

# Uncovering the Nature of Information Processing of Men and Women Online: The Comparison of Two Models Using the Think-Aloud Method

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## Abstract

This paper compares two models predicting gender differences in information processing to determine if either of the models is more pertinent to goal-oriented Internet searches. The Selectivity Model (Meyers-Levy 1989) proposes that women make more comprehension effort than men whereas the Item-Specific/Relational Processing Model (Putrevu 2001) suggests that men and women differ primarily in their processing style, with men tending to use item-specific processing by focusing on product attributes and women tending to use relational processing by looking for interrelationships among multiple pieces of information. The study participants (106 total, 50% female) were asked to think aloud while performing one of two goal-oriented search tasks on a website. Their thoughts were then coded according to relevant categories by two independent analysts using Atlas TI software. Consistent with the Selectivity Model, women made more comprehension effort than did men. However, our hypotheses related to a difference in processing style between men and women received less support. Overall, the results help disentangle the two theories and provide website developers with a basis for creating sites that are suited to men's and women's distinctive information processing strategies.

**Keywords:** Selectivity model, Item-specific processing, Relational processing, Gender differences, Information processing, Online consumer behavior, Verbal protocol

## 1 Introduction

Many studies have highlighted differences in the psychological orientation of men and women [1], [6], [7], [9], [18]. According to these studies, men tend to be guided by agentic concerns, referring to instrumental and self-purposive concerns, whereas women adopt a more communal outlook, characterized by an emphasis on interpersonal relationships, affiliation and attachment to others. This agentic-communal distinction is considered so fundamental that it is the basis for two models grounded in cognitive psychology suggesting that men and women differ in how they process information [31], [40]. The Selectivity Model [31] contends that women are comprehensive processors whereas men are selective processors. The model suggests that women tend to engage in detailed, elaborative and effortful information processing. In contrast, men tend to employ heuristic devices that serve as surrogates for more detailed processing, such as focusing on highly available information that is salient in the context. In contrast, Putrevu [40] argues that men and women differ in processing *style* rather than in processing *effort*: men are item-specific processors and women are relational processors (this model is called hereafter the Item-Specific/Relational Processing Model or IS/RP model). The latter model asserts that men only pay attention to attributes that are distinctive for a brand or product whereas women tend to engage in relational processing, looking for interrelationships and similarities between multiple cues as they process information.

Both of these models have received support in various marketing contexts. To our knowledge, however, this study is the first to test the basic tenets of the models, namely gender differences in processing effort or processing style, within the same context. It thus addresses the need to determine the exact nature of how men and women process information, as has been called for in the marketing literature [24], p.15 and also affords an opportunity to determine the degree to which these models are complementary. The Internet has become a prominent medium both for information searches and retail sales. In this environment, the consumer is in control of choosing and processing information about the firm. It is entirely in the consumer's power to decide which web page to browse, for how long, and how much information to obtain [12]. Further, a recent report went so far as affirming that women's online behavior is dramatically different than men's [45]. Thus, in an era where personalizing the consumer's experience online is believed to be a key element contributing to customer satisfaction and loyalty [20], tailoring e-tail interface according to the way men and women process information on the Internet is definitely critical. With this study, we hope to contribute to the body of knowledge on both online consumer behavior and cognitive psychology, as well as to help web developers adapt and personalize websites to suit the distinctive information processing strategies used by men and women.

The remainder of the paper is organized as follows. The next section reviews the literature concerning the psychological orientation of men and women and its underpinnings, as well as the two competing information processing models. The methodology and results of the study are then presented. We close with a discussion of the results, including practical recommendations for online retailers and a review of the limitations of the study with suggestions for future research.

## 2 Literature Review and Hypotheses

In this section, the theoretical background of our study is developed. It covers themes related to gender differences in psychological orientation, origins of these differences, as well as a presentation of the two models tested in this research.

### 2.1 Gender Differences in Psychological Orientation

The models that are central to this study are derived from gender differences that have been observed in a wide variety of processes and behaviors related to the agentic-communal orientation, or psychological orientation, typical of each gender. Gender differences in psychological orientation were first described by Bakan [1] and Carlson [6], [7], who proposed that men and women tend to be guided by different concerns in life. Men generally tend to adopt an agentic orientation, showing greater concern for self than for others and focusing on instrumental, self-assertive, and self-purposive matters. In contrast, women are considered to be guided by a more communal outlook characterized by an equal concern for self and others, placing greater emphasis on interpersonal relationships, affiliation, and attachment. This distinction in communal-agentic orientation (as measured by self-reports) tends to remain quite constant over time [18] and to be more pronounced in cultures where traditional gender roles are minimized, such as the U.S. and Europe [9]. Individuals thus internalize these differences. Cross and Madson [10] further elaborated on this distinction by proposing that men and women in the North American culture have different self-construals. They assert that men have a conception of the self as independent from others, i.e., their representations of others are separate from the self. In contrast, women's self-construal is interdependent, i.e., others are represented as part of the self. Because the conception of self is thought to be a powerful regulator that influences information processing, these gender differences in self-construal and psychological orientation are thought to produce considerable individual variation in cognitive processes such as encoding, organizing and processing information [10].

### 2.1.1 The Origin of Gender Differences

The origin of these gender differences is a complex issue in which biological and social influences are intertwined [13], [18], [25]. In broad terms, societal roles for men and women arose mainly from physical differences, particularly women's reproductive activities and men's greater size and strength. These physical differences resulted in an early division of labor in society, reflecting the specialization of each gender in activities for which they were physically better suited: hunting for men and caring for the family for women. In turn, this division of labor led to expectations about male and female gender roles, with an agentic orientation for men and a communal orientation for women [13]. These gender roles are internalized and become part of each individual's self-concept. Men's processing style is thus consistent with the dominant, more forceful social role they have historically held, in which they are free to focus on attaining personal goals. In contrast, women have traditionally held a more submissive role and learned to survive by being attentive to detailed cues from others. From a biological standpoint, the existence of widespread anatomical disparities in the brains of men and women, as well as the effects of hormones on the brain early in life [5], [25], suggest possible innate differences in psychological orientation and information processing. For example, the band of neural fibers connecting the two brain hemispheres appears to be larger in women, making it probable that communication between the hemispheres is facilitated [25]. Men are believed to rely heavily on right-hemisphere processing, as indicated by a greater reliance on global rules and holistic processing, whereas women primarily rely on left-hemisphere processing which involves the specificities and intricacies represented or implied by the stimulus information [31]. Taking both the social and biological causes into account, researchers have proposed a biosocial origin theory to explain these gender differences [13].

## 2.2 Gender Differences in Information Processing: Comparing Two Models

What are the ramifications of these differences in psychological orientations for information processing online? Two theories grounded in cognitive psychology have emerged, each of which provides an interpretation of a broad array of observed gender differences under a unifying framework. Both propose that men and women differ in the way they process information. In putting forward her Selectivity Model, Meyers-Levy [31] argued that men and women differ in effort, attention to details and elaboration when processing information. More recently, Putrevu [40] offered an alternative view with the Item-Specific/Relational Processing Model (IS/RP), according to which men and women differ in their processing *styles* rather than in *effort* or elaboration.

### 2.2.1 The Selectivity Model

According to the Selectivity Model, males and females employ differing information processing strategies. Men are selective processors who do not generally engage in comprehensive, extensive processing of all available information, unless being motivated to do so. Instead, they tend to use various heuristic devices that serve as surrogates for more detailed processing, such as focusing on cues that are highly available or salient in the context or on the ones that converge to imply a single inference [32]. They typically do not pay attention to subtle details [33]. In contrast, women are comprehensive processors who tend to assimilate all available information and elaborate more on that information by making more extensive associations with prior knowledge. 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 has been observed empirically in various marketing contexts, including advertising [11], [32], product trials [24] and Internet browsing behavior [41]. Prior studies on search patterns have shown that females' search strategies appear to be comprehensive and detailed, while those of males appear more straightforward [26], [38], which would be consistent with the Selectivity Model.

This distinction emerges not because males encode fewer cues than females, but most likely because females elaborate more extensively on cues, which they thus make more accessible for subsequent use [32]. Further, the Selectivity Model holds that males streamline the processing of external information by focusing on self-relevant information, which serves as a heuristic device on which to base judgments. In contrast, females process information comprehensively, devoting relatively equal processing time to information relevant to the self and to others. This distinction is highly consistent with the differences in men's and women's psychological orientations. However, men can use cues similarly to women if there is an extrinsic motivation (task or context) that prompts them to do so [32]. In general, gender differences are most likely to emerge when the demands of the task are moderate and when subjects are given adequate time to process and elaborate on information [33].

### 2.2.2 The Item-Specific/Relational Processing Model (IS/RP Model)

Einstein and Hunt proposed that two types of processing facilitate comprehension: relational processing and item-specific processing [14], [22]. Relational processing involves focusing on similarities or shared themes among disparate pieces of information and can pertain to associations between brands or to associations with people, objects and occasions when the product category may be used [30]. In contrast, item-specific processing involves focusing on attributes of a particular piece of information that are unique or distinctive. Building on Einstein and Hunt's work, [40] argues that culture, psychological orientations and gender roles predispose men and women toward a particular type of processing. In this view, men are more prone to *item-specific processing*, which involves generating precise associations with a particular product, separate from other products [30]. Men thus tend to pay attention to attributes of a brand or product that are distinctive. In contrast, women are more likely to engage in

*relational processing*, attempting to decipher the interrelationships between attributes or brands within a product category. Contrary to the Selectivity Model, the IS/RP Model does not postulate a difference in elaboration or processing effort but rather in processing style: each gender tends naturally to focus on a different aspect of the available information.

In support of the IS/RP Model, Putrevu [38] showed that men and women differ in the types of thoughts listed when presented a variety of print advertisements. Men listed more attribute-oriented thoughts, whereas women listed more category-oriented thoughts. There were no differences between males and females in the number of cognitive thoughts listed (a traditional indicator of processing effort). Thus, the author concluded that the results showed no support for the Selectivity Model. However, Putrevu [39] did not measure the intensity of elaboration, which would have allowed a more rigorous test of comprehension effort. Recent studies supported the IS/RP model: Noseworthy, Lee and Cotte [37] replicated Putrevu's [39] results. Lorigo et al. [29] found that when searching on the web, men tend to process information in an item-specific manner, looking at more search-result abstracts in a linear manner, whereas women tend to make more associations among cues (relational processing) by returning more often to information that they had previously viewed.

The goal of this study is to assess whether these two models are competing or complementary and determine whether one model provides a better fit for information processing by men and women as they navigate online with the same goal in mind. To make such a determination, elaboration, comprehension effort, and processing style (item-specific vs. relational) must be measured, as reviewed in the following section.

### 2.3 Measurement of Comprehension Effort and Processing Style

A classical indicator of comprehension effort is the number of thoughts generated by the information presented, a quantitative measure which was used by both Celsi and Olson [8] and Putrevu [39]. However, comprehension processes also vary qualitatively along a continuum from the automatic, lower-effort process of preconscious attention to the more controlled, higher-effort processes involved in elaboration. Elaboration describes the process of activating prior knowledge from memory and associating it with new information from the environment to produce new meaning that is not present in the environmental cues alone [8]. Thoughts can thus be classified as elaborative or non-elaborative. Adapting the categories established by Celsi and Olson [8] to the context of online information searches, we can define non-elaborative thoughts as sensory-level descriptions of product characteristics and verbatim playbacks of product or brand information explicitly presented on the website. In contrast, elaborative thoughts — such as overt evaluations, conclusions, questions, and comparisons — reflect a deeper comprehension that goes beyond the explicit information provided on the site.

Comprehension processes thus vary in both quantity and effort level, with the number of elaborative thoughts providing an indicator of the amount of effort that occurs during comprehension [8]. Consequently, in this study, we used both the number of cognitive thoughts verbalized and the proportion of elaborative thoughts as indicators of comprehension effort. In addition, when processing the information on a website, a subject's thoughts may specifically address the task at hand (which product to choose) or, more generally, may be focused on understanding the structure of the website and browsing through it. The number of thoughts related to which product to choose is thus more task-relevant and reveal the amount of comprehension effort devoted to the task. According to the Selectivity Model, women using their comprehensive strategy should produce more task-relevant thoughts than men, therefore more product-related thoughts.

According to the Selectivity Model, women would be expected to attempt to make an effortful analysis of all the information on the website and devote more cognitive effort to processing that information than men. Men would be expected to focus more on information that is highly available and salient, and elaborate less on that information. Alternatively, if the IS/RP model holds in this context, comprehension effort should not vary between men and women.

Alternative hypotheses can thus be proposed, depending on which model framework applies. Hence, we posit that in a goal-oriented online task, one of the two alternatives will hold for each hypothesis:

- H1-0: Men and women do not differ in the total number of thoughts verbalized while accomplishing a given task.
- H1-A: Women verbalize more thoughts than men do while accomplishing a given task.
- H2-0: Men and women do not differ in the number of product-related thoughts verbalized while accomplishing a given task.
- H2-A: Women verbalize more product-related thoughts than men do while accomplishing a given task.
- H3-0: Men and women do not differ in the proportion of elaborative thoughts verbalized while accomplishing a given task.

- H3-A: Women verbalize more elaborative thoughts than men do while accomplishing a given task.

The IS/RP model predicts that men and women will differ in the focus of their comprehension processes. Women would be expected to engage in relational processing in which they seek interrelationships, similarities and differences between the multiple cues presented. In contrast, men are more likely to perform item-specific processing, whereby they focus on key attributes or the distinctive attributes of a brand or product. Alternatively, according to the Selectivity Model, men and women would not be expected to differ in the focus of processing. Therefore, we posit that one of the two alternatives will hold for each hypothesis:

- H4-0: Men and women do not differ in the proportion of item-specific thoughts verbalized while accomplishing a given task.
- H4-A: Men verbalize more item-specific thoughts than women do while accomplishing a given task.
- H5-0: Men and women do not differ in the proportion of relational thoughts verbalized while accomplishing a given task.
- H5-A: Women verbalize more relational thoughts than men do while accomplishing a given task.

By using the alternative hypotheses (H-0 and H-A), we will be able to differentiate between the two models and determine if one is more pertinent to understanding how men and women process and respond to online information. It may also be the case that both processing style and comprehension effort differ across gender. In this case, the models would be complementary. Note that individuals may differ in the ease with which they verbalize their thoughts, although no gender differences have been reported [16], [47]. Such variation can be controlled for, as suggested by Wright [47], by re-expressing the absolute number of thoughts of a particular type as a proportion of the subject's total verbalized thoughts. In light of this, we formulated our hypotheses related to elaboration and processing style using the relative proportion of thoughts. The theoretical differences between the two models and the related hypotheses are summarized in Table 1.

Table 1: Comparison between the Selectivity Model and the IS/RP model and summary of the hypotheses

Variable	Information processing differences across gender		Related hypotheses	Supporting model
	Selectivity (Meyers-Levy)	IS/RP (Putrevu)		
<b>Comprehension effort</b> -Number of thoughts*  -Number of product thoughts*  -Elaboration**	Yes	No	Women = Men (H1-0) Women > Men (H1-A)  Women = Men (H2-0) Women > Men (H2-A)  Women = Men (H3-0) Women > Men (H3-A)	IS/RP Selectivity  IS/RP Selectivity  IS/RP Selectivity
<b>Processing style</b> -Item-specific**  -Relational**	No	Yes	Women = Men (H4-0) Men > Women (H4-A)  Women = Men (H5-0) Women > Men (H5-A)	Selectivity IS/RP  Selectivity IS/RP

\* The related hypotheses are based on counts.

\*\* The related hypotheses are based on proportions (e.g., elaboration = number of elaborative thoughts as a proportion of the total number of product thoughts).

### 3 Method

To gather the most relevant material to test the hypotheses, we used qualitative data collected using the concurrent verbal protocols method. When data is being collected and analyzed to study cognitive processes, concurrent verbal protocol (also called *think-aloud*) is a useful approach because it allows cognitive processes to be traced as subjects report their thoughts while performing a task [46]. When verbalizing during the task, subjects report the content of their short-term memory at that moment. This method reveals the subject's assumptions and elaborations as they occur in real time. When performed under suitable conditions (including undirected instructions to elicit the verbal

reports, and verbalization being as undisturbed and constant as possible), it allows the systematic and valid analysis of information that is not otherwise available [15]. This approach also avoids problems of reliability that may arise with other methods (e.g., ex-post interviews, questionnaires, retrospective protocols), where omissions and fabrications can occur due to the tendency of people to forget many details of what they experience or justify their actions once they have completed the task [15]. Ericsson and Simon [16], [17] showed that verbalizing cognitive processes has little or no effect on performance, because it is independent of the task. This is particularly the case if subjects verbalize in a self-paced, distraction-free and low-time-pressure environment designed to minimize competing processing activity [47].

Concurrent verbal protocols have been widely used to assess reactions to advertising and persuasion [47] and, more recently, to assess website usability [2], [3], [35]. It has also been successfully used to analyze the characteristics of virtual experience in e-commerce [27] and to examine information-seeking processes using online tasks [4], [48]. Moreover, Kempf, Laczniaik and Smith [24] suggested that verbal protocols could be used to uncover the real nature of gender differences in information processing. We are therefore confident that it is the method of choice to test our hypotheses.

### 3.1 Sample and Procedure

In order to provide optimal conditions for concurrent verbalization, participants were invited to perform a specific goal-oriented task in a laboratory setting. The participants (106 total, 50% women, all Internet users) were recruited via a hyperlink on a home improvement retailing website where they were asked to sign-up for an individual laboratory session. A few subjects were also referred by participants recruited via that hyperlink (snowball procedure). Participants were contacted and invited to the laboratory where they were randomly assigned to one of two tasks to be performed on the same website used for recruitment. These sessions were conducted on a one-to-one basis to keep verbalizations as constant and distraction-free as possible and also to provide an environment that would facilitate instructions and prompts from the assistant as well as audio/video recording. An experienced assistant (a graduate student, not aware of the goals of the study or the specific hypotheses regarding gender) delivered instructions and informed participants of the task they were to perform on the website. The participants were told that they would need to verbalize every thought that went through their mind while browsing online. Efforts were made to keep the think-aloud behavior as natural as possible: the participants were instructed that they could think aloud at their own pace and that a standard prompt would be used (i.e., *keep on talking*) by the assistant if they were silent for more than 20 seconds to remind them to continue verbalizing their thoughts. Although the assigned task was mandatory, they were told that they could interrupt their browsing at any time and that there was no time limit for completing the task. The only requirement was to think aloud throughout the navigation process. After the introduction and a brief description of their assigned task, the participants were directed to a portal website to read their horoscope and find a movie they would like to see the following week-end. This warm-up session was intended to make the participants feel comfortable verbalizing their thoughts and to familiarize them with the laboratory environment. After the warm-up session, participants were directed to the home improvement website's homepage and asked either to find information on and select a humidifier for the bedroom (Task 1), or to find information on and select the best type of paint to repaint a deck (Task 2). Because the goal of the user visiting a website has a major impact on navigation patterns [34], it was important to make sure all participants navigated on the same website with the same goal in mind. Contrary to preconceived notions regarding gender and home improvement shopping, recent studies have shown that women play a major role [21]. In addition, approximately 50% of online shoppers in the home improvement product category are women [43]. These tasks and product categories were selected because the content available for these products on the home improvement website provided many opportunities to compare among brands and/or models, to access the detailed characteristics of each model and to find advice regarding usage. These tasks and product categories were thus selected to stimulate elaborative, item-specific and relational processing.

The study participants were not asked to complete a transaction on the website, but they were given a credit card upon request (the transaction was not processed). Each participant received compensation of \$50 for their participation. The navigation data and verbalizations were recorded in AVI format (video and sound sequence) using CAMTASIA software. The task completion time (browsing time) varied from 2.1 minutes to 29.1 minutes, with an average of 10.24 minutes (SD = .08 min.) for Task 1 and 9.03 minutes (SD = .08) for Task 2. There were no significant differences in average task completion time between men and women ( $F(1,109) = 2.9, p > .05$ ) or between tasks ( $F(1,109) = 1.1, p > .05$ ). After completing the task, the participants filled out an online questionnaire to provide their demographic information, experience with the Internet, and experience with the specific website.

### 3.2 Coding of the Verbalization Data

As a first step, the concurrent verbalizations were transcribed verbatim by a professional who used italics to indicate when the participants were reading information from the website. This was important, as reading aloud cannot be considered elaborative thought. All transcripts were validated by the first author before continuing with further coding. In the second step, the text was divided into distinct *units of thought*. Each unit of thought corresponds to an objective assessment of a single task assertion or reference by the subject. For this study, adopting the method used by Li, Daugherty and Biocca [27], a unit of thought was defined as the smallest set of words that was meaningful

when removed from its context, which allowed the coder to interpret the meaning of the statement without referring to the text before and after that statement. The division of each transcript into units of thought was further revised by the coders to ensure reliability. A total of 6,382 units of thought were used for further coding, for an average of 67 verbalized thoughts per subject (minimum = 10, maximum = 247). The average number of verbalized thoughts did not differ across tasks ( $F(1,95) = .363, p > .05$ ).

### 3.2.1 Coding Categories and Measures of the Variables

The next step involved classifying the thoughts into categories. Two coders (one male and one female, both with extensive experience with the program) used the Atlas TI 5.2 qualitative data analysis software program for this classification. The coders were independent of the research team and were not informed of the subjects' gender. Based on the hypotheses presented above, an initial coding scheme was developed a priori. For training purposes, the thoughts from eleven subjects were independently classified by each coder. The coding problems and disagreements were then discussed and the coding scheme was revised. This process was repeated several times for each task, pursuant to the procedure advocated by Lombard, Snyder-Duch and Bracken [28], until the instrument was considered to provide reliable coding. The final coding protocol for Task 1 is presented in the Appendix A.

As mentioned earlier, product thoughts are deemed more task-relevant in this study. Product thoughts are those that refer to the product assigned for the task (i.e., paint or humidifier) and can include many cognitive processes such as remembering which product to find, reading tabs or text concerning the product, comparing brands, evaluating brand attributes, and using the search engine to find the product. To assist in coding, we constructed a glossary for each task listing *product keywords* extracted from the verbalizations of the subjects included in the training or from analysis of website content. 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," "What is the difference between latex and oil paint?" and "Now I have to find a humidifier for my bedroom." Because the participants sometimes referred to a product named in a preceding thought using words that were not in the glossary (e.g., "This is interesting," referring to a type of paint), in a second phase we scanned all the units of thought to find such occurrences. Since the Atlas TI's systematic lexical search procedure asks the analyst to confirm the coding of each *hit*, it was possible to decline coding if the association was inadequate. On average, 38.2% of the thoughts verbalized by the subjects qualified as product thoughts (ranging from 16% to 93%,  $SD = .15$ ). There were no significant differences in the proportion of product thoughts across tasks ( $F(1,95) = 1.84, p > .05$ ).

Because the focus of the navigation task was on finding a specific product, only product-related thoughts were used to test hypotheses H3 to H5, related to elaboration and processing style. We then used the coding scheme of Celsi and Olson [8], adapted for online search tasks, to further codify product thoughts as either elaborative or non-elaborative. Non-elaborative product thoughts included sensory-level descriptions of product characteristics and verbatim reading or paraphrasing of the product/brand information explicitly presented on the website such as, "Here they tell me that this model removes bacteria" (transcribed in italics). In contrast, elaborative thoughts go beyond the information provided; they include evaluations, conclusions, questions, comparisons and interpretations pertaining to a brand, attribute or product information. Examples would include: "Why is this model more expensive than the other one?" and "Bionaire is a good brand." An average of 21% of the verbalized product thoughts were elaborative thoughts (ranging from 0% to 75%,  $SD = .15$ ). Significantly more elaborative thoughts were verbalized for the humidifier task than for the paint task ( $F(1,95) = 18.81; p < .00$ ).

Product thoughts were also classified as representing either *item-specific processing*, *relational processing* or *other thoughts*. We used a coding scheme that closely resembled that used by Putrevu [39] to enhance the face validity of our measures, but we adapted the scheme for online search tasks. We defined *item-specific processing* as thoughts about specific brands or models, distinguishing among the attributes that a particular brand did or did not have, and making associations between a target product (brand) and its attributes [30]. Such thoughts focus on the distinctive or unique features of the product. Examples of item-specific thoughts include: "This one is \$24.99," and "Latex paint does not smell." *Relational processing* was operationalized as associations made with the product category and includes people, objects and occasions of use; comparisons between products (brands); and comparisons among attributes [30]. Such thoughts focus on the common themes found in the information, in addition to the unique features. Relational processing thus includes thoughts such as: "Clarion is better than Bionaire," "Latex paint is as resistant as oil paint," and "This one is too big for my bedroom." The *other thoughts* category comprised those that were not related to any product attribute or product category, such as thoughts pertaining to the website (e.g., "Where can I find paint on this site?"). On average, 33.6% of the product thoughts verbalized by the subjects were item-specific (ranging from 0% to 88%,  $SD = .21$ ), 18.8% were relational (ranging from 0% to 52%,  $SD = .12$ ), and 47.6% were other thoughts (ranging from 3% to 100%,  $SD = .23$ ). On average, significantly more product thoughts were item-specific in the humidifier task ( $M = 45.2\%$ ;  $SD = .027$ ) than in the paint task ( $M = 22.8\%$ ;  $SD = .026$ ;  $F(1,95) = 35.5, p = .00$ ). Conversely, significantly fewer product thoughts were relational in the humidifier task ( $M = 13.8\%$ ;  $SD = .017$ ) than in the paint task ( $M = 23.6\%$ ;  $SD = .016$ ;  $F(1,95) = 18.06, p = .00$ ).

Using this coding procedure, thoughts tagged as elaborative can be classified as *item-specific processing*, *relational processing* or other. Similarly, *item-specific processing* and *relational processing* thoughts can be classified as either elaborative or non-elaborative. As an illustration using the examples given above, "Why is this model more expensive than the other one?" is elaborative thought classified as *relational processing*, whereas "Bionaire is a good brand" is also elaborative, but classified as *item-specific processing*. Similarly, "Clarion is better than Bionaire," is

relational and elaborative, but “Latex paint is as resistant as oil paint,” is relational but non-elaborative because the transcript showed that the participant literally read this sentence from the website (in italics in the transcript).

Table 2 summarizes the codes, categories and descriptive statistics associated with each task. These categories formed our dependent variables and were the basis for the subsequent data analysis. The independent variable was gender (i.e., biological sex as reported by the participant). Experience with the Internet, experience with the specific website, age and education were measured using ordinal scales.

Table 2: Codes, categories and descriptive statistics related to the hypotheses

Codes (dependant variables)	Categories	Mean (SD)		Proportion		Difference between tasks (p)
		Task 1	Task 2	Task 1	Task 2	
<b>Total number of thoughts (H1)</b>		70 (50.9)	64.6 (36.1)			n.s.
<b>Product thoughts (H2)</b>	a) Product thought b) Other thoughts			36.1% 63.9%	40.1% 59.9%	n.s
<b>Elaboration (H3)</b>	a) Elaborative b) Non-elaborative			27.5% 72.5%	15.1% 84.9%	p = .000
<b>Processing style (H4-H5)</b>	a) Item-specific b) Relational c) Other thoughts			45.2% 13.8% 41.0%	22.8% 23.6% 53.6%	p = .000

## 4 Results

In this section, an analysis of the reliability of the measures is presented as well as the description of the sample. This is followed by testing of the hypotheses (H1-H5) using ANOVAs. Finally, other results of interest are presented.

### 4.1 Reliability of the Measures

Following the procedures suggested by Riffe and colleagues [42] to assess intercoder reliability, we conducted a pilot test using a random sample of units of thought after training the coders. Two indices of reliability were used: percent agreement and Scott's pi. There is general consensus in the literature that percent agreement is a liberal index as it does not account for agreement that would occur simply by chance, whereas Scott's pi is highly conservative [28].

Reliability was tested again during coding of the experimental sample (95 subjects), using a different random sample of units of thought (n = 161 for Task 1; n = 191 for Task 2), to formally assess the reliability of the measures. Table 3 summarizes the indices of intercoder reliability thus obtained. In the literature, reliability coefficients of .80 or greater are generally acceptable and a threshold of .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 [36]. We thus find that the values for percent agreement (all above 80%) and Scott's pi (one at 69%, the rest above 70%) indicate good intercoder reliability.

Table 3: Intercoder reliability indices\* for all variables

Variables	Percent agreement		Scott's pi		Percent agreement (across tasks)	Scott's pi (across tasks)
	Task1	Task 2	Task 1	Task 2		
<b>Product thoughts (H2)</b>	99%	99%	99%	98%	<b>99%</b>	<b>98.5%</b>
<b>Comprehension effort**</b> -Elaboration (H3)	88%	99%	74%	95%	<b>93.5%</b>	<b>79.5%</b>
<b>Processing style (H4-H5)</b>	82%	86%	69%	79%	<b>84%</b>	<b>74%</b>

\*ReCal, an intercoder reliability calculator (Site 1) was used to calculate the indices.

\*\*Note that the total number of thoughts (H1) is not presented in the table because it did not require coding.

### 4.2 Sample Description

The experimental sample consisted of 95 subjects. Men and women in the sample were first compared on key characteristics such as demographic variables and Internet experience. The subjects were generally young and educated, and most had more than three years of experience using the Internet, which is representative of the typical Internet user. Although 45% of the participants had visited the website before, only 1% had ever bought something



from the site. There were no significant differences between men and women on any of these characteristics (Table 4).

Table 4: Sample characteristics\*

Variables	Women (n = 46)	Men (n = 49)	Gender difference*
<b>Age</b>			p > .05
18-34	78.3%	63.3%	
35 and up	21.7%	36.7%	
<b>Education (completed degree)</b>			p > .05
Less than college	15.2%	12.2%	
College	28.3%	30.6%	
University	56.5%	57.2%	
<b>Internet experience</b>			p > .05
Less than 3 years	23.9%	22.4%	
Over 3 years	76.1%	77.6%	
<b>Have you ever browsed on the website you just visited?</b>			p > .05
Yes	43.5%	46.9%	
No	54.5%	53.1%	
<b>Have you ever bought something on that website?</b>			p > .05
Yes	2%	0%	
No	98%	100%	

\*Chi Square tests were performed for each variable.

The direct effect of each potential control variable (age, education, Internet experience and experience with the website) on the dependent variables was examined. No significant effects were found for age, education or experience with website visited, consequently these variables were dropped from further analyses. However, Internet experience influenced the proportion of elaborative thoughts verbalized. As mentioned above, the nature of the task also influenced some dependant variables, hence both Internet experience and task were included as covariates for further analyses to rule out alternative explanations for the results.

### 4.3 Hypothesis Testing

We conducted a series of ANOVAs comparing the average scores of men and women on the dependent variables to test our hypotheses. The relevant univariate comparisons are presented in Table 5.

Table 5: ANOVA results\*

Dependent variable		Mean (SD)		F value	p value (one-sided)	Model Supported
		Men	Women			
Total number of units of thought (H1)		57.3 (7.5)	77.0 (8.2)	3.13	<b>0.04</b>	<b>Selectivity</b>
Total number of product thoughts (H2)		20.8 (3.3)	31.9 (3.6)	2.1	0.01	<b>Selectivity</b>
Product thoughts only	Proportion of elaborative thoughts (H3)**	0.20 (.02)	0.26 (.02)	2.91	<b>0.046</b>	<b>Selectivity</b>
	Proportion of Item-specific thoughts (H4)**	0.33 (.03)	0.35 (.03)	0.09	>0.05	<b>Selectivity</b>
	Proportion of relational thoughts (H5)**	0.16 (.02)	0.22 (.02)	3.88	<b>0.026</b>	<b>IS/RP</b>

\* When controlling for Internet experience and task

\*\* For these hypotheses, two variables were created from the participant's data: (1) the number of thoughts in that category and (2) that number as a proportion of the total number of product thoughts. Since the latter variable may serve to correct for differences in verbosity among the participants [47] it was preferred. However, analyses were also conducted using the number of elaborative, item-specific and relational thoughts (not presented here) and led to the same conclusions as did analyses using the proportions.

Hypotheses 1, 2 and 3 concerned measures of comprehension effort. On average, women exerted more effort in comprehending the information on the website than men, as measured by the total number of thoughts verbalized during the task (Table 5). They also exerted more comprehension effort in processing the product-related information than men, as measured by the number of product thoughts and the proportion of elaborative thoughts related to the assigned task product. These results support H1-A, H2-A and H3-A. Hypothesis 4 and 5 concerned the influence of gender on processing style. Men and women did not differ in the proportion of item-specific thoughts, which supports H4-0 (Table 5). However, women verbalized more relational thoughts than men, supporting H5-A. Thus overall, the data provided more support for the Selectivity Model than the IS/RP model.

#### 4.4 Additional Results of Interest

If self-construal is internalized by individuals and influences their cognitive processes as Cross and Madson [10] suggest, this should be detectable when consumers browse online while performing goal-oriented tasks. The influence of self-construal may result in more thoughts that refer to people close to the subject being verbalized during navigation. Indeed, Li, Daugherty and Biocca [27] reported that 60% of participants verbalized the potential importance of products/attributes to someone else while interacting with 3-D products online, but the authors did not expand on the role of gender. For exploratory purposes, we also coded thoughts including family members and friends (percent agreement and Scott's pi = 100%). The results showed that only 11.6% of subjects verbalized such thoughts (7 women and 4 men) and that the number of such units of thought per browsing session per subject ranged from 1 to 4. Women were more likely than men to verbalize thoughts referring to family or friends ( $M_{\text{women}} = 2$  vs.  $M_{\text{men}} = 1$ ;  $p = .06$ ). Although these results are highly exploratory and marginally significant, they suggest that, when focusing on a goal-oriented task, women's representations of close others are more accessible than men's, as reflected in their verbalizations. This finding would be consistent with women's more interdependent self-construal.

### 5 Discussion

Overall, the results show that the Selectivity Model [31] accounts for the observed gender differences in information processing better than the IS/RP Model does, in the context of an online goal-oriented task. Our findings show that women exerted more comprehension effort than men, as measured by both the number of units of thought verbalized and the proportion of elaborative thoughts, even when Internet experience and task differences were controlled for. In contrast, gender differences in processing style [39], [40] received only partial support in the context used in this study. Item-specific processing did not differ across gender, as the IS/RP Model would predict, as men did not verbalize a greater proportion of item-specific thoughts. However, as predicted by the IS/RP model, women were more likely to use relational processing.

These findings contribute significantly to the literature on gender differences in information processing by providing evidence of the more effortful processing used by women and the more selective processing used by men when performing the same online goal-oriented task. Women elaborate more on the information presented, tending to make more associations between the various pieces of information, comparing brands based on various attributes, or linking products to contextual information. Furthermore, by using a qualitative approach such as the think-aloud method and by formulating alternative hypotheses, this study is the first to disentangle and test the key postulates of two theories of gender differences in information processing. On the whole, our observations provide more support for the Selectivity Model than for the Item-specific/Relational Model, as differences in effort were observed, whereas only some differences in processing style were noted.

#### 5.1 Managerial Implications

These findings lead to a number of implications for online retailers and web developers seeking optimal ways of appealing to men and women and converting them from browsers to customers. Gender is a segmentation variable 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 web pages with content, design and features that are adapted to the information processing strategies of males and females. For sites targeting men, our findings suggest that designers should structure content to suit men's selective processing style, which operates on a *what's in it for me* basis. Sites adapted to male customers should have a focused page structure in which the key information is made salient and easy to find. For more complex products, providing a single strong cue that visually summarizes the key product features and benefits would be suited to men's heuristic processing. The use of clickable links to relevant extra information would allow male consumers to deepen their analysis if needed without crowding the page with too much written information, which is particularly unappealing to men [40].

Conversely, our findings suggest that creating a site that appeals to women would entail structuring the information to facilitate relational processing and elaboration. For transactional sites, one good way of exploiting women's tendency toward relational processing is by leveraging the Internet's interactive capabilities, which applies particularly well to cross-selling strategies. Users could then shop for a combination of items (coordinated shirt and pants, for example) instead of just one item. Women might also be particularly sensitive to information highlighting the context in which products are used. These strategies would likely enhance the shopping experience for women. Another Internet functionality that facilitates and encourages comparison between brands is comparison matrices. Matrices list various product attributes and can be used both to analyze common elements between brands and to identify unique features. They also allow shoppers to compare brands or models on a few key attributes, simplifying decision-making. These characteristics make comparison matrices consistent with and adaptable to the information processing strategies of both males and females. Finally, women's tendency to engage in elaborative processing, coupled with their discerning eye for details, presents marketers with abundant opportunities to finely tune their product positioning. Furthermore, today's advances in technology and behavioral sciences allow the design and information structure of a website to be implicitly adapted to how each consumer processes information [44]. *Morphing the web*, as the authors explain, occurs when the website *learns* the information processing style of the

consumer as he or she clicks through the pages. The website then *matches* its design and structure accordingly, in order to be respond to individual differences, resulting in increased trust and, hence, additional sales.

## 6 Limitations and Suggestions for Future Studies

As with all behavioral research, there are limitations to the potential for generalization from our findings that should be considered. First, this research focused on gender differences in processing and not on differences in outcome variables such as attitude toward the website, behavioral intentions, or purchase. Neither the Selectivity Model nor the IS/RP Model predict that one gender will make better decisions than the other; they suggest only that females will use a different strategy than males to process information. Future research should examine the relationship between information processing and outcome variables for male and female consumers when shopping online. Second, this study focused on the effect of biological sex, however future studies could usefully explore the influence of psychological orientation on information processing in the context of online goal-oriented tasks. For example, the application of scales of self-orientation vs. other-orientation [23] would enrich our understanding of information processing among men and women. Third, individual variables such as the need for cognition or the participant's familiarity, interest and experience with the product category (e.g., if they had recently painted a deck or bought a humidifier), which were not measured in this study, could influence information processing and should be incorporated in future studies. Finally, as Wright [47] mentioned 30 years ago, "an unfortunate aspect of verbalization data is how burdensome they are to analyse." A sample size of 95 subjects is on the high end of the feasible range for studies using verbal protocols [2], [4], [19], [27], [47]. However, the sample was generated using a convenience method with its associated weaknesses, and a single website was used. Future studies should take the time to replicate these findings using a larger and more representative sample, as well as other product categories or types of task.

This study adds to our understanding on how gender, a key segmentation variable in marketing, influences how consumers process and respond to information presented on the Internet. We are thus confident that the results of this study will provide web developers with useful tools for adapting and personalizing web content and structure according to the distinct information processing strategies of men and women.

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## Websites List

Site 1: Deen Freelon, Assistant Professor, American University School of Communication  
<http://dfreelon.org>

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## Appendix A: Final Coding Scheme for Analysts

This coding scheme was developed for Task 1, concerning the choosing of a humidifier. A similar guide was developed for Task 2.

**Goal of the study:** To examine the participants' process of understanding as they perform an online goal-oriented task.

**Content to be examined:** Concurrent verbalizations of 106 participants completing two different tasks on a specific website. Task 1 was to find a humidifier for the bedroom and Task 2 was to find exterior paint to repaint a wooden deck. The verbalizations were captured in audio/video and were then transcribed by a professional transcriptionist. The transcripts were subsequently divided into distinct units of thought. Each unit of thought is numbered. Pauses are indicated by a series of periods, depending on the length of the pause. The transcriptionist used *italics* to indicate when the participant was reading information directly from the website and used the **bold** to indicate text that the participants typed into the website (e.g., responses to questions in order to become a member of the website). Verbalizations made by the interviewer during the browsing session (e.g., "Please keep on talking") are in **RED** and **should not be coded**.

### **Before coding: Validating the division into distinct units of thought**

Before starting the coding procedure, you will need to validate the division of the text into distinct *units of thought*. This must be done before you import the text in Atlas TI and both analysts must agree on the division. Please use the following guidelines to validate the division of the units of thought.

- A unit of thought corresponds to an objective assessment of what constitutes a single task assertion or reference by the subject.
- A unit of thought could consist of a sentence or a sentence fragment, but no more than one sentence.
- A unit of thought is the smallest set of words that is meaningful when taken out of context, which allows a coder to interpret the meaning of the statement without referring to the text before and after that statement.

**Coding Procedure:** You will code all units of thought, one participant at a time, using the following coding instructions. When finished, you will compile the results on the coding sheet for each participant. The second analyst would independently complete the same coding procedure.

### **The procedure needs to be done in two phases.**

In the first phase, you will code thoughts that qualify as *product thoughts*. This coding is done independently by each coder and disagreements between the coders must be resolved before going to phase two. Disagreement that cannot be resolved by the two analysts will be resolved by the researcher. When the first phase is done and product-related thoughts have been coded separately and subsequently agreed on by both analysts, the second phase begins.

In the second phase, *only the product thoughts* will be coded as elaborative thoughts and/or item-specific or relational processing following the coding scheme. Again, the analysts should code one category at a time: for each participant, first code the elaborative thoughts, then the item-specific or relational processing. Disagreements that cannot be resolved by the two analysts will be resolved by the researcher.

### **Coding definitions and categories:**

(The examples are real units of thought taken from the pre-test.)

**1) PRODUCT THOUGHTS:** A thought that make reference to the assigned task-product (i.e., humidifiers). Product thoughts include information on attributes, brand characteristics, product category (humidifier), comparison between brands, etc.

**How to code:** In Atlas TI, using the auto-coding procedure, you will perform a search using the PRODUCT\_HUMID search category (glossary) for each participant. Do not forget to add the vertical bar character "|" at the beginning of the research code. For each match, Atlas TI will ask for validation. Some matches need to be excluded (not coded) as they do not relate to the task product. After you have finished the search for a participant, you need to go back to the transcription and check the unit of thought following each **PRODUCT THOUGHT** to search for occurrences of product thoughts that used demonstratives such as "that", "it", etc. These words refer back to or replace a "product word" that was used in the preceding unit of thought, but are not captured by the automatic search using the glossary. Therefore, you need to manually review the participant's verbalizations to uncover these *hidden* product thoughts. Here is an example:

123: Look at this Bonaire.

(Coded as product thought.)

124: **It** is too big for my bedroom.

(This thought should also be coded as a product thought because "**it**" refers to the Bonaire humidifier.)

**Only the product thoughts will be coded using the following categories:**

**2) ELABORATIVE THOUGHT** regarding the **product**:

- Thoughts in which the participant goes beyond the information presented in an effort to make sense of the product information or to interpret it. Evaluations, conclusions regarding a product or brand, comparisons between brands or attributes, and questions about specific products or brands are all elaborative thoughts (e.g., "This one is better," "Bionaire is a good brand," "Why is this model more expensive?").

**Elaborative thoughts regarding the product ARE NOT:**

- *in italics* (because italics indicate that the participant is reading information explicitly presented on the website);
- a paraphrase of information the participant has just found. In this case participant reiterates something he has just read in his own words (e.g., "There they told me that it eliminates bacteria");
- sensory-level descriptions of the product or product characteristics (e.g., "It is white");
- a product choice (e.g., "I choose this model");
- a description of what the participant is doing or intends to do (e.g., "Now I will go take a look at this model");
- an inference regarding where to find the product on the website (e.g., "If I click here, I will find information on humidifiers);
- a series of tabs including the word "humidifier" (these should normally be in italics).

**Only the product thoughts will be coded using the following categories:**

**3) ITEM-SPECIFIC OR RELATIONAL PROCESSING:**

**ITEM-SPECIFIC PROCESSING:**

- Thoughts related to attributes and/or features specific to a product, model or brand. These thoughts could be associations between a product (brand) and attributes that it does or does not have. As a general rule, one attribute will be related to one product in any given unit of thought. A list of attributes was supplied to the analysts. Examples of units of thought reflecting item-specific processing include, "Bionaire," "Why does this Clarion eliminate bacteria?" and "This one is \$24.99."

**RELATIONAL PROCESSING:**

- Thoughts related to the general product category (humidifier), a brand's position within the category, comparisons between brands in general or on specific attributes, or comparisons between attributes. Examples include, "What's the difference between this one and the other model?" and "Bionaire is better than Clarion."
- Thoughts related to the usage context (bedroom), occasions when the product would be used, people who might use the product, and so on. Examples include, "This one is too big for my bedroom," and "Be careful to choose the right humidifier for the size of the room you want to humidify."

**OTHER THOUGHT (left blank): NEITHER ITEM-SPECIFIC NOR RELATIONAL PROCESSING.** These include the following types of thoughts:

- product choices (e.g., "I choose this one");
- website tabs containing the word "humidifier";
- descriptions of what the subject is doing or intends to do; or
- thoughts making an association between the product and the website.