web
Emotional content	Content that arouses emotion
Aesthetically appealing content	Content that is aesthetically appealing
Appearance versus content	The relative importance of a Web site's appearance and content
Rich network of links	A rich network of hypertext links within a Web page

Usable interface

Table G.6. Codes related to a usable interface.

Code	Meaning
Short response time	The time required to download a Web page is short
Organised content	Content that is well organised or structured
Intuitive navigation	A navigation system that is easy to use
Consistency	Visual and behavioural consistency in an interface
Good page layout	A page layout that is structured and readily interpreted
Appropriate colours	Appropriate use of colour in an interface

Distracting interface

Table G.7. Codes related to a distracting interface.

Code	Meaning
Long response time	The time required to download a Web page is long
Disorganised content	Content that is poorly organised or structured
Obscure navigation	A navigation system that is difficult to use
Inconsistency	Visual and behavioural inconsistency in an interface
Poor page layout	A page layout that is unstructured, cluttered or difficult to interpret
Inappropriate colours	Inappropriate use of colour in an interface
Stale links	Hypertext links that don't work
Ambiguous link labels	Hypertext link labels that are ambiguous
Pop-up advertisements	Advertisements that pop up in a new window

Flow properties

Table G.8. Codes related to properties of flow.

Code	Meaning
Duration of flow	The duration of a flow experience
Frequency of flow	The frequency with which a Web user experiences flow
Intensity of flow	The intensity of a flow experience
Topics sought	Topics sought during information-seeking activities
Other flow activities	Flow experiences that occur while engaged in activities other than seeking information on the Web

Flow dimensions

Table G.9. Codes related to dimensions of flow.

Code	Meaning
Enjoyment	Feelings of enjoyment during flow
Discovery, learning	Discovering or learning something during flow
Awareness of physical surroundings	Reduced awareness of one's physical surroundings during flow
Awareness of interaction with others	Reduced awareness of interactions with other people during flow
Awareness of usual preoccupations	Reduced awareness of one's usual worries and concerns during flow
Awareness of physical needs	Reduced awareness of physical needs such as hunger during flow
Awareness of navigation path	Reduced awareness of the navigation path one has followed during flow
Awareness of original goal	Reduced awareness of one's original information-seeking goal after getting sidetracked during flow
Distorted sense of time	The feeling that time is passing faster than usual during flow
Action & awareness merge	The feeling that a flow activity has become spontaneous or automatic, and the usual dualism between the individual and his or her actions has disappeared
Sense of control	A sense of control during flow
Mental alertness	Feelings of mental alertness during flow
Telepresence	The feeling of presence in a virtual environment during flow

Flow consequences

Table G.10. Codes related to consequences of flow.

Code	Meaning
Guilt	Feelings of guilt after a flow experience, usually because of the amount of time consumed
Justification	Attempting to justify the time that was spent on a flow experience
Repeat visits	Repeat visits to a particular site or repeated Web use as a consequence of flow