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# Online Information Seeking: Understanding Individual Differences and Search Contexts

Maureen E. Hupfer

*McMaster University*, hupferm@mcmaster.ca

Brian Detlor

*McMaster University*, detlorb@mcmaster.ca

Elaine Toms

*Dalhousie University*, elaine.toms@dal.ca

Valerie Trifts

*Dalhousie University*, valerie.trifts@dal.ca

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# Online Information Seeking: Understanding Individual Differences and Search Contexts

**Maureen Hupfer**  
McMaster University  
hupferm@mcmaster.ca

**Elaine Toms**  
Dalhousie University  
Elaine.Toms@dal.ca

**Brian Detlor**  
McMaster University  
detlorb@mcmaster.ca

**Valerie Trifts**  
Dalhousie University  
Valerie.Trifts@dal.ca

## ABSTRACT

This paper outlines a broad research agenda aimed at examining the manner in which individual differences in information seeking behavior interact with the search task to affect search outcomes. As part of this agenda, we describe specific experimentation that will assess the impact of both Need for Cognition (the tendency to elaborate upon, structure and evaluate information) and Self- and Other-Oriented (gender-related traits that tap independent versus interdependent characteristics) on the search outcomes that arise in attribute- versus alternative-based decision making. We hypothesize that among individuals identified by these instruments as having a high propensity for effortful search, we will observe more detailed search strategies but also will see a greater tendency for information overload. Conversely, those who are more prone to superficial search may appear to be more efficient, but may be sacrificing accuracy for speed.

## Keywords

Individual differences, online information search, search task.

## INTRODUCTION

This paper describes current research that is being undertaken to systematically explore the impact of individual difference variables on online information seeking behavior across varied search tasks. Scholars have begun to examine the role of individual differences in online behavior (e.g., Bhatnagar & Ghose, 2004; Das, Echambadi, McCardle, & Luckett, 2003; Dillon & Watson, 1996; Ford, Miller, & Moss, 2001, 2005a, 2005b; Heinström, 2005; Ho, 2005; Martin, Sherrard, & Wentzel, 2005; Tuten & Bosnjak 2001), but work to date often has failed to link findings with broader theoretical frameworks concerning information seeking behavior. Furthermore, studies often have neglected to study the effects of individual differences in conjunction with specific search contexts. The work of Ford et al. (2001, 2005a, 2005b) is a notable exception both for its extension of Wilson's model of information behavior (Wilson & Walsh, 1996) and for its examination of how search complexity and individual differences interact to result in differing search strategies. Our multi-phase project will build on this work by examining how particular individual differences in cognition, in conjunction with the search task, affect users' search strategies, efficiency and satisfaction. We provide an overview of the broader research agenda, introduce current experimentation being conducted at two universities, with particular focus on the work being done at one institution, and conclude with our expected theoretical and practical contribution.

## THEORETICAL FRAMEWORK

Because of its broad applicability to information search, we are using Wilson's model of information behavior (Wilson & Walsh 1996) as a theoretical foundation (see Figure 1). In this model, the "context of the information need" leads to "information seeking behavior" that is mediated by "activating mechanisms" and other "intervening variables" that include individual differences. Searchers proceed to states of "attention", "passive", "active" or "ongoing search", followed by "information processing and use". Ford et al. (2001) augmented this framework by focusing on specific activating mechanisms (based on stress/reward theory and risk/reward theory) and several demographic and psychological individual difference variables. Our work differs from Ford et al. (2001) in that we provide a more detailed exploration of the "context of information need" construct. We argue that search tasks vary on a number of dimensions and we identify factors that will affect task complexity. Further, we hypothesize that key individual difference variables have differential effects on search behavior that depend on the task's level of complexity. We also add search strategy indicators to the "active search" construct

and include a range of search outcome measures in the “information processing and use” construct. Thus, we extend Wilson’s framework on four fronts by specifying search contexts, elaborating on intervening individual difference variables, investigating specific search strategies, and including measures of retrieval effectiveness.

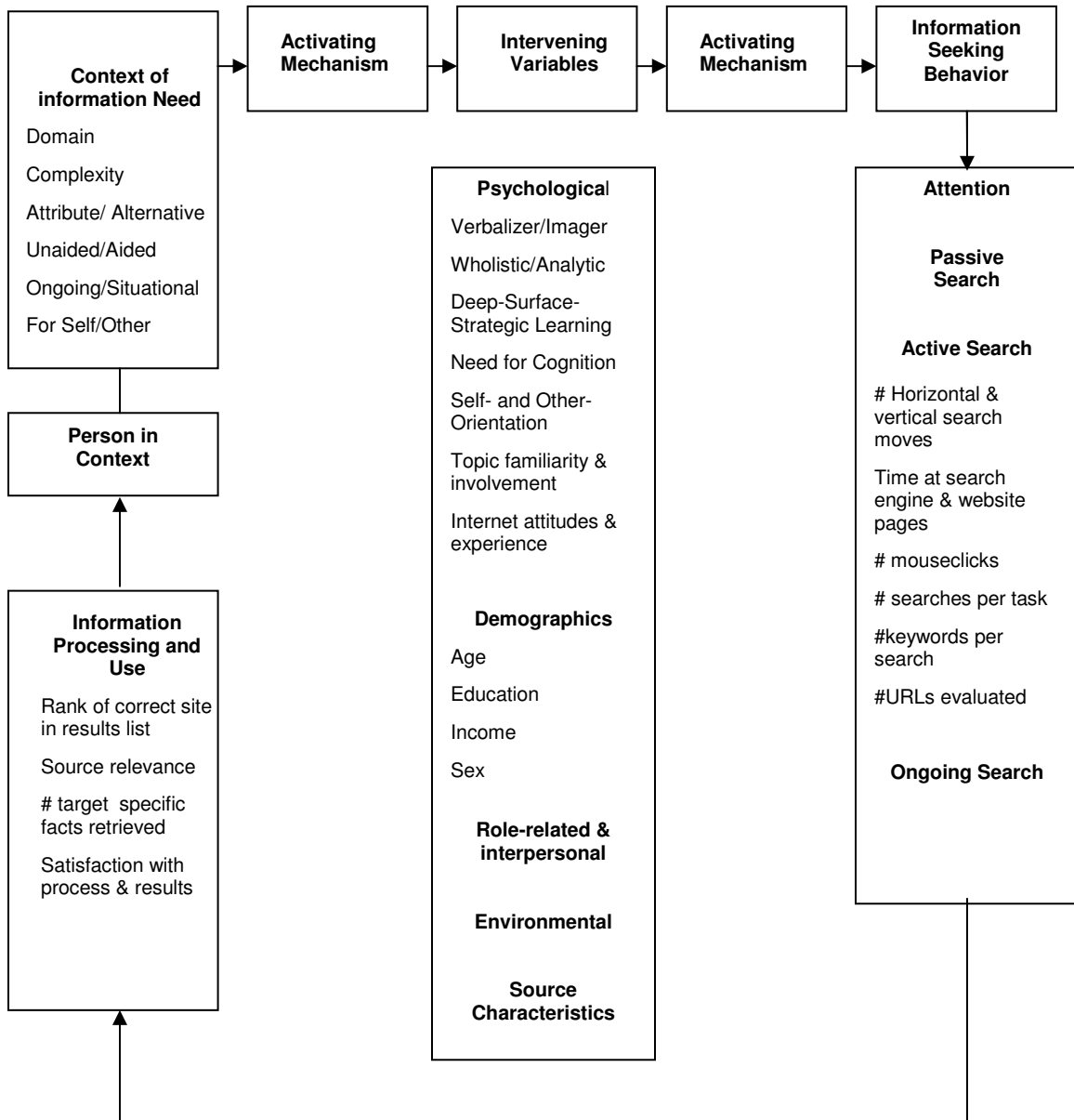


Figure 1. Adaptation of Wilson’s Model of Information Behavior (Wilson and Walsh 1996)

### Search Task Dimensions

Research concerning online information seeking has found substantial differences in information search patterns across information search tasks and between product categories or information domains (e.g., Bhatnagar & Ghose, 2004; Moe, 2003; Trifts & Toms, 2006; Wildemuth & Hughes, 2005). These differences can be explained in part by the complexity of the search task, the extent to which the task is clearly structured, whether one is searching for oneself or for someone close (Hupfer & Detlor, 2006), and semantic differences between search domains. Ford et al. (2003) suggest that complex tasks

require a conceptual broadening of useable terminology to reflect broader search concepts. Conversely, simple tasks would be ones in which all essential concepts necessary to complete the search task are fully specified.

With respect to the “context of the information need”, we have identified five key dimensions by which the search task can vary. These include *search orientation*, *interactivity*, *immediacy*, *relevance*, and *domain*. *Search orientation* refers to whether a searcher is engaged in searching for information by attribute (e.g., the price of a product) or by alternative (e.g., the product itself) (Huneke, Cole & Levin, 2004). Decision strategies that require processing information by attribute as opposed to alternative are thought to be easier to undertake and in the context of online search should be of lesser complexity. Trifts and Toms (2006) found that search orientation had a significant impact on the allocation of search effort between general search engines and within specific websites. Those engaged in alternative-based processing were more focused on finding an appropriate source of information and allocated more search effort to a general search engine than to in-site search. Next, *search interactivity* refers to the extent to which web search is assisted by interactive decision aids. In the domain of online shopping, Häubl and Trifts (2000) found that interactive tools that assisted consumers in their initial screening of alternatives substantially reduced the amount of search undertaken and improved decision making. A third dimension, *search immediacy*, refers to whether the information is needed for present use, such as a pre-purchase situation in which a decision is imminent, or collected on an ongoing basis, such as when an individual has an interest in a product category or topic but does not intend to make a decision immediately (Payne, Bettman & Johnson, 1993). An immediate information need would imply a more cognitively complex task because of time pressure. Context can be further categorized according to *search relevance* in terms of whether information is sought for oneself or on behalf of someone with whom the searcher has a close relationship (Hupfer & Detlor, 2006). Search also can vary with the information domain, such as shopping, travel, medical, e-government, and general research *search domains*.

### Individual Differences as Intervening Variables

Individual differences play a key role in determining both the search strategy and its effectiveness. These differences include the individual’s familiarity or level of involvement with the search topic (Moorthy, Ratchford & Tuukdar, 1997), Internet experience (Bhatnar & Ghose, 2004), perceptions of Web-based information seeking (Ford & Miller, 1996), and enduring psychological traits (e.g., Ford et al., 2001; 2005a; 2005b). Online searching also depends on the individual’s information seeking mode in that one may merely be browsing, or may be searching with active purchase intent (Moe, 2003). Users also may go online with a specific goal in mind or they may simply be “surfing” in an experiential mode. Other demographics, including age and sex, also have been associated with differences in web search patterns (Ford et al., 2001; Roy & Chi, 2003).

In addition to domain-specific measures that reflect the individual’s familiarity with the particular topic and measures that tap Internet attitudes and experience, our particular focus is on psychological differences that reflect a propensity to engage in elaborate, effortful processing versus effort minimization and reliance on heuristics. Discussed below, these include Verbalizer/Imager and Wholistic/Analytic cognitive styles; Deep, Surface and Strategic Learning approaches; Need for Cognition; and Self- and Other-Orientation.

#### *Cognitive style*

Individuals differ in the strategies they use to seek and process information, and they tend to favor certain strategies, or cognitive styles, on a consistent basis. Among these styles, Verbalizer/Imager and Wholist/Analytic are the two dominant dimensions (Riding & Cheema, 1991). The Verbalizer/Imager dimension refers to a preference for and facility with tasks and information that are presented in a verbal versus visual format; verbal and spatial ability are closely related measures (Ekstrom, French, & Harman, 1976). Analytic individuals perceive components of complex stimuli as discrete elements and are better able to analyze and impose structure than those who are Wholist, who tend to perceive stimuli in a holistic or global manner. Where Internet searching is concerned, Wang, Hawk and Tenopir (2000) found that Wholist searchers experienced more difficulty and confusion than Analytic users. Poor retrieval has been linked to a Verbalizer style, as well as perceptions that the Internet’s graphic elements were of little value; in addition, relationships have been found among Wholists, Imagers and Boolean searching and among Analytics, Verbalizers and Best-match searching (Ford et. al, 2001; 2005a; 2005b). Finally, it appears that cognitive style effects are more important for novice than for experienced Internet searchers (Palmquist & Kim, 2000).

#### *Learning style*

Those with a surface approach to learning are defined as individuals who describe learning as knowledge reproduction achieved through rote learning and memorization. They are passive uncritical learners who devote relatively little effort to

information seeking (Entwistle & Tait, 1995; Ford, 1986). Deep learners, on the other hand, view learning as knowledge creation through synthesis and assimilation of new information. They seek a broad range of information sources using a variety of search strategies. Strategic learners are able to choose either deep or surface learning approaches as appropriate. Analysis of self-reported information-seeking behavior has found that a surface approach was associated with a “fast surfing” information-seeking strategy in which users experienced problems with analyzing and judging the relevance of retrieved documents (Heinström, 2005). They also demonstrated confirmatory bias and preferred to access information using only a few documents. In contrast, “deep diving” characterized those with either deep or strategic learning styles; these individuals were effortful searchers who sought high quality documents. In addition, Ford et al. (2005a) have found that individual items in the surface learning style (fear of failure and poor time management) were linked to poor retrieval.

### *Need for Cognition*

Individuals with a high Need for Cognition (NFC) enjoy thinking and have a greater tendency to elaborate upon, structure and evaluate information (Cacioppo, Petty and Kao, 1984). They engage in more effortful decision making than those who are low NFC and arrive at better search outcomes (Bailey, 1997). High NFC users also have more favorable attitudes toward websites with complex verbal and simple visual elements (Martin et al., 2005). NFC is positively correlated with Web information usage (Tuten & Bosnjak, 2001) and has a direct impact on self-reported information seeking behavior (Das et al., 2003). Finally, high NFC online grocery shoppers, compared with low NFC consumers, investigated more URLs and spent more time reading (Ho, 2005).

### *Self- and Other-Oriented*

These two scales tap gender-related traits that pertain to an independent (Self-Oriented) versus interdependent (Other-Oriented) self-concept orientation (Hupfer, 2000). The two scales interact to predict how often individuals search online (Hupfer & Detlor, 2006) both for themselves and for those close to them. Other-Oriented also is positively related to usage rates for Internet applications with relationship implications (Hupfer & Detlor, 2007). Furthermore, the scales interact to predict importance ratings of website characteristics that imply an information-rich environment versus navigational aids that ease processing and maximize efficiency (Hupfer & Detlor, forthcoming 2009).

### **Active Search**

The “active search” effort variables that we are investigating include the number of mouse clicks per session, number of queries initiated, number of keywords per search, number of URLs or documents evaluated, time spent at the search engine versus website pages, and total time spent. Search strategy indicators include type of searching (e.g., Boolean) as well as the presence of “horizontal” versus “vertical search moves”. With a “horizontal” strategy, after submitting a query the user quickly inspects the returned results list before submitting another search (Roy & Chi, 2003). In contrast, “vertical search moves” are more linear and effortful, involving inspection of a majority of documents in each hit list.

### **Information Processing and Use**

Our indicators of “information processing and use” include source relevance, rank of correct site in results list, number of target-specific facts retrieved, and satisfaction with the process and its results.

### **METHODOLOGY**

Because of the number of variables involved, we plan a set of studies in which each phase is linked to its successor. Web-based experiments conducted in labs at two Canadian universities will test hypotheses in shopping and general research domains, using Amazon and Wikipedia data sources. Our present focus extends earlier work addressing the search orientation dimension (Trifts & Toms, 2006) in which participants complete either attribute- or alternative-based search tasks. Our university is responsible for manipulating these tasks in an Amazon shopping context; the general research tasks, which will be conducted in a modified Wikipedia environment, are the responsibility of our partner institution.

In both labs, the individual difference variables of current interest are Need for Cognition (NFC) and Self- and Other-Oriented (see Appendix). Transaction logs will record much of the data described above in “active search” and “information processing and use”. These data will allow us to determine the effort that is expended, identify search strategies, and assess search effectiveness. Satisfaction with the search process will be elicited with quantitative Likert-scales. In sessions at both labs, demographic variables (age, sex, income, and education), as well as measures of topic familiarity and perceptions about searching will be collected.

## Hypotheses

Speaking generally, we hypothesize that participants who are predisposed to effortful search, compared with those who are less so, will conduct more detailed search across both the alternative- and the attribute-based tasks. More specifically, we expect that high levels of Self-Orientation will be associated with a selective strategy, while Other-Orientation and Need for Cognition will predict an effortful approach. Furthermore, High-Other and High-NFC searchers should be the most likely to experience information overload, diminished effectiveness and less satisfaction when confronted with the more complex alternative-based task. More details concerning the experimental work at our own institution are provided below.

## Amazon Shopping Tasks

### *Product category selection*

Before devising the attribute-alternative task manipulation, we first determined that the products for which participants were to seek information should meet several key criteria. First, the product categories should range from a lower to higher level of involvement, as defined by participant interest and knowledge, expense, and degree of product complexity, and the categories also should be very different from each other (e.g., not all consumer electronic or technology products). We also required categories in which we could expect to find an adequate level of variance in individuals' interest and knowledge about the product. Next, for the attribute- versus alternative-tasks to be realistic, the product categories also would require a certain number of characteristics along which they could be compared. Finally, we wanted products that elicited no significant sex differences in response, since Self- and Other-Orientation tap gender-related traits (Hupfer, 2000).

Altogether, six product categories drawn from low, moderate and high levels of involvement were pre-tested with 44 male and 30 female undergraduate students. These included dog foods, organic foods, sports watches, running shoes, cell-phones and digital cameras. Using 9-point scales anchored by strongly disagree and strongly agree, respondents were asked to answer the following two questions for each product category: "I am very knowledgeable about XX and their features" and "I am very interested in XX as a product category". Organic foods, running shoes and digital cameras met our criteria in terms of response ranges, means and variances (see Table 1). No sex differences were found.

Product Category	Range	Mean (all)	Variance	Mean (males)	Mean (females)	<i>t</i> (72 <i>df</i> )	Sig.
Organic foods (knowledge)	1-8	4.31	3.78	4.07	4.67	-1.31	.20
	1-9	4.50	5.43	4.41	4.63	-.40	.69
Running shoes (knowledge)	1-9	5.19	4.43	4.98	5.50	-1.05	.30
	1-9	4.85	5.14	4.55	5.30	-1.42	.16
Digital cameras (knowledge)	1-9	6.19	3.39	6.43	5.83	1.38	.17
	1-9	5.68	4.20	5.66	5.70	-.08	.93

**Table 1: Pre-test Results**

### *Attribute- versus alternative-based task manipulations*

All data will be collected with the assistance of a research tool that facilitates the experimental manipulation of websites, including random assignment, provision of experimental instructions, and order counterbalancing (Harold, 2007). The tool also permits the integration of variables collected from transactional logs with data collected in response to survey instruments.

In the attribute task manipulation, participants will be required to evaluate two products from each of the three product categories on a sequence of three attributes (characteristics). Before beginning the shopping task, participants' knowledge and

interest in the category will be assessed in the same manner used in our pre-testing. Using organic foods as an example of the first shopping task, participants will be given the following scenario: “Imagine that you have decided that you want to start packing organic dried fruit snacks in your lunch. Visit the organic food product category in Amazon and find a product characteristic that you would consider to be important in choosing a fruit snack”. Once participants have clicked the “continue” button, they will be directed to a page that asks them to enter that characteristic in the appropriate text box, and provide an importance rating of it (1 = not at all important, 9 = very important). Next, they will be asked to locate a specific fruit snack (e.g., A) and rate it on the characteristic they previously identified (1 = not at all good, 9 = very good). This will be followed by a direction to locate another fruit snack (e.g., B) and rate it on that same characteristic. Once this rating is complete, participants will move on to the sequential identification of two additional product characteristics and the provision of their ratings of fruit snack A and B on each of these characteristics. The final page in the shopping task asks participants to choose one of the two fruit snacks (or neither) on the basis of the three characteristics they have identified, and to indicate their level of familiarity with the two products before the experimental session.

In the alternative task manipulation, a holistic comparison of two different products in each product category is required. Participants will receive the same knowledge and interest questions, and view the same opening scenario, except that they will be asked immediately to identify three different characteristics or attributes. Once participants have clicked the “continue” button, they are asked to enter these characteristics in the designated text boxes and indicate how important each of these is in choosing a fruit snack. Next, they will be directed to find a specific fruit snack (A) and rate it on the basis of their overall assessment of the three characteristics. They then will be asked to locate Fruit Snack B and provide a similar overall rating. As with the attribute task, they will conclude with their choice of A, B or neither, and indicate their familiarity with the two before having participated in the experiment. The alternative tasks for the running shoes and digital cameras follow in a similar fashion. In both manipulations, as participants complete each shopping task, they will be asked to respond to the post-shopping questionnaire (see Appendix) before moving on to the next. The experiment concludes with demographic, NFC and Self- and Other-Orientation items.

#### *Anticipated results*

As indicated, we predict that individuals who are highest on NFC and Other-Orientation will conduct the most effortful search in order to identify appropriate product characteristics and will spend more time reading the product descriptions in order to evaluate them. We also expect that they will be more inclined to drill deeper down into sidebar menus in order to investigate product alternatives. In addition, they should express less satisfaction with their searches and experience a greater degree of information overload. Conversely, those who are highest on Self-Orientation should conduct the most superficial search, make more efficient use of search engines, and be inclined to move through product evaluations swiftly. Their search behavior may appear to be the most efficient, but more thorough perusal of their product choices versus their stated importance ratings may show that they have sacrificed accuracy for speed.

#### **CONCLUSION**

The broad research agenda that we have outlined will allow us to compare the prediction afforded by the various individual difference measures, to identify circumstances under which greater search effort is expended, to determine when users who are prone to comprehensive search become overwhelmed and experience information overload, and to test the usefulness of interactive interventions. Our extension of Wilson’s model will make an important theoretical contribution to information science, will introduce a valuable theoretical framework to consumer researchers who study information search, and sets a clear agenda for future research. The project also has valuable implications for practice. Knowing the type of information that is sought and the psychological makeup of the user, designers can use search personalization tools to adjust the interface’s information display. For example, users who are high on psychological measures that indicate detailed search effort could receive a focused presentation and prompts to streamline search and prevent them from becoming bogged down in their comprehensive strategy. For those at the low end of these measures, the site might expand or diffuse information presentation, or perhaps offer suggestions for broadening and enriching the search strategy. Such design modifications will benefit firms and information provision sites that want consumers to locate their information easily and also will improve user search effectiveness and satisfaction.

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## APPENDIX

### Need for Cognition

Please indicate the extent to which you disagree or agree with the following statements (1 = strongly disagree and 9 = strongly agree).

1. I would 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 a 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. I prefer to think about small, daily projects to long-term ones.
8. I like tasks that require little thought once I've learned them.
9. The idea of relying on thought to make my way to the top appeals to me.
10. I really enjoy a task that involves coming up with new solutions to problems. Learning new ways to think doesn't excite me very much.
11. I prefer my life to be filled with puzzles that I must solve.
12. The notion of thinking abstractly is appealing to me.
13. I would prefer a task that is intellectual, difficult and important to me to one that is somewhat important but does not require much thought.
14. I feel relief rather than satisfaction after completing a task that required a lot of mental effort.
15. It's enough for me that something gets the job done; I don't care how or why it works.
16. I usually end up deliberating about issues even when they do not affect me personally.

### Self- and Other-Orientation

Please rate each item below according to how well you think these statements describe you, where 1 = never true of me and 9 = always true of me. For example, if the statement were 'I am a creative person', and you thought that this was hardly ever true of you, you would select an answer toward the left side of the scale. If you thought that this was true about half the time, you might select an answer near the middle of the scale. (Items 2, 4, 6, 7, and 10 tap Self-Orientation; the remaining items pertain to Other-Orientation.)

1. I am a nurturing person.
2. I am a self-sufficient person.
3. I am understanding.
4. I make my own choices.
5. I am a compassionate person.
6. I am my own person.
7. I am self-reliant.
8. I am sympathetic.
9. I am sensitive to the needs of others.
10. I am an independent person.

### Post-Shopping Questionnaire

All items use 9-point scales anchored by strongly disagree and strongly agree.

1. I am certain that I found the information that I was looking for.
2. It was easy for me to do this search.
3. I am satisfied with my search results.
4. I spent the amount of time that I expected to spend on this search.
5. My previous knowledge of the topic helped me with this search.
6. The search experience was very efficient.
7. I felt like I received too much information.
8. I think that my skills for looking for information on the Web are good.