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Three Essays on Sex Differences in the Web Environment : An Information Processing Perspective

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RÉSUMÉ

Plusieurs études ont mis en lumière différents traits de personnalité qui distinguent les hommes et les femmes. Basées sur ces traits respectifs, deux théories développées en psychologie cognitive ont suggéré que les hommes et les femmes diffèrent dans leur façon de traiter l'information. Le modèle de la sélectivité (Meyers-Levy, 1989) prévoit que les femmes traitent l'information de façon plus compréhensive et investissent davantage d'effort dans le traitement de l'information que les hommes, qui eux, sont plus enclins à traiter l'information de façon sélective. Putrevu (2001) propose quant à lui, que les hommes et les femmes ne diffèrent pas quant à l'effort investi pour traiter l'information mais que les différences sont au niveau du style de traitement. Les femmes ont davantage tendance à traiter l'information de façon relationnelle alors que les hommes la traite de façon par item. L'objectif principal de cette étude est de mieux comprendre comment les hommes et les femmes traitent l'information dans un contexte de recherche d'information dirigée sur Internet et aussi d'explorer la pertinence de ces théories dans un tel contexte.

Cette thèse est composée de trois essais empiriques. Le premier essai compare directement les théories de Meyers-Levy et de Putrevu en analysant les processus de traitement de l'information lors de la navigation en ligne. Le second essai se concentre sur les mesures d'efficience et d'efficacité de recherche d'information des hommes et des femmes selon divers niveaux de complexité de la tâche. Le dernier essai mesure l'effet modérateur du sexe dans la formation des perceptions de facilité d'utilisation d'un site ainsi que dans la formation des intentions comportementales envers le site.

Les principaux résultats de cette recherche sont les suivants. Lors de recherches d'information en ligne, les femmes se distinguent par un traitement de l'information où il y a plus d'effort de compréhension que les hommes, ce qui est congruent avec le modèle de la sélectivité (Meyers-Levy). Les femmes ont aussi plus tendance à faire preuve d'un style de pensée relationnel que les hommes tel que proposé par Putrevu.

Cependant, contrairement au modèle développé par Putrevu, les hommes n'ont pas démontré un style de traitement de l'information plus par item que les femmes. De plus, la complexité de la tâche a des effets différents chez les hommes et les femmes quant à l'efficacité et l'efficience de leur recherche d'information en ligne. Ces résultats sont congruents avec le modèle de la sélectivité et appuient les résultats d'autres recherches effectuées en comptabilité. Finalement, les facteurs influençant les intentions comportementales des internautes ne diffèrent pas selon le sexe mais la formation des perceptions d'utilisabilité est plus fortement liée à la personnalisation chez les hommes alors qu'elle est plus en lien avec la qualité de l'information chez les femmes.

Ces résultats ont des implications théoriques et pratiques significatives. Sur le plan théorique, les résultats de cette recherche confirment la pertinence de la théorie de la sélectivité (Meyers-Levy, 1989) dans un contexte de recherche d'information en ligne. Sur le plan pratique, les gestionnaires marketing et les designers de site web peuvent s'inspirer des résultats de cette recherche pour développer des éléments de personnalisation congruents avec le traitement de l'information des hommes et des femmes.

Mots-clés

- Sexe;
- Genre;
- Traitement de l'information;
- Internet;
- Recherche d'information dirigée;
- Modèle de la sélectivité;
- Traitement de l'information par item et relationnel.

SUMMARY

Sex differences in personality trait have been documented in many empirical studies. Grounded on these differences in traits, two theories developed in cognitive psychology have proposed that men and women differ in the way they process information. Meyers-Levy (1989) proposed that women are comprehensive processors while men are selective processors: women tend to engage in more detailed, elaborative and effortful processing of information than do men. Putrevu (2001; 2004) proposed a competitive theory arguing that men and women do not differ in elaboration and processing effort but in their style of processing: Men are item-specific processors and women are relational ones. The main objective of this study is twofold: First, to improve our understanding on how men and women process information in the context of directed information searches on the Internet and, second, to explore the relevance of both theories in this context.

This dissertation is composed of three empirical essays. The first essay directly compares Meyers-Levy and Putrevu models in providing a fine-grain analysis of the information processing of Internet users while they perform a goal-oriented search. The second essay assesses search efficiency and effectiveness of men and women at different levels of task complexity, and the last essay investigates the moderating role of sex in the relationship between key website characteristics, ease of use, and behavioral intentions.

The major findings of this research are the following. While searching for information on the web, women exerted more comprehension effort than men, and showed a greater usage of a relational processing style than men. However, men failed to verbalize more item-processing thoughts than women in processing the product information available on the site. The results support the theory of the selectivity model (Meyers-Levy, 1989) but gives only partial support to the Item/Relational processing theory developed by Putrevu.

Furthermore, task demands have a differential impact on the efficiency and effectiveness of men and women Internet users. These results are also in line with the selectivity model and affirm findings found in an audit context. Finally, factors driving behavioral intentions do not differ between men and women but perceptions of websites' ease of use are formed by different factors according to the sexes. Site information is more salient for women than for men in forming ease of use perceptions. However, the relationship between personalization of the interaction and ease of use is stronger for men than for women.

These findings have significant theoretical and managerial implications. From the point of view of research, results of the study support the relevance of the selectivity model in the context of online directed search of information. The research findings can also be used by marketing managers and website designers to develop personalisation elements in line with the information processing of men and women Internet users.

Keywords

- Gender;
- Information processing;
- Internet;
- Selectivity model;
- Item and relational processing;
- Goal-oriented search.

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À Normand, Philippe et Émile, les trois hommes de ma vie

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CHAPITRE 1
Introduction

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Plusieurs études ont mis en lumière différents traits qui distinguent les hommes et les femmes, notamment au niveau de l'orientation psychologique (Maccoby et Jacklin, 1974; Feingold, 1994; Costa, Terracciano et McCrae, 2001) où l'homme est guidé par une orientation agentive et la femme présente une orientation plus communale. Ces différences sont aussi bien documentées lorsque les consommateurs utilisent le web et elles se manifestent par des motivations (Smith et Whitlark, 2001), des utilisations et des styles de recherche en ligne (Roy et Chi, 2003; Large, Beheshti et Rahman, 2002) propres à chaque sexe. Basées sur ces traits de personnalité respectifs, deux théories ont proposé que les hommes et les femmes diffèrent dans leur façon de traiter l'information (Meyers-Levy, 1989; Putrevu, 2001). Le modèle de la sélectivité, développé par Meyers-Levy, prévoit que les femmes traitent l'information de façon plus compréhensive et investissent davantage d'effort dans le traitement de l'information que les hommes, qui eux, sont plus enclins à traiter l'information de façon sélective. Putrevu (2001) propose quant à lui, que les hommes et les femmes ne diffèrent pas quant à l'effort investi pour traiter l'information mais que les différences sont au niveau du style de traitement. Les femmes ont davantage tendance à traiter l'information de façon relationnelle alors que les hommes la traite de façon par item. Ces théories ont été surtout mises à l'épreuve individuellement dans un contexte publicitaire (Putrevu, 2004; Meyers-Levy et Maheswaran, 1991; Meyers-Levy et Sternthal, 1991), lors d'essais de produits (Kempf, Laczniak et Smith, 2006) et dans un contexte de recherche d'information en magasin (Cleveland et al., 2003). À ce jour, aucune étude n'a encore évalué la pertinence de ces modèles dans un contexte de recherche d'information en ligne où les consommateur naviguent sur Internet en fonction d'un mêm e but. De plus, aucune étude n'a encore comparé directement les fondements de ces deux modèles compétitifs sur Internet. Ainsi cette thèse, composée de trois essais empiriques, compare les modèles de

Putrevu et de Meyers-Levy dans un contexte de recherche d'information dirigée sur Internet et ensuite explore la pertinence des modèles basés sur le traitement de l'information pour prédire les résultantes des recherches (efficacité et efficience de la recherche, perceptions de facilité d'utilisation et intentions comportementales envers un site) des hommes et des femmes. Chaque essai se distingue par une approche méthodologique spécifique et adaptée aux objectifs spécifiques visés.

Le premier essai explore les différences hommes/femmes au niveau du trait de l'orientation psychologique et du traitement de l'information et compare les postulats des modèles de Meyers-Levy et Putrevu. La méthode de l'analyse des protocoles verbaux simultanés (Ericsson et Simon, 1993; Wright, 1980) est utilisée pour permettre une analyse fine des processus de traitement de l'information des internautes lorsqu'ils et elles naviguent sur Internet à la recherche d'information. Nous avons pu ainsi évaluer la pertinence relative des deux modèles développés en psychologie cognitive. Les implications théoriques et pratiques des résultats obtenus sont présentées.

Le second essai porte sur l'effet du sexe et de la complexité de la tâche sur les stratégies de recherche et la performance (efficience et efficacité) de la recherche sur Internet. Les recherches en psychologie (Meyers-Levy, 1989; Fairweather et Hutt, 1972) et en comptabilité (O'Donnell et Johnson, 2001; Chung et Monroe, 2001) démontrent que les femmes sont moins influencées par la complexité de la tâche que les hommes, suggérant une interaction entre le sexe et la complexité de la tâche. L'analyse des logs de navigation est la méthode retenue pour mesurer les variables de performance de la recherche. Cet essai se conclut par une discussion des résultats et leurs implications théoriques et pratiques.

Finalement, le troisième essai présente les résultats d'une étude effectuée auprès d'un échantillon représentatif de 3,970 internautes canadiens français couvrant 57 sites web provenant de 12 industries. L'objectif de cet essai est d'évaluer le rôle modérateur du sexe dans la formation des perceptions de facilité d'utilisation d'un

site ainsi que dans la formation des intentions comportementales envers le site. Ce dernier essai se conclut avec une discussion des implications théoriques et managériales des résultats obtenus.

Importance du sujet

Dans la dernière décennie, l'utilisation d'Internet a progressé à un rythme phénoménal. Une étude canadienne récente rapporte que la recherche d'information est une raison prédominante pour laquelle les consommateurs naviguent sur Internet (Zamaria et Fletcher, 2007). Il n'est donc pas étonnant de constater que ce nouveau médium a suscité l'intérêt de plusieurs chercheurs en marketing et en technologie de l'information, soit dans le développement d'outils permettant de mesurer la qualité des sites webs (Yoo et Donthu, 2001; Barnes et Vidgen, 2003; Wolfinbarger et Gilly, 2003; Bressolles, 2004; Loiacono, Watson et Goodhue, 2007; Aljukhadar et Senecal, 2009) ou encore d'études pour mieux comprendre comment les consommateurs traitent l'information en ligne (Bucklin et Sismeiro, 2003; Sismeiro et Bucklin, 2004; Senecal, Kalczynski et Nantel, 2005; Kalczynski, Senecal et Nantel, 2006). Cependant, peu d'études se sont intéressées à l'influence du sexe dans ce contexte. Il a même été mentionné que le sexe était quasi absent de la recherche comportementale en technologie de l'information (Gefen et Straub, 1997). Pourtant, le sexe du consommateur est une variable de segmentation classique en marketing. Il s'agit d'une variable facilement identifiable et les segments ainsi générés sont assez larges pour générer du profit. De plus, les possibilités de personnalisation de l'information sur les sites web, rendus possibles par les avancées technologiques, permettent l'adaptation de contenus et/ou de structures cohérentes avec les styles de traitement de l'information des consommateurs. Justement, à ce titre, au moins deux modèles développés en psychologie cognitive proposent que les hommes et les femmes diffèrent dans leur façon de traiter l'information. Ces modèles n'ont par contre jamais été validés dans un contexte de recherche d'information en ligne, lorsque les consommateurs naviguent en fonction d'un but précis. La présente recherche a donc pour but de contribuer à ce champ de recherche en étudiant la

pertinence de ces théories dans un contexte de recherche d'information dirigé sur Internet pour évaluer les stratégies de traitement d'information des hommes et des femmes et leurs conséquences sur la performance de la recherche.

Cadre théorique

Cette recherche s'inspire de l'approche cognitive du comportement du consommateur et est ancrée dans les modèles de traitement de l'information du consommateur (Meyers-Levy, 1989; Putrevu, 2001). Les facteurs sous-jacents à un traitement de l'information différencié selon le sexe sont de natures culturelles et/ou biologiques et concernent des différences aux niveaux des traits de personnalité, de l'organisation du cerveau, des hormones et/ou des rôles sociaux que les hommes et les femmes ont occupés dans la société. Ainsi, s'inspirant de l'approche cognitive, cette recherche s'intéresse aux processus d'attention et de compréhension des consommateurs ainsi qu'aux conséquences potentielles de ces processus différenciés sur les performances de recherche sur Internet, les perceptions et les intentions des consommateurs.

Conclusion

Au cours de ce premier chapitre, le sujet de cette recherche a été présenté. Peu d'études se sont intéressés à comparer les modèles de traitement de l'information qui postulent des différences entre hommes et femmes dans un contexte de recherche en ligne. Pourtant, le sexe est une variable facile d'accès pour les gestionnaires en marketing et constitue une variable intéressante de segmentation de marché. Les trois essais brièvement introduits au cours de ce chapitre sont présentés dans les prochains chapitres.

CHAPITRE 2

"Evidence of a Differential Information Processing Strategy between Men and Women During Searches on the Web"

Co-author: Jacques Nantel, Professor of Marketing HEC Montreal.

Abstract

This exploratory research investigated sex differences in information processing and in psychological orientations when consumers perform goal-oriented search tasks on the Internet. Grounded in cognitive psychology, two theories of differential processing between the sexes--the Selectivity Model and item-specific/relational processing--were compared using concurrent verbal protocols (Ericsson & Simon, 1993; Wright, 1980). The Selectivity Model (Meyers-Levy, 1989) predicts differences in information processing related to comprehension effort while the Item-specific/Relational Theory (Putrevu, 2001) predicts differences in processing style but not in effort. One hundred and nine subjects performed one of two directed search tasks in a laboratory setting. Women put forth more comprehension effort than men, and showed a greater usage of a relational processing style than men. However, men failed to verbalize more item-specific thoughts than women in processing the product information available on the site. Overall, results support the Selectivity Model Meyers-Levy, 1989), whereby women are comprehensive processors and men selective ones. The item-specific/relational processing model receives limited support. The communal orientation of women was also partially supported in that

women verbalized more thoughts than men related to close others (family and friends). Theoretical and managerial implications of these results are provided.

Keywords: selectivity model; item-specific processing; relational processing; sex differences; information processing; information search; verbal protocols.

Introduction

In recent decades, sex differences[1] in personality traits related to measures of agency and communality, sometimes called psychological orientation, have been documented in many empirical studies (Costa, Terracciano & McCrae, 2001; Feingold, 1994; Maccoby & Jacklin, 1974). As such, men tend to be guided by instrumental, self-assertive, and self-purposive concerns. By contrast, women adopt a more communal outlook, characterized by an emphasis on interpersonal relationships, affiliation, and attachment to others. A substantial body of research shows that males and females differ in perceptions of technology (Brunner, 1997; Brunner &Bennett, 1997), usage of the Internet and related motivations (Akhter, 2003; Jackson et al. 2001; Smith & Whitlark, 2001; Teo, 2001; Teo & Lim, 2000; Van Slyke, Comunal & Belanger, 2002) in ways that are congruent with their respective psychological orientations. Grounded in these differences in psychological orientations, two theories have proposed that men and women differ in the way they process information. Meyers-Levy (1989) contends that women are comprehensive processors while men are

[1] The American Psychological Association Publication Manual (4th Edition) states that the word gender is cultural, whereas the word sex is biological; However, in the literature, the terms "gender" and "sex" are often used interchangeably. The focus of this study is on differences between men and women and an effort has been made to use the term "sex" whenever possible.

selective processors: women tend to engage in detailed, elaborative and effortful processing of information. In contrast, men tend to employ heuristic devices that serve as surrogates for more detailed processing, such as focusing on information highly available and salient in the context. Putrevu (2001; 2004) argues that men and women do not differ in elaboration and processing effort but in their processing style: Men are item-specific processors and women are relational processors. As such, men putatively pay attention only to attributes that are distinctive for a brand/product. In contrast, women tend to engage in relational processing, whereby they look for interrelationships and similarities between multiple cues as they process information. Meyers-Levy's model has been tested in various contexts, including advertising (Darley & Smith, 1995; Meyers-Levy & Maheswaran, 1991; Meyers-Levy & Sternthal, 1991), product trials (Kempf, Laczniak & Smith, 2006) and in-store search (Cleveland et al., 2003), while Putrevu's model is more recent but has received support in an advertising context (Putrevu, 2004). However, to our knowledge, this study is the first to (1) test these competing theories in the Internet context, where subjects perform the same goal-directed search tasks, (2) explore if the respective psychological orientations of men and women described in the literature emerge while performing web tasks, and (3) use the verbal protocols method, which allows assessment of key variables differentiating the Selectivity Model from the Item-specific/Relational Model, namely comprehension effort and elaboration. With this study, we hope to contribute both to the theoretical body of knowledge in consumer behavior and to help practitioners adapt and personalize their websites with relevant design or materials that are congruent with the sexes' information processing

styles and traits. Because advertising is sold on the basis of the expected audience's demographics (Wolin, 2003), understanding the way men and women process information on the Internet is definitely important.

Literature Review and Hypotheses

Sex Differences in Psychological Orientations

Sex differences in psychological orientation were first described by Bakan (1966) and Carlson (1971; 1972), who proposed that men and women tend to be guided by different concerns in life. Men generally adopt an agentic outlook focusing on instrumental, self-assertive, and self-purposive concerns. In contrast, women are believed to adopt a more communal outlook characterized by an emphasis on interpersonal relationships, affiliation, and attachment of self and others. In recent decades, sex differences in measures of agency and communality have been documented in many empirical studies (Costa, Terracciano & McCrae, 2001; Feingold, 1994; Maccoby & Jacklin, 1974), most of which use meta-analysis to compile research findings. Interestingly, these sex differences tend to remain quite constant over time, and results on these traits do not vary markedly depending on the age and education of subjects (Costa, Terracciano & McCrae, 2001; Feingold, 1994) , but they appear to be greater in developed countries (Costa, Terracciano & McCrae, 2001). Similarly, Gilligan (1982) maintains that women see themselves as being in connection with others, while men see themselves in terms of separation from others and autonomy. Evidence of such differences is also found in the literature on Internet

usage, motivations, and adoption of computer-based technology. When asked to describe feelings and fantasies about technology, boys report fantasies about brain implants that allow people to transcend the limitations of time and space. For males, technology is a source of power that can be used as one-way communication. In contrast, girls' fantasies concern flexible objects that allow communicating, connecting and sharing ideas. Females focus on technology as a useful tool that can mediate social functions rather than as objects with an intrinsic interest (Brunner, 1997). It is consequently not surprising that women perceive a greater social presence in the email medium than do men (Gefen & Straub, 1997). As Brunner & Bennett (1997) point out : "*Women view the chance to communicate with others to be among the greatest benefits of the Internet*." Thus, women are more prevalent among early adapters of social media (eMarketer, 2006) and teen females are more likely to post photos online in social media than males Lenhart et al., 2008). Females seem to perceive online social media as providing the communication benefits described by Brunner & Bennett more than ten years ago.

Studies on motives underlying Internet usage between men and women shows that men primarily favor task-oriented, instrumental goals (information search, downloading or buying) and use the Internet to find information on subjects related to their personal interest such as investment or software (Akhter, 2003; Jackson et al. 2001; Smith & Whitlark, 2001; Teo, 2001; Teo & Lim, 2000; Van Slyke, Comunal & Belanger, 2002). Women, in contrast, use the Internet more as a means of building and sustaining interpersonal relationships, spending a good portion of their time online using email to stay in touch with others. In the same vein, Smith & Whitlark

(2001) describe key usage situations of men and women on the Internet. Making friends, fighting for causes and nurturing children is what attracts women to the Internet, while the usage situations for men are associated with computers and hobbies, personal productivity or competing and winning. Studies reviewed here support the divergent psychological orientations of men and women. Males' and females' motivations, perceptions and Internet use thus differ but are quite congruent with their respective orientations, which reinforces the robustness of these differences.

Markus & Kitayama (1994) and Cross & Madson (1997) elaborated on these differences in psychological orientation by proposing different self-construals between men and women in North America. Accordingly, men are believed to have a structure of the self that is independent from others, and their representations of others are separate from the self. In contrast, women favor an interdependent self-construal, where others are considered part of the self (Markus & Kitayama, 1994). The self is a powerful regulator that directs information processing because self-representations function as "lenses" for the perception and interpretation of information. Therefore, divergent self-construals may produce significant individual variation in cognitive processes such as encoding and organization of information. For example, women's interdependent self-construal includes representations of close others (spouse, best friends, etc) and these representations are likely to be highly accessible in the act of thinking (Cross & Madson, 1997).

We propose that the independent/interdependent self and the agentic/communal orientation of the sexes should be detectable when consumers navigate on the Internet

while performing goal-oriented tasks. Li, Daugherty & Biocca (2001) report that 60% of participants verbalized the potential importance of products/attributes to someone else while interacting with 3-D products on the web, but they did not expand on the role of sex in their study. We therefore posit that:

> *H1: Women generate a greater proportion of thoughts that refer to other persons (relative to the total number of thoughts) in a given online task than men do.*

Sex Differences in Information Processing and their Impact on Comprehension Effort and Processes

Grounded in these differences in psychological orientations between the sexes, two theories state that men and women differ in the way they process information. Meyers-Levy (1989) introduce a unifying framework that recognizes and interprets a broad array of observed sex differences encompassed by the Selectivity Model, which argues that men and women differ in effort, attention to details and elaboration when processing information**.** More recently, Putrevu (2001) offered a competing view, namely that men and women differ not in effort or elaboration but in their processing style (item-specific vs. relational).

The Selectivity Model

According to the Selectivity Model, males and females employ differing information-processing strategies: males are selective processors that do not generally engage in comprehensive, extensive processing of all available information. Instead, they use various heuristic devices that serve as surrogates for more detailed processing. Men tend to focus on cues that are highly available and particularly salient in the context or on cues that converge to imply a single inference (Meyers-Levy & Maheswaran, 1991). They do not pay attention to subtle details (Meyers-Levy & Sternthal, 1991). In contrast, women are comprehensive processors that tend to assimilate all available information and elaborate more on it. Women thus attempt to engage in a rather effortful, comprehensive analysis of the available information and are also more likely to notice and elaborate on subtle cues. This difference between the sexes emerges not because males encode fewer cues than females but most likely because women elaborate more extensively on cues, which they thus make accessible for subsequent use (Meyers-Levy & Maheswaran, 1991). Supporting that view, in studies of children, girls were found to spontaneously make greater use of elaborative comprehension strategies than boys in a paired-word memorization task Waters & Schreiber, 1991). Further, the Selectivity Model holds that in keeping with their agentic orientation, males streamline the processing of external world information by focusing on self-relevant information, which acts as a heuristic device on which to base judgments. In contrast, females comprehensively process information, devoting relatively equal processing time to information relevant to the self and to the external world of others, which would be consistent with their more communal orientation.

This latter sex difference was supported in a recognition memory task where, for both teenagers and adults, women outperformed men on female-oriented and random objects. Only in male-oriented objects did males perform at the same level as women (McGivern et al., 1997). Women are also more likely to integrate information from others when forming judgments than are men (Meyers-Levy, 1988).

However, depending on the conditions and the task, men can use message cues similarly to women. Women have a lower threshold for elaborating on message cues than men do. In general, differences seem most likely to emerge when the demand of the task is moderate and when subjects are given adequate time to process and elaborate on information (Meyers-Levy & Sternthal, 1991).

The Selectivity Model has been tested and validated in the context of advertising (Meyers-Levy & Maheswaran, 1991; Meyers-Levy & Sternthal, 1991) and product trials (Kempf, Laczniak & Smith, 2006). It has been successfully used as the theoretical framework to predict men's and women's search patterns in-store when shopping for a Christmas gift (Cleveland et al., 2003) and is therefore a promising theory to measure sex differences in search patterns in an Internet context.

The Item-Specific/Relational Processing Theory

Based on the argument that some of the predictions of the Selectivity Model have not been supported, and given the mixed findings of studies of sex differences in information processing, Putrevu (2001; 2004) considered other possible explanations for the observed differences between males and females. He argues that men and

women favour differing processing styles. Culture, psychological orientations and gender predispose consumers toward a particular type of processing. Men are more prone to *item-specific processing*, and as such tend to pay attention only to attributes that are distinctive for a brand/product. In contrast, women are more likely to engage in *relational processing* in which they attempt to decipher the intricate interrelationships between attributes or brands and tend to be sensitive to cues that focus on the common themes of the information. Item-specific and relational processing are two types of processing that facilitate comprehension (Einstein & Hunt, 1980; Hunt & Einstein, 1981). Relational processing emphasizes similarities or shared themes among disparate pieces of information and can pertain to associations between brands, associations to people, objects and occasions of use associated with the product category (Malaviya, Kisielius & Sternthal, 1991). In contrast, item-specific processing stresses attributes that are unique or distinctive to a particular piece of information. Contrary to the Selectivity Model, the *relational/item-specific processing* dichotomy does not stipulate a difference in intensity of elaboration or processing effort but rather in processing style. Each sex tends to focus on a different aspect of the available information. Putrevu (2004) finds support for his theory in an advertising context by showing that men and women do not differ in the number of cognitive thoughts listed across a variety of advertisements (comprehension effort), but that they differed in the types of thoughts listed. As item-specific processors, men listed more attribute-oriented thoughts, whereas women, relational processors, listed more category-oriented thoughts after viewing printed ads. However, Putrevu did not compare the intensity of elaboration between men and

women. Because the concept that item-specific/relational processing differentiates information processing between men and women is quite recent, no other authors have yet tested it in different contexts. Table I highlights the theoretical similarities, and more importantly, differences between the two theories of information processing.

Table I: A Comparison of the Selectivity Model and the Item-Specific/Relational Theory of Information Processing Between Men (M) and Women (W)

Variables	**Selectivity Model (Meyers-Levy)**	**Item-specific /Relational Theory (Putrevu)**	**Direction/nature of the difference**
Difference in self-relevant focus	Yes	Yes	M > W
Difference in sensitivity to details	Yes	Yes	W > M
Difference in comprehension effort	Yes	No	W > M
Difference in intensity of elaboration	Yes	No	W > M
Difference in item-specific vs. relational processing	No	Yes	W= relational M = item-specific

A primary goal of this paper is to assess which information processing theory provides the best fit when men and women attend to salient aspects of their (Internet) environment and make sense of that information while searching with the same goal

in mind. Therefore, comprehension processes will be measured on a quantitative basis but will also be assessed on a more qualitative basis, by measuring the processing style. We can then perform a finer-grain test of Meyers-Levy vs. Putrevu's models. In order to separate and test the competing theories, we will use alternative hypotheses to build what Bacon (1960) and Platt (1964) call *strong inferences.*[2] Specifically, we will compare Meyers-Levy and Putrevu's models using such hypotheses.

The Measure of Comprehension Effort

Celsi & Olson (1988) and Putrevu (2004) used the total number of thoughts generated by the information presented as a measure of comprehension effort. However, comprehension processes vary qualitatively along a continuum from the automatic, lower effort process of preconscious attention to the more controlled, higher effort comprehension processes involved in elaboration (Celsi & Olson, 1988). Elaboration occurs when prior knowledge activated from memory is integrated with new information from the environment to produce new meaning (inferential thought) not present in the environment (Celsi & Olson, 1988). Therefore, comprehension processes vary in effort, and the number of inferential thoughts can be used to indicate the amount of effort (or elaboration) that occurs during comprehension. As such, thoughts can be divided into inferential and non-inferential categories. Non-

[2] "…the fruitfulness of interconnecting theory and experiments so that the one checked the other. Of the many inductive procedures Bacon (1960) suggested, the most important... was the conditional inductive tree, which proceeded from alternative hypothesis through crucial experiments… to exclusion of some alternatives and adoption of what is left... (Platt, 1964discussing Bacon's process which he labelled "strong inference")

inferential thoughts include sensory-level descriptions of product characteristics or verbatim playbacks of the product/brand information explicitly presented in the website. In contrast, inferential thoughts reflect a deeper comprehension of the information, such as overt evaluations, conclusions, questions, and comparisons. Inferences thus transcend the information provided.

According to the Selectivity Model (Meyers-Levy, 1989) consistent with their comprehensive processing strategy, women should attempt to engage in a rather effortful and piecemeal analysis of all information contained in a website and should therefore devote more cognitive effort while processing information than men. Females should then display a more effortful comprehension process than their male counterparts in any given task, as measured by two indicators: the number of cognitive thoughts and the proportion of inferential thoughts verbalized. Males should tend to focus on information that is highly available and salient in the context and should elaborate less on the information. However, if the Item-specific/Relational Theory developed by Putrevu (2001; 2004) is at play, comprehension effort should not vary across males and females.

Thus, we posit that in a goal-oriented search task on the web, depending on the relevant framework:

> *H2-0: Men and women do not differ in the total number of thoughts verbalized (including inferential and non-inferential thoughts) while accomplishing a given task (Putrevu).*

H2-A: Women verbalize more thoughts (including inferential and non-inferential thoughts) than men do while accomplishing a given task (Meyers-Levy).

H3–0: Men and women do not differ in the proportion of inferential thoughts (relative to the total number of product-related thoughts) verbalized while accomplishing a given task (Putrevu).

H3-A: Women verbalize more inferential thoughts (relative to the total number of product-related thoughts) than men do while accomplishing a given task (Meyers-Levy).

The Measure of Processing Style

The Item-specific/Relational Theory predicts a difference in the focus of comprehension processes between males and females. More communal-oriented, women should engage in relational processing in which they seek interrelationships, similarities and differences between multiple cues as they process information. They tend to generate category-oriented thoughts. Conversely, agentic men are more likely to perform item-specific processing whereby they focus on key attributes or information such as the distinctive attributes of a brand or product and do not attempt to decipher the interrelationships and similarities between them. In that sense, men are more concerned with attribute-oriented thoughts. However, according to the Selectivity Model, men and women should not differ in the focus of processing. Therefore, we posit that:

H4–0: Men and women do not differ in the proportion of item-specific thoughts (relative to the total number of product-related thoughts) verbalized while accomplishing a given task (Meyers-Levy)

H4-A: Men verbalize more item-specific thoughts (relative to the total number of product-related thoughts) than do women while accomplishing a given task (Putrevu)

H5–0: Men and women do not differ in the proportion of relational thoughts (relative to the total number of product-related thoughts) verbalized while accomplishing a given task (Meyers-Levy)

H5-A: Women verbalize more relational thoughts (relative to the total number of product-related thoughts) than men do while accomplishing in a given task (Putrevu)

Method

To test our hypotheses, we retained a qualitative methodology. When the purpose of collecting and analysing data is geared toward the study of cognitive processes, our primary research objective, analysis of concurrent protocols is a useful method because it allows us to trace these cognitive processes as subjects report their thoughts during the performance of a task of interest (Van Someren, Barnard & Sandberg, 1994). This analysis reveals assumptions, inferences, misconceptions and problems that the subject encounters in a real-time setting. When performed under

good conditions (including undirected instructions eliciting verbal reports, and verbalization as undisturbed and constant as possible), this method allows the systematic and valid analysis of information that is not otherwise available (Ericsson & Simon, 1993). It avoids reliability problems that may arise with other methods (ex-post interviews, questionnaire, use of retrospective protocols) where omissions and fabrications can occur due to people's tendency to forget much of their experiences or justify their actions once they have completed the task. When verbalizing during the task, subjects report the content of their short-term memory (STM) while they accomplish their task. Studies (Ericsson & Simon, 1980; 1984) suggest that verbalizing cognitive processes has little or no effect on performance, especially if it occurs in a self-paced, distraction-free and low-time pressure environment designed to minimize competing processing activity (Wright, 1980) because it is independent to the task. However, there may be substantial differences in the ease with which people can verbalize their thoughts. The verbosity of subjects is addressed by re-expressing absolute counts of thoughts in a class as a proportion of a subject's total output (Wright, 1980), which explains why all the hypotheses in the study were formulated as a proportion of a category to a subject's output.

Think-aloud has been widely used in research to assess reactions to advertising and persuasion in the 1970s (Wright, 1980) and more recently in web usability testing (Benbunan-Fich, 2001; Boren & Ramey, 2000; Nantel, Senecal & Mekki-Berrada, 2005). It has also been successfully used to analyse the characteristics of virtual experience in e-commerce (Li, Daugherty & Biocca, 2001) and to measure information-seeking processes using tasks on the web (Branch, 2000; Ching Yang,

1997). This is why we have retained this method to study sex differences in comprehension processes while men and women perform the same goal-oriented tasks on the Internet.

Sample and Procedure

In order to simulate the optimal conditions in which concurrent verbalizations occurred, participants were invited to accomplish a specific goal-oriented task in a laboratory setting. One hundred and nine subjects (50% women), all Internet users, were recruited either by a hyperlink on a hardware store website or were referred by participants recruited via the hyperlink. Participants were randomly assigned to one of two tasks to be performed on a specific retailer website: Find information on and select a humidifier for the bedroom (Task 1), or find information on and select the best type of paint to redo a deck (Task 2). Participants were not asked to complete a transaction on the website, but they were given a credit card upon request. Obviously, the transaction was not processed.

Consumers received compensation of $50 each for their participation. After the welcome and a brief description of their assigned task, participants were directed to a portal website to read their horoscope and find a movie they would like to see during the following week-end. This warm-up session was intended to make the participants feel comfortable while verbalizing their thoughts and to familiarize them with the laboratory environment. During their navigation, participants were asked to verbalize every thought that went through their mind. When subjects were silent for more than

20 seconds, they were instructed to “keep on talking.” Although the assigned task was mandatory, consumers were told that they could interrupt the navigation at any time and that they had no time limit to perform the task. The only requirement was ongoing verbalization throughout the navigation process. The navigation data and the verbalization were recorded in AVI format (video and sound sequence) using CAMTASIA software. After navigation, each participant answered an online questionnaire where demographic information, experience with the Internet as well as experience with the website visited were gathered. The navigations lasted from 2,1 minutes to 29,1 minutes, with an average of 9,65 minutes for the “humidifier” task and 8,45 minutes for the “paint” task. No differences between men and women and between tasks were noted with respect to the average time taken to accomplish the task ($p > 0,10$).

Interpreting and Coding Verbalization Data

As a first step, concurrent verbalizations for each subject were literally transcribed by a professional who used the *italic character* when participants read information on the website. All transcripts were validated by the first author before continuing with further coding.

Second, the text was divided into distinct “units of thoughts.” Each unit of thought corresponded to a naïve assessment of what constitutes a single task assertion or reference by the subject. A “unit of thought” in this study is defined as the smallest set of words that is meaningful out of its context, which allows a coder to interpret

the meaning of the statement without referring to the text before and after that statement, as in Li, Daugherty & Biocca (2001). The division of each transcript was further revised by coders to ensure reliability. On average, subjects produced 67 thoughts (minimum = 10, maximum = 247) for a total of 6,382 thoughts to be used for further coding.

The next step involved coding the thoughts into one or more of four categories. Coding was performed using Atlas TI 5.2, a qualitative data analysis software program. Two coders (one male and one female) that had extensive experience with Atlas TI and that were independent from the research team classified the thoughts into categories. Coders were not informed of the subjects' sex. Based on the hypotheses discussed above, an initial coding scheme was developed "a priori" in order to classify each thought (the final protocol coding scheme is available upon request). Eleven subjects chosen for training were independently coded by the coders. For each training subject, coding problems and disagreements were discussed and the instrument was revised. Following the procedure advocated by Lombard, Snyder-Duch & Bracken (2002), this process was repeated several times for each task until it was believed the instrument would permit reliable coding, at which time a pilot test using a random sample of units of thought was conducted to formally assess reliability. Two indices of reliability were used: percent agreement and Scott's pi.[3] During coding of the full sample, another pilot test using a different random sample

[3] Percent agreement ranges from.00 (no agreement) to 1,00 (perfect agreement). It is simple to use, but its biggest weakness is the failure to account for agreement that would occur simply by chance. Scott's pi, which varies from -1 to 1, is an index that accounts for chance agreement; it takes into account the number of categories as well as the distribution of values across them. There is general consensus in the literature that percent agreement is too liberal an index, while indices such as Scott's pi are too conservative (Lombard, Snyder-Duch & Bracken, 2002).

of units was done (n =161 for task 1 and n=191 for task 2, following guidance and procedures from Lacy, Riffe & Fico, 1998), which produced the indices for intercoder reliability presented in Table II. In the literature, coefficients of 0,80 or greater are acceptable in most situations and 0,70 is often used for exploratory research. More liberal criteria are usually used for the indices known to be more conservative, such as Scott's pi (Neuendorf, 2002). We are therefore satisfied with percent agreement--all over 80%--and Scott's pi indices, all over 70% (except one at 69%) for this exploratory study.

Table II: Intercoder Reliability Indices* for all Dependant Variables

Variables	**% agreement**		**Scott's pi**		**% agreement**	**Scott's pi**
	Task1	**Task 2**	**Task 1**	**Task 2**	**Global**	**Global**
Product thought	99%	99%	99%	98%	**99%**	**98.5%**
Other persons thought (H1)	100%	100%	100%	100%	**100%**	**100%**
Comprehension effort** -Inferential thought (H3)	88%	99%	74%	95%	**93.5%**	**79.5%**
Item-specific /relational processing (H4-H5)	82%	86%	69%	79%	**84%**	**74%**

*ReCal, an intercoder reliability calculator (www.dfreelon.org) was used to calculate the indices

**Note that the total number of thoughts (H2) is not presented in the table because it does not necessitate coding.

Description of the Coding Categories and Measure of the Variables

Product thoughts refer to the task-product and can include many cognitive processes such as remembering the product to find, reading tabs or text found in the website concerning the product, comparing brands, evaluating the different attributes of the brands, and using the search engine to find the product. We consequently constructed a thesaurus for each task, where we included "product keywords" that were taken from the verbalizations of the participants included in the training. If a unit of thought included a product keyword, it was tagged as a product thought. Examples of product thoughts include: "I like this model," "Now I have to find a humidifier for my bedroom" and "What is the difference between latex and oil paint?" Because participants sometimes refer to a product named in a preceding thought by words that could not be included in the thesaurus (e.g. "This is interesting," referring to a type of paint), we scanned all thoughts in a second phase to find such occurrences. Given that Atlas TI's systematic lexical search procedure asks the analyst to confirm the coding of each occurrence of a "hit," it was possible to decline coding when some associations were inadequate (for example adherent (which can be a paint attribute) + Air Miles). By using this procedure, an overall agreement rate between coders of 99% was obtained. On average, 38,4% of thoughts produced by participants were product-related (ranging from 16% to 93%). No differences across tasks were noted regarding the proportion of product-related thoughts ($p > 0,10$)

"Other people" thoughts are verbalizations that refer to people other than the participant. Three different categories of people were referred to by participants: Close others (family members and friends), professionals (e.g. salespeople,

entrepreneurs, experts) and people in general (e.g. someone, people). Examples of each type are: “My mother loves that site” (close others); “I have to go see a salesperson who will explain this to me” (professionals) and “This is for someone who has a small bedroom” (people in general). More than half of the subjects (51,6%) did not express any other person-related thoughts. For those that did, the number ranged from 1 to 10 occurrences per navigation (45% people in general, 36% professionals and 19% close others). No differences across tasks were noted regarding the proportion of website-related thoughts ($p > 0,10$).

Next, product thoughts were further classified as either (a) inferential or non-inferential and as being either a representation of (b) item-specific processing, relational processing or other thought. Because the focus of the navigation task is mainly on finding a specific product and because Putrevu’s categorization is organized around product thoughts, only product thoughts were used for these categories. First, the coding scheme of Celsi & Olson (1988) adapted to a search task on the Internet was used to codify inferential thoughts. Non-inferential thoughts included sensory-level descriptions of product characteristics, verbatim playbacks or paraphrasing of the product/brand information explicitly presented in the website such as “here they tell me that this model removes bacteria” (in italic font in the transcription). In contrast, product inferential thoughts transcend the information given, and include evaluations, conclusions, questions, comparisons and interpretations pertaining to a brand, attribute or product information. Illustrations of inferential thoughts are: “Bionaire is a good brand” and “Why is this model more expensive than the other one?” An average of 22,3% of product thoughts produced

by participants was inferential thoughts (ranging from 0% to 75%). The humidifier task generated significantly more inferential thoughts regarding products than the paint task ($p < 0,05$).

Second, in order to test the Item-specific/Relational theory in a web-based context, product thoughts were also classified as representing either "item-specific processing", "relational processing" or "other thought." Putrevu (2004) exposed subjects to eight print advertisements and asked them to list the thoughts that occurred to them after they viewed each of the test ads. On average, less than four thoughts per ad were listed by subjects. These thoughts were then categorized as either attribute-oriented (item-specific processing), category-oriented (relational processing) or other. As Putrevu explains, attribute-oriented thoughts bring out the distinctive or unique features of the product-brand. Category-oriented thoughts focus on the common themes in the information, in addition to its unique features (e.g. brand position within the subcategory, comparison between brands, verbalization related to the general product category). Other thoughts were not related to any product attribute or the general product category but were either directed at the peripheral background elements or were tangential to the ad itself. We used a coding scheme that closely resembled the one used by Putrevu (2004) to enhance the face validity of our measures, but we adapted the scheme to a web search task. In this study, item-specific processing is defined as thoughts about specific brand features, when participants distinguished between attributes that a brand does or does not have, association between a target product (brand) and some of its attributes (Malaviya, Kisielius & Sternthal, 1996). Examples of item-specific thoughts include: "This one

is $24,99" and "Latex paint does not smell." The assessment of one attribute is also considered a manifestation of item-specific processing (Malaviya, Kisielius & Sternthal, 1996). An illustration is: "Is an electrostatic filter really important?" Relational processing is operationalized in this study as associations with the product category and includes people, objects and occasions of use, comparisons between products (brands) and comparisons between attributes (Malaviya, Kisielius & Sternthal, 1996). It includes thoughts such as; "Clairion is better than Bionaire"; Latex paint is as resistant as oil paint"; and "This one is too big for the size of my bedroom." Other thoughts would be not related to any product attribute or the general product category but would be directed at the website, such as: "where will I find paint on that website?" On average, 38,4% of product thoughts generated by participants were item-specific (ranging from 0% to 88%), 19,7% were relational thoughts (ranging from 0% to 52%) and 41,9% were other thoughts (ranging from 3% to 100%).

The humidifier task was expected to trigger more item-specific processing because participants could easily reach a website section where many brands were presented on a large variety of attributes. In contrast, the paint task was expected to stimulate more relational processing because the paint section of the website was designed not only to offer a selection of products but also a lot of context-related content regarding the paint (painting and temperature, type of paint and different surfaces, products and material needed). Accordingly, on average, 52,2% of all product thoughts in the humidifier task were item-specific compared with only 25,7% in the paint task ($p <$

0,05). Conversely, an average of 13,6% of all product thoughts in the humidifier task was relational compared with 25,4% in the paint task ($p < 0,05$).

Each thought received as many codes as were appropriate. Thus, the number of codes per thought varied. Table III summarizes the codes, categories and descriptive statistics associated with each task. These categories formed our dependent variables and were the basis of the subsequent data analysis.

Table III: Codes, Categories and Descriptive Statistics

Codes (dependant variables)	**Categories**	**Proportion task 1**	**Proportion task 2**
Product thought	a) Product thought	**36,4%**	**40,5%**
	b) Other thoughts*	63,6%	59,5%
Other persons thought (H1)	a) Reference to others	**1,2%**	**1,8%**
	b) Other thoughts*	98,8%	98,2%
Comprehension effort -Elaboration (H3)	a) Inferential	**29,2%**	**16,1%****
	b) Non-inferential*	70,8%	83,9%**
Item-specific/relational processing (H4-H5)	a) Item-specific processing	**52,2%**	**25,7%****
	b) Relational processing	**13,6%**	**25,4%****
	c) Other*	34,2%	48,9%**

*These categories were not coded to ease the codification process.

**Proportion significantly different across tasks ($p<0,05$)

Sex (biological sex as reported by the participant) is the independent variable of the study. We controlled for experience with the Internet, experience with the website visited, age and education. Scales are presented in Appendix A.

Results

Preliminary Analyses

Men and women were first compared on key characteristics such as demographic variables and Internet experience. Subjects were young and educated and most had more than three years of experience using the Internet, which is representative of the typical Internet user. Less than half of the participants had visited the site before and only 1% had ever bought something on that website. Men and women did not differ on any of these characteristics, as Table IV shows.

Table IV: Sample Characteristics[4]

Variables	**Men (n=49)**	**Women (n=46)**	**Sex difference (p)**
Age (18-34 years old)	63%	78%	> 0,1
Education (university degree)	57%	57%	> 0,1
Internet experience (Over 3 years)	78%	76%	> 0,1
Have you ever navigated on the website you just visited? (Yes)	47%	44%	> 0,1
Have you ever bought something on that website? (Yes)	2%	0%	> 0,1

The direct effect of each control variables (age, education, Internet experience and experience with the website) on the dependent variables was examined. Because tests for age, education and experience with website were non-significant, these variables were dropped from further analyses. However, Internet experience influenced the

[4] 109 subjects participated in the study. The first 3 audiotapes were inaudible and could not be used and 11 subjects were used for the pretest, leaving 95 valid subjects for the study.

proportion of inferences verbalized. As mentioned above, proportions of inference thoughts, as well as proportions of item-specific and relational processing, differ across tasks. Internet experience (two categories, divided at median) and task were then included as covariates for further analyses to rule out alternative explanations for the results.

Hypothesis Testing

We performed a series of ANOVAs comparing the average scores of men and women on the dependent variables to test our hypotheses. The relevant univariate contrasts from the ANOVAs are presented in Table V. Note that to test Hypothesis 1, the absolute number of units of thought related to others was used instead of proportions in the analysis because the variable was not normally distributed; half of the participants (51,6%) did not express any thoughts related to other persons. The variable was dichotomized at median split and no differences between the sexes emerged in the chi-square tests ($p > 0,10$). However, additional analyses revealed that, for participants that did verbalize at least one thought related to others ($n = 46$), women expressed on average more thoughts related to close others such as friends and family members[5] than men did (M women = 0,55 vs. M men = 0,16, p one-sided = 0,06). Even though this exploratory finding is marginally significant, it supports the interdependent self-concept of women.

[5] Due to the small sample size involved, Internet experience was not included as a covariate in this analysis. Internet experience had no impact on the number of thoughts related to close others verbalized by subjects.

Table V: Results

Dependant variables	**Mean (SD)**		**F value**	**p value (one-sided)**	**η^2**
	Men	**Women**			
Average number of thoughts related to close others (H1)	0,16 (0,17)	0,55 (0,18)	2,52	**0,06**	**0,057**
Total number of units of thought (H2)	57,3 (7,5)	77,0 (8,2)	3,13	**0,04**	**0,035**
Proportion of inferential thoughts (H3)	0,20 (0,02)	0,26 (0,02)	2,91	**0,046**	**0,032**
Proportion of item-specific thoughts (H4)	0,33 (0,03)	0,35 (0,03)	0,09	> 0,10	
Proportion of relational thoughts (H5)	0,16 (0,02)	0,22 (0,02)	3,88	**0,026**	**0,043**
Proportion of product-related thoughts	0,39 (0,03)	0,40 (0,03)	0,22	> 0,10	

Hypothesis 1 is thus partially affirmed. Hypothesis 2 and 3 concerned the measure of comprehension effort. On average, women exerted more effort measured both in terms of total number of thoughts (M women = 77 vs. M men= 57,3, p one-sided < 0,05) and proportion of inferences related to the task-product (M women = 26% vs. M men = 20%, p one-sided < 0,05), supporting H2-A, H3-A and the Selectivity Model. Note that no difference was noticed on proportion of product-related thoughts between the sexes. Hypothesis 4 and 5 pertained to the sexes' processing styles. Men and women did not differ in the proportion of item-specific processing thoughts (M

women = 35% vs. M men 33%, p > 0,10) supporting H4-0, but as suggested by Putrevu (2001; 2004), women tended to focus more on relational processing than men (M women = 22% vs. M men = 16%, p one-sided < 0,05), supporting H5-A. Table 6 summarizes the hypotheses and the results.

Table VI: Summary of the Results

Variables	**Hypothesis**	**Result**
H1: **Psychological orientation and self-construals**: proportion of other-related thoughts	**W > M**	**Partially supported**
H2: **Comprehension effort**: total number of units of thought	**A: W > M (Meyers-Levy)** 0: W = M (Putrevu)	**Supported**
H3: **Comprehension effort:** proportion of inferential thoughts	**A: W > M (Meyers-Levy)** 0: W = M (Putrevu)	**Supported**
H4: **Style of information processing**: proportion of item-specific thoughts	**0: W = M (Meyers-Levy)** A: M > W (Putrevu)	**Supported**
H5: **Style of information processing**: proportion of relational thoughts	0: W = M (Meyers-Levy) **A: W > M (Putrevu)**	**Supported**

Discussion

Overall, the results support the tenets of the Selectivity Model (Meyers-Levy, 1989), whereby women exert more comprehension effort than men in accomplishing a goal-oriented task on the Internet, as measured both by the number of units of thought and the proportion of inferential thought verbalized, even when controlling for Internet experience and the task. Sex differences regarding the processing style (Putrevu, 2001; 2004) received partial support in that particular context. Item-specific processing did not differ between the sexes but women were more prone to relational processing. Additional analyses revealed that women apparently considered more attributes than men when selecting products online (M men = 3,8 vs. M women = 5,9, p one-sided < 0,05) and deciphered the intricate interrelationships between them, as proposed by Putrevu. Women's relational processing style does not refute the selectivity hypothesis because verbalization associating the product category with objects or occasions of use is consistent with the effortful processing style of women depicted by Meyers-Levy. However, men failed to generate a greater proportion of item-specific thoughts as predicted by the Item-specific/Relational Model.

Surprisingly, men and women did not spontaneously verbalize many thoughts related to others in the goal-oriented tasks proposed, but when they did, the proportions were similar. The qualitative nature of the other persons thoughts mentioned was nonetheless revealing. Other persons thoughts were divided into three categories (close others, people in general and professionals) and only in the absolute number of mentions of close others did we find a sex difference, which is congruent with the interdependent self-construal of women (Cross & Madson, 1997) and the difference

in traits regarding agency and communality. Women's representations of close others seem to be more accessible than men's in the act of thinking as reflected in verbalizations.

These results make important contributions to the literature on sex difference in information processing by providing evidence of the more effortful information processing of women and the more selective processing used by men when performing the same goal-oriented task on the Internet. Furthermore, by using verbal protocols, a method of choice to study information processing, and by formulating alternative hypotheses, this study is the first to disentangle and test the key postulates of two competing theories of sex differences in information processing. Accordingly, the Selectivity Model gains more support than the Item-specific/Relational Model because differences in effort were observed, whereas only some differences in processing style were noted. The findings also support different self-construals between men and women, as close ones were more freely mentioned by women than by men when performing goal-directed searches on the Internet.

The findings spawn a number of implications for marketers and web developers that seek optimal ways to appeal to men and women and convert them from browsers to customers. Sex is a variable of segmentation that is easy to identify, highly available and provides large enough segments to be profitable. Advances in technology and customer information tracking make it possible to personalize pages on the Internet with content, design or features adapted to the information processing strategies of males and females. For sites targeting men, designers should structure content congruently with men's processing style, which operates on a "what's in it for me"

basis. Males' adaptation should be stressing unique features and differential advantages of brands early in navigation, which implies a simple and focused web page structure. For more complex products, providing a strong, single cue that visually summarizes the key product features and benefits would be consistent with men's heuristic processing. Usage of clickable links to relevant extra information would allow consumers to deepen their analysis if needed without crowding the page with too much written information, which is especially uninviting to men (Putrevu, 2004). Conversely, making a site more female-oriented entails structuring the information to facilitate or favor relational processing and elaboration. For transactional sites, a good way to exploit women's proneness to relational processing is by leveraging the Internet's interactive capabilities, pertaining in particular to cross-selling strategies. Users could then shop for a mix of items (coordinated shirt and pants, for example) instead of just one item. Such a strategy will likely enhance the shopping experience for women. A comparison matrix available on the Internet is a functionality that facilitates and encourages comparison between brands on various attributes and can be used to analyze common elements between brands as well as unique features. This matrix also allows shoppers to compare brands or models on a few key attributes, simplifying decision. It is thus congruent and adaptable to the information processing of both sexes. The interdependent self-construal of women would predispose women to share information with close others and to be sensitive to their recommendations. This is in line with Garbarino & Strahilevitz (2004), who showed that recommendations from friends had stronger effects for women than men in reducing perceived risk and intentions to buy online. Web 2.0 applications should

be strategically integrated in websites targeting female patrons (make-up, health, kids etc) because they fit women's information processing style. On a more general basis, women should be more receptive than men to web atmospherics, ads or content picturing contexts of family and friends. Finally, women's proclivity to engage in elaborative processing coupled with their discerning eye for details present marketers with abundant opportunities to finely tune their positioning of products.

These results raise the questions of the origin of the differences in both information processing and psychological orientation. Literature in various domains proposes socio-cultural and biological explanations. For example, the social role theory of sex differences (Eagly, Wood & Diekman, 2000) posits gender hierarchy and social roles as the fundamental origins in sex differences in human behavior in a given culture. Gender roles dictate the behaviors and traits that are appropriate for males and females, and the social agents encourage these gendered behaviors. As such, men's processing style is consistent with the dominant, more forceful social role they historically held in society, being free to concentrate their attention on attaining personal goals. Females, who held a more submissive role in our evolution, learned to survive by understanding and responding to others' state of mind (Janeway, 1980) and by being attentive to detail cues. In contrast, the biological model posits that observed sex differences in traits or information processing reflect innate difference between the sexes and are genetically programmed by evolutionary factors. In this case, brain organization or biological substrates like hormones (Berenbaum & Hines, 1992; Berenbaum & Snyder, 1995; Carter, 1998; Sandstrom, Kauman & Huettel, 1998) are the proximal causes that explain these sex differences. For example, brain

hemispheres are believed to be more symmetrically organized (integrated) in females and more specialized in males (Everhart et al., 2001; Gorman & Nash, 1992). Women also appear to have larger areas of connective fibres between the two hemispheres, making it probable that communication between their hemispheres is facilitated (Aboitiz et al., 1992). Males are believed to rely heavily on right-hemisphere processing, denoted by reliance on global rules and holistic processing, whereas females primarily rely on left-hemisphere processing which concerns the specificities and intricacies represented or implied by stimulus information Meyers-Levy, 1989). Our research does not resolve the debate on the origins of sex differences but provides additional evidence supporting differential processing of information between men and women.

Limitations and Suggestions for Future Studies

As with all behavioral research, there are limitations to the generalization potential of the findings that should be considered. First, this research focused on differences in processing and not on differences in outcome variables such as attitude toward the website, behavioral intentions or purchase. Future research should study both aspects to validate implications of differential processing between the sexes in the Internet context. Second, in this study we concentrated on the effect of biological sex. It would be relevant for future studies to explore the influence of gender identity on information processing in the context of directed tasks on the Internet. Scales of femininity/masculinity (PAQ (Spence, Helmreich & Stapp, 1975); BSRI (Bem,

1974)) and self/other orientation (Hupfer, 2001) are available and could enrich our understanding of information processing between the sexes/genders.

Third, the results of this exploratory study should not be interpreted as an indication of a global, sex-specific superiority in cognitive reasoning for a particular task. The selectivity hypothesis and the item-specific/relational processing theory do not predict that one sex will make better decisions than the other. It suggests only that females will, under certain conditions, use a different strategy than males to process information. Individual variables such as familiarity and involvement with the product category, need for cognition and cognitive styles, not measured in this study, could influence information processing. Although we do not believe involvement and familiarity would have been high for the product type chosen or would have varied between the sexes, future studies should incorporate these variables. In the same vein, contextual/social factors that could influence search strategies on the Internet were not included in the design and would warrant future research.

Finally, as Wright (1980) mentioned 30 years ago, "an unfortunate aspect of verbalization data is how burdensome they are to analyse." Ninety-five subjects is on the high end of sample size for studies using the method of verbal protocols (Benbunan-Fich, 2001; Branch, 2000; Ching Yang, 1997; Fisher Gardial et al., 1994; Li, Daugherty & Biocca, 2001). However, the sample was generated using a convenience method with the associated weaknesses, and the limited sample size affected the power of some analyses. Future studies should try to replicate the results of this exploratory study in different settings, using a larger and more representative sample.

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Appendix A: Scales for Control Variables

Experience with the Internet was measured with an ordinal scale ranging from (1) 1 year or less to (6) More than 3 years

-"*How long have you been using the Internet?"*

Experience with the website at hand was measured with the following question

-"*Have you ever navigated on the website you just visited*?" Yes or No

Age was measured with an ordinal scale ranging from (1) 18 to 24 years old to (7) Over 65 years old

Education was measured with an ordinal scale ranging from (1) Primary school to (7) University degree.

-"*What is your last completed degree of education*?"

CHAPITRE 3

"The Effects of Sex and Task Demands on Search Patterns and Task Performance on the Internet: An Exploratory Study Using an Information Processing Perspective"

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Abstract

This study investigates the effects of sex and task demands on search patterns and task performance on Internet. Research in cognitive psychology, marketing and auditing showed that women may be less impacted by task demands than men, suggesting an interaction effect between sex and task demands. One hundred and nine participants performed directed search tasks on websites from various sectors in a laboratory setting. As expected, males' performance deteriorated when task demands increased, while performance remained constant for women. Results mostly support the selectivity model (Meyers-Levy 1989) arguing that women are comprehensive processors and men selective ones. Theoretical and managerial implications of these results are provided along with suggestions for future studies.

Introduction

In 2008, total online retail sales in the US were estimated at close to $137 billion, a 7% increase since 2007 (eMarketer 2008). Even though e-commerce has progressed at a phenomenal rate over the last 20 years, some statistics are troubling. The bounce rate and cart abandonment rate are still extremely high: they reached 39% and 59% respectively in early 2008 (Market Live 2008). This means that four consumers out of

ten clicked off a website after viewing only the first page, and close to 60% of consumers that had started a transactional session abandoned it prematurely. These figures emphasize the importance of better understanding how consumers process information on the Web. While much research has been done in this area (Bucklin and Sismeiro 2003; Sismeiro and Bucklin 2004; Senecal, Kalczynski, and Nantel 2005; Kalczynski, Senecal, and Nantel 2006), few studies have examined the influence of key individual variables. We believe sex might influence search patterns and online task performance because men and women differ in the strategies they use to process information (Meyers-Levy 1989): According to the selectivity model, women are comprehensive processors that engage in detailed, elaborative and effortful processing of information, whatever task they accomplish. In contrast, men are selective processors. They tend to use various heuristics to streamline the processing of information. Meyers-Levy's model has been applied and tested in various contexts, including advertising (Meyers-Levy and Maheswaran 1991; Meyers-Levy and Sternthal 1991; Darley and Smith 1995), product trials (Kempf, Laczniak, and Smith, 2006) and in-store search (Cleveland et al. 2003).

Furthermore, the selectivity model suggests a potential interaction between sex and task demands that has been observed relative to judgment efficiency and effectiveness in an auditing context (O'Donnell and Johnson 2001; Chung and Monroe 2001). Therefore, the selectivity model constitutes a relevant framework to investigate sex differences and potential interactions in search patterns and search performance on the Internet.

By investigating how men and women perform a series of goal-directed search tasks on websites from various industries, the present study tests the selectivity model in the Internet context. To our knowledge, this study is the first to investigate sex differences in search patterns and performance on the Internet while adults are assigned to the same goal-oriented tasks. In an era where personalizing the consumer's experience online is believed to be a key element contributing to customer satisfaction and loyalty (Holland and Menzel-Baker 2001), and where

technology allows for redesigning marketing practices to be more customer-centric (Wind and Rangaswamy 2001), investigating sex differences in search strategies on the Internet is definitely informative.

Literature Review and Hypotheses

Sex Differences in Search Patterns

Cleveland et al. (2003) investigated men's and women's search patterns when shopping for clothing as a Christmas gift. Patterns differ considerably between sexes, with women acquiring more information than males. In contrast, men were more apt to seek the assistance of store sales personnel than females. These differences tended to support the idea that women exert more effort and, consider more information when searching, while men simplify their search process by partly subcontracting their process, at least in the Christmas shopping domain. Search patterns in computer-related technologies have attracted the attention of researchers in the fields of information systems, education and marketing. The Internet grants users great flexibility; they can search according to their own style. Many studies, often involving children, suggest that sex might be a major predictor of search patterns on the Web. For example, Leong and Hawamdeh (1999) assert that boys found Web pages lengthy to read, spent more time scrolling through the pages and were especially impatient when pages contained only text instead of pictures with captions. Large, Beheshti and Rahman (2002) supported the above results but reported that boys spent less time on individual pages, checked more hypertext links per minute, and in general, were more active online (frequency of mouse clicks) then girls. They also found that boys tended to perform more page jumps per minute, used the Stop button more, and tended to click on more hits from a search engine's result page. However, the total time spent online did not vary between the sexes. Similarly, Roy

and Chi (2003) examined sex differences in Web searches for information and found that boys tended to filter information early in the search cycle while girls tended to pursue a particular line of search, drilling down into documents. The search pattern adopted by females led to poorer knowledge gains in the search task compared with the males' performance (Roy and Chi 2003). Roy and Chi's results might also be explained by women's not keeping on target and letting themselves be drowned in irrelevant (but potentially interesting) material, as Ford, Miller, and Moss (2001) observe. Studies on the impact of sex on search effectiveness provides, however, only limited evidence because they used a general search on the Web on a particular subject and did not measure effectiveness within the same specific target task on the same website. However, collectively, the literature seems to indicate that females' search strategies on the Web might be more detailed, while males' strategies appear more straightforward, similarly to what Cleveland et al. (2003) report in a shopping task.

An Explanation of Sex Differences: The Selectivity Model

How can these sex differences in search patterns and task performance be reconciled? Considerable research proposes that the difference may partially lie in different information-processing strategies adopted by each sex. Meyers-Levy (1989) introduced the selectivity model, which argues that men and women differ in effort, attention to details and elaboration when processing information**.** When faced with the same information, males and females will use different amounts of it when forming judgment. Men are selective processors: they do not generally engage in comprehensive, extensive processing of all available information. Instead, they employ various heuristic devices that serve as surrogates for more detailed processing. Men tend to focus on the most salient cues and do not pay attention to subtle (sometimes disconfirming) details (Meyers-Levy and Maheswaran 1991; Meyers-Levy and Sternthal 1991). In contrast, women are comprehensive processors who tend to assimilate all available information and elaborate more on it. Women are

also more likely to notice and elaborate on subtle cues. This difference across sexes emerges not because males encode fewer cues than females but most likely because women elaborate more extensively on the cues, which increases their accessibility for subsequent use (Meyers-Levy and Maheswaran 1991).

The Moderating Role of Task Demands

The selectivity model suggests that females have more subcategories in memory within which they store information. Males, in contrast, employ broader, more inclusive categories, each containing a comparatively larger number of memory cues (Meyers-Levy and Maheswaran 1991; Meyers-Levy and Sternthal 1991). This memory advantage, coupled with more extensive experience with comprehensive processing of information, may give females an advantage over males in processing multiple cue information. This advantage is believed to increase proportionately with task demands (Fairweather and Hutt 1972). O'Donnell and Johnson (2001) and Chung and Monroe (2001) found results supporting this assertion in an auditing task context, and observed interaction between sex and task demands. As task demands increased, males' judgment of the adequacy of audit documents (accuracy rate) deteriorated while women's judgment was unaffected (Chung and Monroe 2001). Sex differences emerged only under high task demands. In the same vein, O'Donnell and Johnson (2001) found that males examined significantly more information cues as task demands increased. Task demands had no such effect on women, as the number of pieces of information examined by women did not differ significantly across conditions. Similar results were observed with respect to time taken to complete the task, resulting in a sex difference in effectiveness when task demands were high but not when they were low. What is quite consistent in the literature is that women bring their comprehensive, detail-oriented processing to the task, independently of its demands. Women are thus highly predictable. Many studies (Meyers-Levy and Maheswaran 1991; Meyers-Levy and Sternhal 1991; Chung and

Monroe 2001; O'Donnell and Johnson; 2001) have reported quite consistently that women's performance, efficiency, effectiveness or judgment is less significantly impacted by task demands than those of men. However, depending on various factors (complexity level, demands of the task), men will either use selective processing or can switch to a more comprehensive processing of information. Research in the auditing context highlights the fact that men tend to use selective processing, even when tasks would require a more comprehensive strategy. Further, their performance deteriorates in such cases.

Internet Weekly Usage: a Proxy for Task Demands

Task demands can be assessed in a variety of ways. In the field of information systems, for instance, complexity is often measured by the degree of pre-determinability or uncertainty of the task. Simple tasks consist in routine information processing where the elements of the task are predetermined. Complex tasks are new and genuine decision tasks where the information required for the accomplishment cannot be determined in advance (Vakkari 1999).

Increased familiarity with a "product", and the resulting expertise, reduces the cognitive effort required to perform a task, refines the category structures used to differentiate products and improves the ability to analyse information and to determine what is most important and task-relevant (Alba and Hutchinson 1987). Evidence related to an Internet search context showed that, with increased experience, consumers reduce the number of pages they view on a given site, but experience does not impact the time spent per page (Bucklin and Sismeiro 2003). This added experience then translates into the consumers' remembering where to go to find what they are looking for and not wasting time on irrelevant pages. We can then argue that as the consumer acquires more Internet experience, using it more

often on a weekly basis, each search task becomes more routine and this increased ability renders tasks more predictable. With such refinement of the cognitive structures, any task should become less complex or less demanding to execute. Therefore, weekly Internet usage can be used as a proxy for task demands. Low weekly usage of the Internet would correspond to high task demands, whereas high weekly usage corresponds to low task demands.

The literature review suggests that men and women have different search patterns and that sex and task demand interact in defining some measures of search efficiency and effectiveness. However, as mentioned above, experience does not impact the time spent per page (Bucklin and Sismeiro 2003). Based on the conceptual foundations reviewed, we posit the following hypothesis:

H1: Women spend more time per page than men during web search tasks

Measures of efficiency in comprehension processes are often conceptualized as time spent processing material (Celsi and Olson 1988; O'Donnell and Johnson 2001) or number of cues examined (O'Donnell and Johnson 2001). We opted for similar indicators adapted to a Web context. We propose that sex will interact with task demands in such a way that:

H2a: Task demands have no impact on the number of clicks for women.

H2b: Men increase the number of clicks significantly when task demands are high (decreased efficiency) compared to when task demands are low.

H3a: Task demands have no impact on the time women spend performing a task.

H3b: Men spend considerably more time accomplishing a task when task demands are high (decreased efficiency) than when task demands are low.

Search effectiveness or performance in the context of a goal-directed search on the Internet can be measured by various indicators: quality of choice, knowledge gains and, success in accomplishing a specific task. Since tasks do not always entail a choice between brands and in order to keep our indicators close to the search process and in line with prior research, we opted for two indicators of search performance: a) success or failure in completing the goal-oriented task and b) the number of dead ends encountered during the task. A dead end is an unsuccessful attempt to find information that consumers encounter while shopping or browsing on a website. Dead ends occur either because consumers make a wrong judgment on the structure of the website or because the website has a poor semantic structure (Nantel, Senecal, and Mekki-Berrada 2005). Therefore we propose that:

H4a: Task demands have no impact on the number of dead ends encountered by women.

H4b: Men significantly increase the number of dead ends encountered when task demands are high (decreased effectiveness) compared to when task demands are low.

H5a: Task demands have no impact on women's success rate.

H5b: Men's success rate is significantly lower when task demands are high (decreased performance) than when task demands are low.

Method

Sample and Procedure

One hundred and twenty Internet users were recruited from a panel of consumers. The large majority (80%) of them (men and women) had more than 5 years of Internet experience. Subjects were invited to a laboratory where they performed goal-oriented tasks on two or three websites from different industries. On each site, they were assigned a precise task to perform. Traditionally, shopping has been characterized as a female activity, especially for some product categories such as grocery (Dholakia 1999), home furniture and children's apparel that are highly under women' influence and specialisation (Davis and Rigaux, 1974). In order to avoid confusing the effect of expertise on consumption tasks such as shopping, and sex, we carefully chose tasks that were not part of the traditional ones assumed by women. Insurance, gardening tools, traveling, technology and banking are domains where decisions are taken often conjointly or are traditionally associated with males' interests (Davis and Rigaux 1974; Brunner and Bennett 1997, Macklin, 2006). Participants were randomly assigned to the various websites. The sites and the required tasks are presented in Table I. Consumers were paid $50 in exchange for their participation. During their navigation, participants were asked to verbalize their every thought. This approach, inspired by Simon (1979) and Ericsson and Simon (1993), is known as protocol analysis. It has proven to be very useful for website analysis (Benbunan-Fich 2001). First, participants did two warm-up tasks to practise verbalizing their thoughts and to become familiar with the laboratory environment. Participants then performed the experimental tasks. They could interrupt the navigation at any time, for any reason. The only requirement was ongoing concurrent verbalization throughout their navigation process. For each task, navigation data were recorded in AVI format (video and sound sequence) using CAMTASIA software and navigation logs (time per page, number of pages, downloading time, etc.) were simultaneously recorded. Following navigation on each website, participants were asked to complete an online questionnaire measuring usage and experience with the Internet and with the website on which they had just navigated,

as well as demographic information. Unfortunately, data from the questionnaire were lost for the first 11 participants, resulting in 109 usable participants (58% females) with complete data.

Table I – Nature of the experimental tasks

Type of site	**Task**	**# of women**	**# of men**
Bank	Gather information for a loan	15	19
Insurance	Get a quotation for car insurance	21	18
Airline	Book a flight for two to Vancouver, CA	14	17
Travel agency	Book a flight for two and make hotel arrangements	16	14
Home improv. center	Choose a new lawnmower	18	24
Telephone company	Find information about the current rate for a specific cell phone	24	17
ISP	Find information about broadband capacity	17	17
Book /DVD retailer	Buy the latest Harry Potter DVD	20	9
Electronic equipment	Buy a 4 mega-pixel digital camera	20	20
# of tasks performed		**165**	**155**
Tasks successfully completed (%)		**68,8%**	**66,8%**

Measure of the Variables

Sex and task demands were the independent variables**.** Sex is the biological sex reported by the participant. Weekly Internet usage is used as a proxy for task demands and is measured using an ordinal scale ranging from (1) 5 hours or less to (7) More than 50 hours. Assuming that increased Internet experience renders search tasks more predictable due to the refinement of the cognitive structures as mentioned above, we propose that low weekly usage of the Internet corresponds to high task demands and conversely, that high weekly usage corresponds to low task demands.

The dependent variables (success rate, total time to accomplish the task, number of clicks, time spent per page and number of dead ends) were measured by two independent analysts to ensure reliability. They reviewed each video file, and observed whether consumers had successfully completed their online task, how long it took them to do so (excluding downloading time), the number of pages visited and the time spent per page (once downloading was completed). Because participants could click onto and off of a page which was being downloaded, the number of clicks is slightly higher than the number of pages. For a dead end to be counted, two conditions had to be met: first, the video had to show that the participant needed to go back or migrate to another part of the site, and second, they had to concomitantly verbalize the fact that they did not intend to go where they had gone. These two conditions ensured that not all navigational loops were categorized as dead ends. Analysts agreed in most instances and the main researcher's interpretation prevailed to resolve the few differences between judges. Finally, for each variable, measures for each participant across the sites visited (2 or 3) were averaged.

Subjects were then categorized as having either a low or high level of weekly Internet usage. To ensure that cells were adequately populated and not unduly imbalanced, subjects were split at 10 hrs per week of Internet usage, which corresponds to the average time Canadian Internet users spend on the web on a weekly basis (Segal, 2008). This split procedure (see appendix 1 for details) resulted in 41.3% of the sample's reporting low Internet usage (high task demands) and 58.7% reporting high online usage (low task demands).

Control Variables

Age and education are key variables that have been found to influence information search and/or search performance in past research (Furse, Punj, and Stewart, 1984; Goldman and Johansson, 1978; Bhatnagar and Ghose, 2004; Danaher et al., 2004; Capon and Burke, 1980; Kiel and Layton, 1981). They were included as control variables to rule out alternative explanations for differences in the dependent variables. However, since tests assessing their direct as well as interactive effects with sex were non-significant, they were dropped from further analyses.

Results

Men and women subjects were young and educated and 25% of them had previously navigated on the site visited. Men and women did not differ regarding age, education ($p > 0.1$). However, more men tended to be heavy Internet users while women tended to be evenly split between light and heavy users, a difference that reflects a real variation in the population. Overall, subjects profile was representative of the Canadian Internet users (Zamaria and Fletcher, 2008). More importantly, experience with websites visited did not differ significantly between men and women ($p > 0.1$), ruling out a potential task expertise effect. Table II summarizes there results.

We tested our hypotheses with a series of ANOVAs[6][7] comparing the average scores of men and women on the dependent variables. Because the number of clicks and the

[6] Note that analyses of variance were performed using estimated marginal means to account for unequal group size.

number of dead ends were highly correlated (r = 0.71), a MANOVA was performed using both variables. Multivariate results show that at a 0.10 significance level, sex (Wilks' Lambda = 0.96, p=0.08) and the interaction between sex and task demands were significant (Wilks' Lambda 0.95, p = 0.05). Thus, both variables were included for further analyses detailed below.

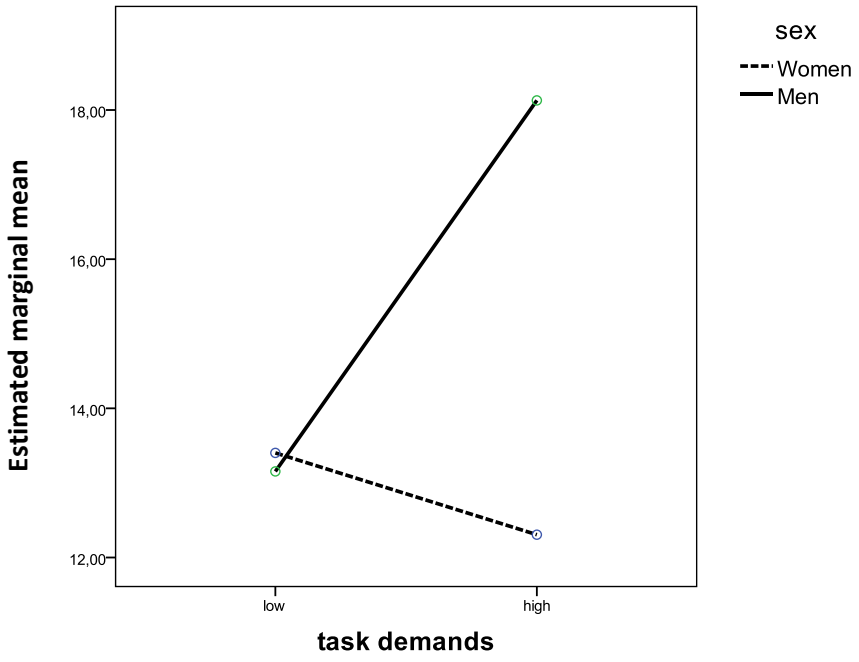
Table II - Sample description

Variable	**Items**	**Men (n=45)**	**Women (n=64)**	**Sex difference (p)**
Age: mean (standard dev.)		33,58 (13,5)	31,42 (12,3)	> 0,1
Education	Less than college College University	11,1% 31,1% 57,8%	8,0% 31,7% 60,3%	> 0,1
In average, how many hours/week do you use Internet?	10 hrs or less Over 10	28,9% 71,1%	50,0% 50,0%	**0,028**
Have you ever navigated on the website you just visited?	Yes	23,3%	28,6%	> 0,1

[7] Analyses of standardized residuals and of homogeneity of variances across groups were performed and some variables were transformed to satisfy the assumptions of the statistical model underlying the linear model of the ANOVA and MANOVA. Analyses were performed with transformed variables and original ones with no impact on results. Interpretations are then presented on the original data.

Women spent an average of 30,79 seconds per page while men spent only 28,26 seconds. This trend was quite consistent throughout industries, but these differences were not large enough to be significant ($F(1, 108) = 0,9$, $p > 0,1$, one-sided), refuting H1. Women clicked an average of 12,85 times per task and men an average of 15,64 times. The analysis of variance showed a main effect for sex ($F(1, 108) = 4,9$, $p < 0,05$, one-sided) and the interaction between sex and task demands was significant ($F(1, 108) = 5,8$, $p < 0,05$). Examination of the simple effects revealed that males in the high task demands condition clicked more often than under the low task demands condition ($F(1, 44) = 2,9$, $p < 0,05$; M high task demands =18,1 > M low task demands = 13,1). For females, there was no significant difference in their activity ($p > 0,40$) across conditions. Hence, results support H2a and H2b with a negative effect for males' efficiency as task demands increase and no effects for females across conditions. Results are summarized in figure 1.

Figure 1: Number of clicks by task demands



Total time required to accomplish a task did not vary significantly across the sexes (*M women* = 340,5, *M men* = 352,9; F(1, 108) = 0,08, p > 0,1), and no interaction between sex and task demands was observed (p > 0,1). However, regarding the relevant contrasts, men in the high task demands condition took significantly longer to accomplish their tasks than those in the low task demands condition (M high task demands = 406 seconds > M low task demands = 300 seconds, p =0,035, one-sided). For women, there was no significant difference in the time spent (p > 0,50) across conditions. Here again, task demands affect men and women differently, reducing men's efficiency when performing web search tasks, which affirms H3a and marginally supporting H3b. Figure 2 illustrates this finding. On average, women and men encountered 4,6 and 5,4 dead ends respectively, during their tasks. This difference was not significant (F(1, 108) = 1,3, p > 0,10), but again, a significant interaction between task demands and sex emerged (F(1, 108) = 4,1, p < 0,05). Figure 3 illustrates that men showed an important increase in the number of dead ends encountered as tasks become more demanding (*M low task demands* = 4,2, *M high task demands* = 6,6, p < 0,05) while task demands had no such effect for women (*M low task demands* = 4,8, *M high task demands* = 4,5, p > 0,60), supporting H4a and H4b.

Women and men successfully completed the assigned task 68.8% and 66.8% of the time, respectively. This difference is not significant (F(1, 108) = 0.06, p > 0.10), and no significant interaction was noticed between sex and task demands (F(1, 108) = 2.1, p > 0.1). Simple contrasts show that women's success rate is not significantly impacted by task demands (*M low task demands* = 0.70, *M high task demands* = 0.676, p > 0.60), supporting H5a. A similar pattern was observed for men, refuting H5b. Table III summarizes the results of the study.

Figure 2: Total navigation time by task demands

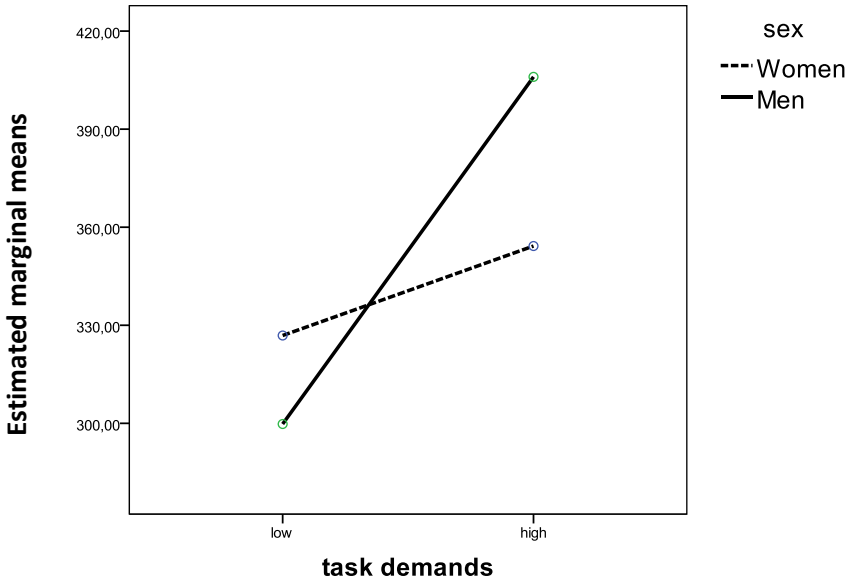
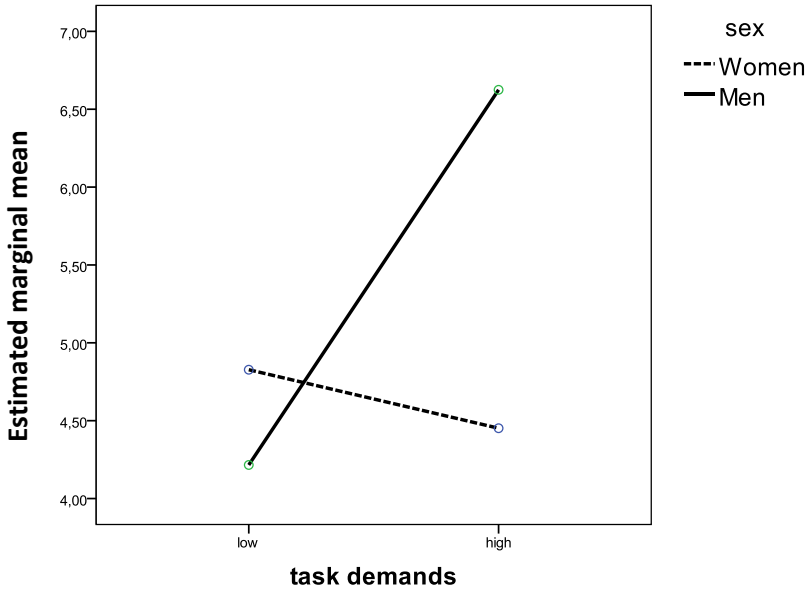


Table III – Summary of Results

Variables	**Hypothesis**	**Result**
H1: Time per page	W>M	Not supported
H2: Task demands and clicks	W: no relationship M: positive relationship	Supported Supported
H3: Task demands and total time	W: no relationship M: positive relationship	Supported Marginally supported
H4: Task demands and dead ends	W: no relationship M: positive relationship	Supported Supported
H5: Task demands and success rate	W: no relationship M: positive relationship	Supported Not supported

Figure 3 - Number of dead-ends by task demands



Discussion

Overall, results mostly support a differential information processing strategy between men and women using the Internet, consistent with the selectivity model (Meyers-Levy 1989) and parallel findings from O'Donnell and Johnson (2001) and Chung and Monroe (2001), who observed interaction between sex and task complexity on auditing tasks. Even though women spent more time per page in most instances (6 industries out of 9), these differences were not statistically significant. However, as expected, increased task demands had a negative impact on men's efficiency (increasing the number of clicks and total time spent) and effectiveness (number of dead ends) while increased task demands had no such impact on women. Success rates between males and females were not significantly different across task demands ($p=0.17$). Note that the success rate does not depend solely on effectiveness, but also on perseverance with the task. Since there is no evidence that men and women vary on perseverance, these results indicate that men are somewhat less effective under conditions of high task demands due to their selective processing, but they are as

perseverant as women in completing tasks. Therefore, men appear to search somewhat less efficiently and effectively than women when task demands are high, because they get trapped in more dead ends, resulting from poorer judgment about the structure of the website. Women, in contrast, apply their comprehensive processing however complex the task. Therefore, owing to their comprehensive strategy, and their less inclusive category structures to organize information, women's efficiency and effectiveness are not as affected by task demands in an Internet context. Men's tendency to process information heuristically renders them somewhat less efficient and effective when task demands are high. Viewed differently, men may gain more from the refinement of the cognitive structures that comes from higher Internet usage, probably because women already use more differentiated and, narrower category structures. These findings extend the literature on sex-based differences in consumers' information processing strategies on the Internet regarding two important dimensions. First, this is the first study to document sex differences when adult consumers perform specific search tasks on the Internet with the same goal in mind. Second, to our knowledge, an interaction between sex and task demands with respect to the level of activity reported and the number of dead ends encountered to accomplish Internet tasks had never been documented before. The parallel between our findings and studies performed in a substantially different setting (auditing) reinforces the assumption that familiarity and/or task demands interacts with sex so as to influence measures of efficiency and effectiveness. These results also have interesting managerial implications. The influence of differential information processing between men and women during Internet searches is more likely to manifest itself in reduced usage of the medium. Hypermedia systems and websites can be developed to adapt to diverse individual differences. For example, navigational support tools such as (1) direct guidance, (2) personalized feedback and (3) adaptive annotation where the user can find additional information about the content behind hyperlinks are tools that have been proposed by Fan and Macrediel (2006) in order to accommodate different information seeking strategies and navigation style between the sexes in the e-learning context. Similar help measures could be useful adaptations to improve men's efficiency and effectiveness under

specific conditions. Another avenue is tailoring search results to individual's preferences, needs and information processing strategies, which are nowadays possible via explicit and implicit mechanisms (see Hearst, 2009 for a good review). In a nutshell, adapting websites to processing differences across the sexes might help reduce somewhat the bounce rate and cart abandonment rate when users are searching for information, especially when task demands is high.

As with all behavioral research, there are limitations to this study that need to be addressed. First, task complexity and Internet usage should both be manipulated in a future study in order to disentangle their respective effect and provide further evidence of an interaction with sex in an Internet context. For this paper, Internet usage was used as a proxy for task demands. Second, the size of the sample used for this research was quite modest (n=109). Because a large number of sites were used, the result was a small number of observations per site, which may substantially limit the generalization potential of these findings. The limited sample size also reduced the power of analyses; particularly the MANOVA, because of the small number of men with low Internet use (n=13). Third, we do not know how participants spent their time on each page. If men and women present different information processing style, qualitative differences of this nature could emerge and would be worth investigating, using a more qualitative method. Finally, the results of this study should not be interpreted as evidence of a global, sex-specific superiority in cognitive reasoning for a particular task. The selectivity hypothesis does not predict that one sex will make better decisions than the other. It suggests only that females will, under certain conditions, use a different strategy than males to process information. Note that contextual/social factors that could influence search strategy and judgment have not been included in this study.

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Appendix 1

Split procedure for Internet Usage

Internet usage was measured with an ordinal scale using 7 categories. The split in two groups (high and low) was made at 10 hrs to ensure an equal representation of the sample in general, and of each sex, in both groups. As highlighted below, separating the groups at 10hrs ensure a 41.3%-58.7% split, while having separated the groups at 20hrs, for example, would have resulted in imbalanced groups (72.5%-27.5%).

In average, how many hours per week do you use Internet * sex Crosstabulation

			sex		
			Women	Men	Total
In average, how many hours per week do you use Internet	5 hrs or less	Count	15	3	18
		% within sex	23,4%	6,7%	16,5%
	Between 6 and 10 hrs	Count	17	10	27
		% within sex	26,6%	22,2%	24,8%
	Between 11 and 20 hrs	Count	17	17	34
		% within sex	26,6%	37,8%	31,2%
	Between 21 and 30 hrs	Count	9	6	15
		% within sex	14,1%	13,3%	13,8%
	Between 31 and 40 hrs	Count	3	3	6
		% within sex	4,7%	6,7%	5,5%
	Between 41 an 50 hrs	Count	2	1	3
		% within sex	3,1%	2,2%	2,8%
	More than 50 hrs	Count	1	5	6
		% within sex	1,6%	11,1%	5,5%
Total		Count	64	45	109
		% within sex	100,0%	100,0%	100,0%

CHAPITRE 4

"Sex Differences in the Relation between Key Website Characteristics, Ease of Use and Behavioral Intentions during Information Searches"

Co-author: Jacques Nantel, Professor of Marketing HEC Montréal. Paper to be published in a special edition of *Management et Avenir*, Jan. 2010.

Abstract

Grounded in the selectivity model developed by Meyers-Levy (1989), which suggests that men and women process information differently, this research investigates the moderating role of sex in the relation between key website characteristics, ease of use, and behavioral intentions. We posit that the aspects of websites that drive consumers' ease of use perceptions vary between men and women, as do key factors that influence behavioral intentions. Almost 4 000 Internet users (50% females) participated in a study involving 57 websites covering 12 sectors. From their homes, subjects performed a goal-oriented task and subsequently completed a questionnaire in which they evaluated the quality of the website on five dimensions (visual attractiveness, ease of use, site information, security/privacy and personalization of interaction). Behavioral intentions toward the website visited were also gathered. Confirmatory factor analysis (CFA) and invariance tests revealed that factors driving behavioral intentions are comparable between men and women but that perceptions of websites' ease of use are shaped by different factors according to the sexes. Site information is more salient for women than for men in forming ease of use perceptions. However, the relationship between personalization of the interaction and ease of use is stronger for men than for women. The results partially support the selectivity model, whereby women are comprehensive processors and men selective ones. Theoretical and managerial implications of the findings are discussed.

Introduction

The growth and promise of Internet applications have stimulated a sizeable research effort to develop instruments to assess user perception of website quality (Yoo and Donthu, 2001; Barnes and Vidgen, 2003; Wolfinbarger and Gilly, 2003; Bressolles, 2004; Loiacono, Watson and Goodhue, 2007; Aljukhadar and Senecal, 2009). These tools are useful for website designers because they clarify the attributes that are the most significant in forming consumers' intention to revisit websites. Sex[8] might be a key moderating variable in ease of use formation and intentions to revisit websites: considerable empirical research supports the idea that men and women process information differently (Meyers-Levy, 1989; Meyers-Levy and Maheswaran, 1990; Meyers-Levy and Sternthal, 1991) and exhibit different personality traits (Costa et al., 2001; Feingold, 1994). Sex differences in Internet adoption, motivation to use the Internet and in the content that attracts users online have also been consistently reported (eMarketer, 2005; eMarketer, 2008; Smith and Whitlark, 2001; Phillips, 2009). Studies also identify varying factors driving males' and females' adoption of information systems (Venkatesh and Morris, 2000). However, despite these recognized sex differences, no research to date has investigated whether men and women are influenced by the same key attributes when forming ease of use and behavioral intentions (BIs) when they search for information on a specific website in their natural environment.

Further, few studies have explored the antecedents of ease of use, a key construct in information system acceptance (Benbasat and Barki, 2005). The rare exceptions, e.g. Venkatesh (2000) and Venkatesh and Davis (1996), highlight the importance of individual variables in defining ease of use but did not study the impact of sex. Sex has generally been missing from IT behavioral research (Gefen and Straub, 1997).

[8] The American Psychological Association Publication Manual (4th Edition) states that the word "gender" is cultural whereas the word "sex" is biological. However, in the literature, the terms "gender" and "sex" are often used interchangeably. Whether the differences discussed in this study are cultural or biological (or both) is as yet unresolved and lies beyond the scope of this study. An effort has been made to use the term "sex" whenever possible because the variable of interest is biological sex.

This study attempts to fill this gap by positing that, when navigating online with a specific goal in mind, men and women differ in the weight attached to various website attributes that form ease of use perceptions and behavioral intentions.

The present study differs significantly from previous research done in this area. First, it does not use a convenience sample, but relies on a large and fairly representative sample of Canadian Internet users (n=3,970). Second, 57 websites, representing 12 sectors of the economy, were used, rather than a few websites. Third, participants evaluated the website visited and expressed their intentions regarding the site after performing a goal-oriented search task from their homes, not in a laboratory context that could limit the external validity of the results. Therefore, we are confident that our results closely mimic the way consumers behave when they search for information at home.

Sex has long been considered a market segmentation variable. It is easily identifiable and the segments are large enough to generate profit. Specifying the moderating role of sex can thus help e-tailers design strategies tailored to various consumer profiles.

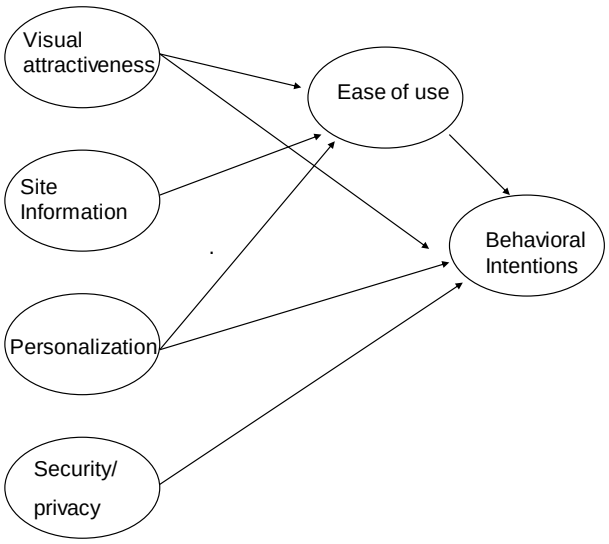
Literature Review and Hypotheses

Measurement of Key Website Characteristics

Because the attributes of online retailing differ from those of traditional "brick and mortar" retailing, it has been suggested that existing concepts of service and retailing quality might be ill-adapted to the online context (Wolfinbarger and Gilly, 2003). In consequence, researchers have developed tools to capture the important dimensions of web quality, including Sitequal (Yoo and Donthu, 2001), Webqual (Barnes and Vidgen, 2003; Loiacono et al., 2007), eTailQ (Wolfinbarger and Gilly, 2003), Netqu@l (Bressolles, 2004). Netqu@l originally included 19 items measuring five

underlying dimensions of website quality: visual attractiveness, ease of use, site information, security/privacy, and personalization of the interaction. It has since been used in a number of studies using different samples and types of websites and has proven to reliably measure important dimensions of website quality (Nantel et al., 2005; Nantel and Bressolles, 2006). Aljukhadar and Senecal (2009), working with a large representative sample of Internet users, proposed a new structural pattern of the Netqu@l constructs with more parsimonious scales, highlighting the central role of ease of use on attitude and behavioral intentions. Zeithaml et al., (1996) suggest that behavioral intentions (BIs) are the best indications of customer satisfaction and service quality as measured by repeat visits/purchases, recommendations and positive comments. Because this conceptualization has been used in a study modeling BIs on the web (Liu et al., 2005), we opted for a similar definition of BIs. We adopted the research framework and key Web characteristics developed by Aljukhadar and Senecal (2009) for our study. The research framework of reference is presented in Figure 1.

Figure 1. - Research framework



Differential Information Processing between Men and Women

Joan Meyers-Levy (1989) developed a framework that unified a variety of sex differences within the selectivity model that stipulates that males and females differ in the strategies they use to process information. Accordingly, males are selective processors; they do not engage in comprehensive, extensive processing of all available information. Instead, they employ various heuristics that serve as surrogates for more detailed processing on which they base their judgment, such as focusing on self-relevant information, on cues that are highly available and salient in the context or on cues that converge to imply a single inference. Men are not likely to pay attention to subtle details (Meyers-Levy and Maheswaran, 1990; Meyers-Levy and Sternthal, 1991; Graham et al., 2002). In contrast, women are comprehensive processors that tend to assimilate all available information, encode more cues, and elaborate more on them. Women attempt to engage in a rather effortful, comprehensive, piecemeal analysis of all information. Further, Meyers-Levy and Sternthal (1991) posit that women have a lower threshold at which they notice these subtleties. The selectivity model is the core framework underlying the proposed sex differences in this study.

Sex and Visual Attractiveness

Because women, as comprehensive processors, encode and elaborate on cues more than men do, we believe that they should also be more sensitive to the visual attractiveness of the site. Costa et al. (2001) contend that men and women differ in the aspects of experience to which they are preferentially open. Women score higher than men in openness to aesthetics and should therefore be more receptive to and influenced by beauty, colors or design. Several studies support this view. For example, color coded material seems to improve learning and decision accuracy for females but not for males compared with black-and-white coded material (Dwyer and Moore, 2001; So and Smith, 2002). More recently, Moss et al. (2006) show that women are more concerned by aesthetics and colors than men when designing their

own websites. It has been argued that girls make more elaborate and more subtle color distinctions than boys do (Green and Gynther, 1995). Different anatomy of the eye between males and females is believed to be an underlying factor explaining males' and females' aesthetic preferences (Kaplan and Benardete, 2001; Meissirel et al., 1997; Iijima et al., 2001). This biological difference may explain why women tend to be more critical of the aesthetics/design of websites than men (Arcand and Nantel, 2005; Cyr and Bonnani, 2005). Web design specialists such as Nielsen (1999) and Ladwein (2001) highlight the crucial links between web design and usability. Maximizing web pages readability or "scannability" (Nielsen, 1999), by ensuring that links on pages are easy to find and by using graphic/colors adequately to organize information are key factors to enhance usability. A site well designed provides easy access to the content and ensures users are in optimal dispositions to perform useful tasks, such as gathering the information they are looking for (Ladwein, 2001; Nielsen, 1999). We believe that women can cue, more than men, into the detailed visual aspects of a website, including colors and design. Therefore, we posit that:

> *H1: The relation between visual attractiveness and ease of use is stronger for women than for men.*
>
> *H2: The relation between visual attractiveness and BIs is stronger for women than for men.*

Sex and Site Information

In the Information Systems (IS) literature, ease of use and information are closely related. According to Keevil (1998), "*usability refers to how easy it is to find, understand and use the information displayed on a web site*." When modeling usability, site information/content is viewed as an important antecedent or dimension

of the usability construct (Palmer, 2002; Grange, 2007). The selectivity model states that females have more subcategories in memory within which they store information. Males, in contrast, employ broader, more inclusive categories. Females are also more attentive to details and can then establish more differentiated, narrower category structures to organize their finer distinctions (Meyers-Levy, 1989). This could suggest that as "experienced" comprehensive processors, women might be better equipped to deal with substantial amounts of information. Observation of children engaged in search tasks on the Web indicate that boys find Web pages lengthy to read, are especially impatient when pages contain only text instead of text with pictures, and tended to spend less time per page than girls (Leong and Hawamdeh, 1999; Large et al., 2001). These studies conclude that women tend to assimilate all available information while men are more selective in their approach. Accordingly, site information should be more salient for women in forming ease of use perceptions than for men. Therefore, we posit that:

> *H3: The relation between site information and ease of use is stronger for women than for men.*

Sex and Personalization of the Interaction

Personalization is seen as "*the ultimate form of customization, the final result of understanding the unique needs of the customer*" (Holland and Menzel-Baker, 2001). Personalization in the Internet context contributes to the creation of brand loyalty by improving search accuracy, and speeding the completion of transactions, therefore increasing the efficiency of achieving goals (Holland and Menzel-Baker, 2001). Recently, Liang et al. (2006-2007) find that some forms of personalization can increase user satisfaction with an interactive website. However, consumers must both desire and value personalization for it to have effect on their behavior or loyalty. In the IS discipline, interactivity and customization features affect usability perceptions (Palmer, 2002; Grange, 2007; Agarwal and Venkatesh, 2002).

The literature portrays men as being task-oriented and instrumental. In contrast, women are believed to adopt a communal orientation (Costa et al., 2001; Bakan, 1966; Carlson, 1971). These differences in traits are also salient in the Internet environment (Jackson et al., 2001; Akhter, 2003; Smith and Whitlark, 2001). The relative importance of personalization of the interaction for men and women has received little attention in academia. As a feature that increases task effectiveness, personalization of the interaction should be more desired by men than women, owing to their traits and processing style. Further, because men tend to streamline the processing of external world information by focusing on self-relevant information, (McGivern et al., 1997; Meyers-Levy, 1989), they may find personalization features particularly valued and relevant. We predict that the personalization features of websites will be more important for men than for women in conditioning their intention to use, make purchases on or recommend the site. A similar pattern should be expected in the modeling of ease of use. Therefore, we posit that:

H4: The relation between personalization of the interaction and ease of use is stronger for men than for women.

H5: The relation between personalization of the interaction and BIs is stronger for men than for women

Sex and Security/Privacy

Consistent with the selectivity model, because men focus on the most salient cue, they are more likely to focus on task effectiveness of a technology, i.e. convenience of online purchasing, without considering risk because it does not converge to a single inference. In contrast, as detailed processors, women will consider all information available, including that which is subtle and potentially disconfirming. Women are then more likely to incorporate risk and other secondary information in their decision and behavior (Graham et al., 2002). Further, women are generally portrayed as being more risk adverse than men in a variety of contexts (Byrnes et al.,

1999), including the Internet (Garbarino and Strahilevitz, 2004). Findings regarding sex and privacy concerns are mixed. Faja and Trimi (2008) conclude that men and women do not differ in their concern about information privacy online, while other studies (Bartel-Sheehan, 1999; Phillips, 2009) show that women report greater concern than men about the potential impact of the Internet on their privacy; However, men seem more likely than women to adopt protective behaviors that are congruent with their privacy concerns (Bartel-Sheehan 1999; CEFRIO 2008). Overall, despite some disparate findings, the literature suggests that women should consider the *privacy/security* dimension as more diagnostic when deciding on intention to buy a product on a web site or revisit the site. Therefore, we posit that:

> *H6: The relation between security/privacy and BIs is stronger for women than for men.*

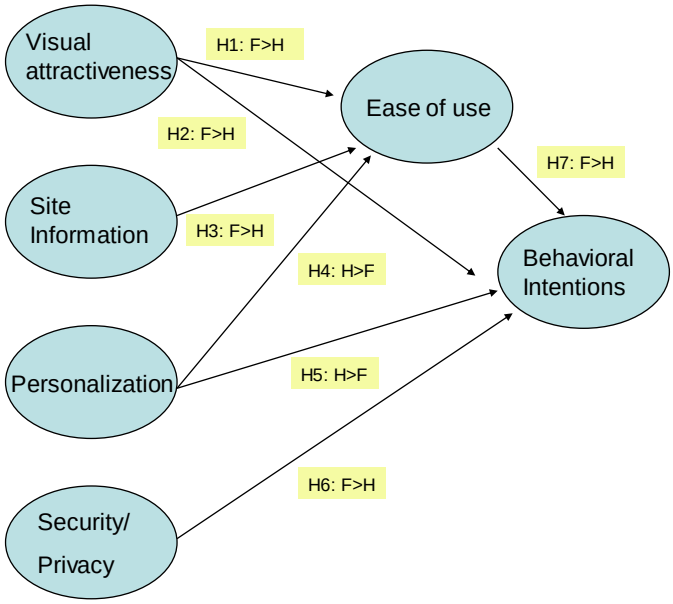
Sex and Ease of Use

Substantial research shows that women experience higher anxiety with computers (Rosen and Maguire, 1990; Igbaria and Chakrabarti, 1990) and lower perceived self-efficacy or computer-related confidence than men (Brosnan, 1998; Whitley, 1997). Lower self-evaluation and lower computer-related confidence by women might result from consideration of more cues during evaluation, as suggested by the selectivity model. Venkatesh and Morris (2000) underline the moderating role of sex in the adoption of a new software system using the Technology Acceptance Model (TAM). Perceived usefulness of the technology was the major factor driving men's acceptance of new software. In contrast, software's perceived ease of use was a key determinant for women, whereas it was insignificant for men. Chiu et al., (2005) assert that the influence of ease of purchasing on online purchase intentions is stronger for female than for male Taiwanese Internet users. *Ease of use* is thus putatively more salient for women than for men in the modeling of behavioral intentions toward a website. Therefore, we posit that:

H7: The relation between ease of use and BIs is stronger for women than for men.

The research model and the related hypotheses are illustrated in Figure 2.

Figure 2. - The hypothesized moderating role of sex in the model



Method and Procedures

Sample and Data Collection

In order to test the hypotheses related to the moderating role of sex in the model, we used data gathered via questionnaire from consumers that completed a goal-oriented task on a website. Data were collected as part of a nationwide online study conducted in collaboration with a large Canadian marketing research firm. Every two months, several sites from a given industry were chosen. An email was sent to a representative

sample of the firm's Canadian Internet panel. After the panel was stratified according to conventional socio-demographic variables, participants were randomly selected to participate in the study. They were invited to navigate on a specific website (B2C) from a given industry to accomplish a goal-oriented task. A fairly representative sample was thus formed for each of the twelve sectors studied.

Tasks were identical for each sector and had comparable difficulty levels. After they finished navigating, participants were directed to an online questionnaire in which they evaluated the website on five dimensions (visual attractiveness, ease of use, site information, security/privacy, and personalization of the interactivity) and indicated their BIs toward the website. Socio-demographic variables and information on experience with the Internet and with the website at hand was also gathered. Respondents were entered in a monthly drawing in exchange for their participation. A control mechanism was put in place to ensure that subjects would navigate on their assigned website only once. Data from completed questionnaires were transmitted automatically to a secure site managed and hosted by the marketing research firm, where they were saved individually for each industry. Table I summarizes the industries, tasks and number of men and women that participated in the study and whose reports on the relevant variables were complete. In total, 3 970 respondents (50% women) participated in the research, which encompassed 57 websites representing 12 industries. Participants navigated on their assigned website from their home. This procedure was intended to improve the external validity of the study by offering an environment that was similar to that consumers typically use when they search for information or shop online. The response rate (completed surveys/email read) for the twelve surveys ranged from 18.3% to 23.0% which is in the average to high end of the response rate continuum obtained in recent academic email surveys (for reviews, see Deutskens et al., 2004 and Kaplowitz et al., 2004).

Table I - Nature of the tasks

Industry sector	**Task**	**Number of women**	**Number of men**
Banks	Find the interest rate for a one-year fixed rate mortgage	156	167
Home renovation & decoration	Find the price of the cheapest jigsaw	142	130
Electronics	Find the brand and the model of the cheapest 4-megapixel digital camera	188	150
Travel & Tourism	Find the price for two adult tickets to Cancun with a specific departure date	204	179
Books	Find the retail price of a dictionary	207	239
Auto manufacturers	Find the suggested retail price of a vehicle previously selected across the best selling models of each manufacturer	119	111
Media	Find the main economic news published on the day of their visit	139	192
Communication service providers	Find the price of the cheapest package allowing unlimited use of cell phone during weekends	157	142
Retail stores	Find the address and phone number of the store closest to their home	105	102
Insurance services	Complete an online quote request for home insurance	210	146
Classifieds	Find ads for winter tires and report if such ads exist on their assigned website	182	212
Real estate	Find information on condominiums for sale with detailed specifications and prices	171	220
No. of tasks performed		1 980 (49,9%)	1 990 (50,1%)

The majority of subjects (73%) had never navigated on their assigned site before, regardless of sex, and 62% had previously made an online purchase. Only 55% of women had closed a purchase online compared with 70% of men, a difference that reflects a real variation in the population (Zamaria et al., 2005). Men and women did not differ significantly on education but significantly more men than women aged 55 and over took part in the study, which is also consistent with a similar variation in the Canadian population (Zamaria and Fletcher, 2008). Overall, the sample was highly representative of Canadian Internet users.

Measures of the Constructs

In order to maximize the content validity of the constructs, we used or adapted scales that have been used by other researchers in the field.

The Dependent Variable: Behavioral Intentions

Zeithaml et al. (1996) suggest that BIs are the best indications of customer satisfaction and service quality as measured by repeat visits, recommendations, positive comments, and repeat purchases. This conceptualization of BIs has been used in a recent study modeling behavioral intentions on the Web (Liu et al., 2005). Therefore, we proposed an adapted version of this scale. In our study, BIs are defined by 3 items, measured on Likert-type 7-point scales (1-"Completely Disagree" to 7-"Completely Agree"):

-I would recommend this site to friends, colleagues and family.
-This site is my reference when searching for information regarding (product type).
-I would like to visit this site again in the future.

Independent and Mediating Variables: Website Characteristics

As previously noted, key website characteristics are measured using the Aljukhadar and Senecal (2009) model. It includes 16 items measuring 5 dimensions of website quality: visual attractiveness, ease of use, site information, security/privacy, and personalization of the interaction. Item details are available in Appendix1.

Moderating Variable: Sex

The moderating variable is biological sex as reported by participants.

Results

Convergent and Discriminant Validity of the Measures

Convergent and discriminant validity of the measures were assessed to ensure internal consistency and sound psychometric properties of our constructs for both sexes. Individual item lambda coefficients were all above 0.70, with a significant t statistic for each path, which is indicative of good convergent validity (Gefen, 2000). The average variance extracted for each construct ranged from 0.82 to 0.86, well above the squared correlation coefficients between factors (which ranged from 0.29 to 0.73), as recommended by Fornell and Larcker (1981) for evidence of discriminant validity. Table II presents the indicators of discriminant validity. All further analyses were based on the EQS 6.0 program (Bentler, 2004). Confirmatory Factor Analysis (maximum likelihood method) was used to test the invariance of our model across the sexes. We first started by establishing a baseline model separately for men and women. We then tested for measurement equivalence of the instrument to assess its stability. Finally, we tested the invariance of the full causal model, using multigroup analysis. A 2-index strategy was used to assess model fit using CFI (cut-off value of 0,95) and RMSEA (cut-off value of 0,06), supplementing chi-square tests (Hu and

Bentler, 1999). Additionally, because our data presented limited degrees of skewness and kurtosis, we used the robust methodology available with EQS 6.0 to address these issues, including the Satorra-Bentler corrected chi-square (S-B X^2) and adjusted fit indexes (*CFI and *RMSEA).[9]

Table II
Discriminant validity indicators for men and women*

Construct	Visual attractiveness	EOU	Site information	Security/ privacy	Personali-zation	BIs
Visual attractiveness	0,83/0,83	0,51	0,49	0,3	0,51	0,53
EOU	0,42	0,84/0,86	0,67	0,29	0,62	0,57
Site information	0,43	0,73	0,84/0,84	0,39	0,58	0,51
Security/ privacy	0,28	0,28	0,38	0,83/0,86	0,47	0,42
Personalization	0,47	0,6	0,63	0,5	0,82/0,83	0,71
BIs	0,51	0,55	0,53	0,45	0,7	0,82/0,82

*The diagonal entries show Fornell and Larcker's (1981) average variance extracted (men/women) by each construct. Entries below (above) the diagonal represent squared correlation between constructs for men (women).

The Baseline Model for Men and Women

The goal is to establish baseline models for men and women that represent the best-fitting option to the data from the perspective of parsimony and substantive meaningfulness (Byrne, 2006). The baseline model presented an excellent fit for both

[9] Four outliers, all women, were deleted from the sample to reduce potential adverse effects in the analysis.

men and women, as measured by *CFI and *RMSEA fit indices. However, since chi-square is extremely sensitive to sample size, it is artificially inflated here: for men, chi-square = $430{,}65_{(139)}$ (p=0,000), *CFI=0,989, *RMSEA= 0,036 (0,032-0,039); for women, chi-square=$534{,}04_{(139)}$ (p=0,000), *CFI=0,988, *RMSEA=0,038 (0,035-0,041). No further adjustments to the baseline models are deemed necessary.

Multigroup Invariance Tests

In testing for equivalencies across groups, sets of parameters are tested in a logically ordered and increasingly restrictive fashion. As such, these models are hierarchically nested (Byrne, 2006). We tested first for invariance of factor-loading paths (model 2). We then tested factor variance and covariance (model 3) to ensure equivalency of the measurement model across groups. Finally, invariance of causal paths was tested between sex groups (model 4). The latter is the most relevant test of our hypotheses. Table III summarizes the results of the multigroup invariance tests.

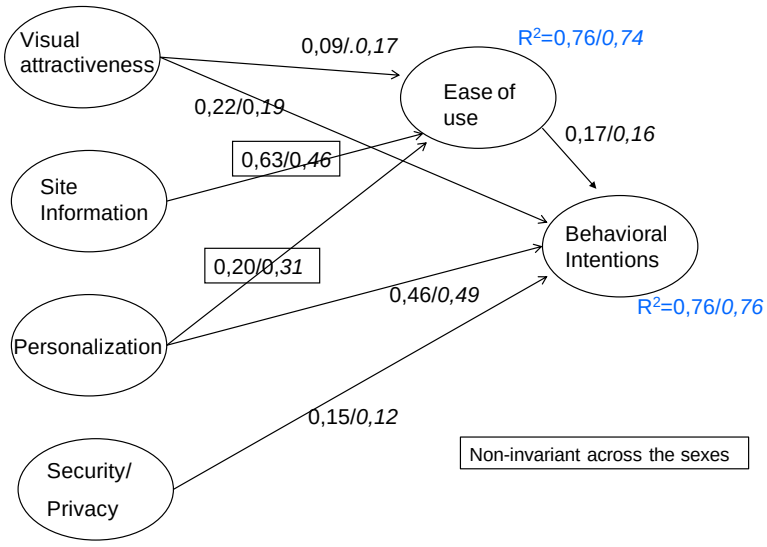
Considering chi-square differences that are not significant between models 2 and 1, or between models 3 and 1, all parameters in the measurement models are invariant across sex groups, indicating good stability of the measurements across groups. However, when adding equality constraints on the 7 causal paths, the fit is good in that chi-square=$1089{,}52_{(308)}$ (p=0,0000), *CFI= 0,98, *RMSEA = 0,026, but the S-B chi-square difference = $56{,}96_{(30)}$ is significant (model 4). Two causal paths are non-equivalent across groups: the path originating from information to ease of use ($p < 0{,}05$), and the one from personalization of the interaction to ease of use ($p < 0{,}05$). The structural paths for men and women based on standardized coefficients are shown in Figure 3.

Table III. - Tests for invariance across the sexes

Model and constraints	**S-B X^2**	**df**	***CFI**	**Model comparison**	**Δ S-B X^2 [10]**	**p value**
Model 1 No constraint	1024,48	278	0,99	----	----	----
Model 2 Factor loadings	1049,11	291	0,98	2 vs. 1	15,49 (13)	>0,05
Model 3 Factor loadings, variance and covariance	1066,66	301	0,98	3 vs. 1	32,84 (23)	>0,05
Model 4 Factor loadings, variance, covariance and causal paths	1089,52	308	0,98	4 vs. 1	56,96 (30)	<0,05

Figure 3. - Confirmatory causal model for men and women

Standardized coefficients (Women/*Men*)



[10] After correction

For both men and women, the model explains approximately 75% of ease of use perceptions and 75% of BIs, which is indicative of good criterion validity. Personalization of the interaction is the most important factor explaining BIs for both men and women (invariant), considering its direct effect as well as indirect influence via ease of use. All factors driving BIs are invariant across the sexes. However, different dimensions seem to play a prominent role in defining ease of use for men and women. For men, personalization of the interaction has a greater impact when forming ease of use perceptions than for women. In contrast, information quality contributes to enhancing women's ease of use perceptions of a website to a greater degree than men's. These latter results support H3 and H4, but H1, H2, H5 and H6 must be rejected.

Discussion and Conclusion

Few studies have focused on the antecedents of ease of use (Benbasat and Barki, 2005) even though it is a key construct in technology acceptance. Venkatesh (2000) and Venkatesh and Davis (1996) are exceptions. They highlighted the importance of individual variables in defining ease of use such as computer self-efficacy, perceived control, perceived computer playfulness, and anxiety. Better understanding of the relationship between important dimensions of websites and ease of use may be helpful in guiding website development and marketing actions. In the IS literature, Palmer (2002), Grange (2007) and Agarwal and Venkatesh (2002) show that information content and personalization are related to usability perceptions. Our study contributes to the literature by affirming that ease of use perceptions are shaped differently for men and women. For women, site information and ease of use are more closely related than for men. This is indicative of females' more comprehensive style of information processing. It is also consistent with the narrower category structures women use to organize information (Meyers-Levy, 1989). For men,

personalization features improve ease of use perception to a greater extent than for women.

However, contrary to our expected results, no significant differences in the factors that influence the BIs of men and women emerged across the sexes. If men and women process information differently and differ on certain traits, those differences do not affect the weight they attribute to ease of use, visual attractiveness, security/privacy and personalization when forming their behavioral intentions toward websites. These results may be indicative of a narrowing gap regarding the differences between men and women when performing Internet searches.

Overall, our results partially support the theory of the selectivity model in the Internet environment, in particular that women are comprehensive processors and men are selective ones. We can assume a moderating role of sex in the formation of usability perceptions but not in the formation of BIs.

These results have interesting managerial implications for the design of quality websites. When marketing managers work to improve relevance, quality and depth of information on a website, the changes improve consumers' perceptions of ease of use, especially for women. Due to the fact that women are more prone to a comprehensive mode of information processing, when the site presents appropriately detailed high quality content, it will have more impact on them compared to men. Clickable links to relevant extra information and comparison matrix are tools that should be particularly well-suited to women's processing style. By contrast, providing features that allow for personalization reinforce, for men more than for women, the perception that a website can be used without effort (adaptation of Venkatesh, 2000: ease of use definition), because men enjoy the ability to control the amount of information presented at them. For men, customization tools provide a way to avoid processing a vast quantity of information, which is consistent with males' tendency to use shortcuts to streamline information processing (Meyers-Levy, 1989). Because men are more task-oriented and instrumental, they prioritize

efficiency above anything else in achieving their goals, and personalization supports efficiency in directed search tasks (Holland and Menzel-Baker, 2001). Therefore, functionalities allowing users to do research "their way", such as providing filters with their own search criteria or searching within saved research would be to implement first and prior for sites targeting at male patrons. However, because no noticeable differences across the sexes emerges on factors driving BIs, it appears unnecessary to differentiate neither the content (i.e.: information architecture) nor the design of a website for appeal based on sex in order to increase customer loyalty or to gain more favorable word-of-mouth referrals. Finally, in addition to ease of use, it seems that the visual attractiveness of the site and personalized interaction with the consumer are key drivers of BIs for both male and female audiences. This is evident even in a utilitarian context when consumers visit a website in search of a particular piece of information. Our findings support the recommendation of Novak et al., (2000) that "creating a compelling online experience for cyber customers is critical to creating competitive advantage on the Internet." Personalization is especially important in that it also affects BIs indirectly via its impact on ease of use.

Compared with many studies of Internet searches and marketing, our study has three methodological strengths that have enhanced the generalizability of our findings, at least with respect to the Canadian population. First, our study did not use a convenience sample, but relied on a large and fairly representative sample of Internet users (n=3,970). Second, numerous websites that are representative of twelve important sectors of the economy were tested, rather than only a few websites. Finally, participants tested websites from their homes, not from a laboratory, an environment that could limit the external validity of the results. Therefore, we are confident that our research method closely approximates consumers' behavior when they search for information while in their usual environment in order to determine what drives them to return to a website or to recommend it to friends.

Limitations

As with all behavioral research, there are limitations to this study that must be mentioned. Even though we asked participants to navigate the Internet in a context that was as close as possible to their usual environment (their home), they had to accomplish a task at the request of the researcher, which may have rendered the context somewhat artificial. For example, they may have had limited interest or involvement with some product categories for which they were asked to find information. We believe a fruitful avenue for future research could be to manipulate the consumer's involvement level with a product or website to evaluate the potential impact on the saliency of various factors on BIs. The informational nature of many tasks in this study might partly explain why sex differences did not manifest themselves in the formation of BIs. Concentrating on tasks where consumers actually choose and buy products might be more suitable for observing manifestations of sex differences on key dimensions such as security/privacy or ease of use. Most of the research focusing on ease of use in relation to sex has been done using the Technology Acceptance Model (i.e., Venkatesh and Morris, 2000; Ong and Lai, 2006; Amin, 2007). This study did not use the typical constructs of the TAM model, namely perceived usefulness. This difference may explain the lack of saliency of the ease of use construct for women in our study.

Our research investigated a utilitarian context and required participants to accomplish a specific task, because consumers generally use the Internet with a specific goal in mind. We encourage researchers to study sex differences in a more hedonic context (games, virtual worlds, etc.) and to include constructs such as enjoyment and flow. Such studies could explore the relative influence of various dimensions that drive intentions to return to those websites, and how these intentions might vary between men and women.

We are hopeful that these findings will contribute to the theoretical body of knowledge in marketing and IS. We also hope they will help practitioners design and

improve websites based on the understanding that ease of use perceptions is sex-specific. As a final note, we encourage researchers to replicate this study using different settings in order to enrich the understanding of the role that individual variables such as sex play in behavioral intentions in a web-based context. Studies exploring the differences in response to personalization and interactivity based on sex are lacking. New information would be welcome because these issues are especially relevant in the Internet environment.

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Appendix 1 – Aljukhadar and Senecal (2009) scale[11]

Visual attractiveness

This site is colorful

This site is creative

This site has an attractive appearance

Ease of use

This site is easy to use

It is easy to search for information

This site is easy to navigate

Site Information

This site provides relevant information

This site provides accurate information

This site provides in-depth information about the product(s) or service(s) proposed

Security / Privacy

I am confident of the security on this site

This site guarantees me a secure navigation

I feel like my privacy is protected on this site

I trust the web site administrators will not misuse my personal information

Personalization of interaction

This site is personalized to my need

This site provides interactive functions that help me in the accomplishment of navigation

[11] Items measured on 7-point Likert-type scales ranging from 1-Completely disagree to 7=Completely agree

This site memorizes my preferences and offers supplementary services or information based on these preferences

CHAPITRE 5
Conclusion

L'objectif principal de cette recherche était de mieux comprendre comment les hommes et les femmes traitent l'information dans un contexte de recherche d'information dirigée sur Internet et de façon plus spécifique, explorer la pertinence des théories de la sélectivité (Meyers-Levy, 1989) et du traitement de l'information par item/relationnel (Putrevu, 2001) dans ce contexte.

Afin d'atteindre cet objectif, trois études empiriques ont été réalisées. Le chapitre 2 explore directement la pertinence des deux modèles compétitifs lorsque les consommateurs naviguent sur Internet à la recherche d'une même information en mesurant directement les processus de traitement de l'information des consommateurs pendant leur navigation. Le chapitre 3 présente une étude qui mesure l'influence du sexe et de la complexité de la tâche sur l'efficience et l'efficacité des recherches d'information en ligne. Finalement, une recherche d'envergure auprès des internautes canadiens français a permis d'évaluer l'effet modérateur du sexe sur la formation des perceptions de facilité d'utilisation d'un site ainsi que sur la formation des intentions comportementales envers le site.

Les principaux résultats de cette recherche sont les suivants. Lors de recherches d'information en ligne, les femmes se distinguent par un traitement de l'information où il y a plus d'effort de compréhension que les hommes, ce qui est congruent avec le modèle de la sélectivité (Meyers-Levy). Les femmes ont aussi plus tendance à faire preuve d'un style de pensée relationnel que les hommes tel que proposé par Putrevu. Cependant, contrairement à ce que propose Putrevu, les hommes n'ont pas démontré un style de traitement de l'information plus par item que les femmes. De plus, la complexité de la tâche a des effets différents chez les hommes et les femmes quant à l'efficacité et l'efficience de leurs recherches d'information en ligne. Ces résultats sont aussi en ligne avec le modèle de la sélectivité (Meyers-Levy) et appuient les

résultats d'autres recherches effectuées en comptabilité. Finalement, les facteurs influençant les intentions comportementales des internautes ne diffèrent pas selon le sexe mais la formation des perceptions d'utilisabilité est plus fortement liée à la personnalisation chez les hommes alors qu'elle est plus en lien avec la qualité de l'information chez les femmes.

Les contributions de cette recherche sont multiples. Premièrement, les résultats permettent de mieux comprendre les différences entre les hommes et les femmes au niveau du traitement de l'information dans un contexte Internet en démontrant que les femmes tendent à traiter l'information de façon plus compréhensive et les hommes de façon plus sélective. De plus, cette recherche est la première à comparer directement les théories prédominantes dans la littérature en ce qui concerne le traitement de l'information différencié selon le sexe: le modèle de traitement par item/relationel (Putrevu, 2001) et le modèle de la sélectivité de Meyers-Levy (1989). Nos résultats apparaissent davantage congruents avec le modèle de la sélectivité de Meyers-Levy et ce, autant pour expliquer le traitement de l'information que les résultantes de recherche des hommes et des femmes dans un contexte de recherche d'information dirigée en ligne. De plus, la vaste étude entreprise auprès de la population canadienne française semble indiquer que les hommes et les femmes forment différemment leurs perceptions de facilité d'utilisation d'un site web. Les résultats de cette recherche contribuent donc significativement à l'avancement des connaissances en comportement du consommateur sur Internet, un champ de recherche en pleine croissance.

Cette recherche ouvre la voie à des avenues de recherche intéressantes. Il serait pertinent par exemple d'explorer si ces différences au niveau du traitement de l'information se manifestent dans un contexte d'utilisation plus hédonique d'Internet. La recherche d'information multi-canaux (en ligne et hors ligne) est un domaine de recherche peu exploré mais bel et bien utilisé par les consommateurs et des études futures devraient s'intéresser à mieux comprendre comment les hommes et les femmes conjuguent l'utilisation de différents canaux selon leurs styles de traitement

de l'information. Des études récentes tendent d'ailleurs à montrer que les hommes québécois sont plus enclins que les femmes à utiliser Internet pour y faire du lèche-vitrine (CEFRIO, 2009). Finalement, cette recherche s'est intéressée à l'influence du sexe biologique des consommateurs. Il serait pertinent que des recherches futures explorent l'influence du degré de masculinité/féminité sur les processus de traitement de l'information dans le contexte de la recherche d'information sur Internet. Des échelles pertinentes de ces construits sont disponibles (Spence, Helmreich et Stapp, 1975; Bem, 1974; Hupfer, 2001) et de telles recherches permettraient d'enrichir ce domaine d'étude.