The Effect of Searching Versus Surfing on Cognitive and Emotional Responses to Online News

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Abstract. A mixed-design experiment was conducted to explore differences between searching and surfing on cognitive and emotional responses to online news. Ninety-two participants read three unpleasant news stories from a website. Half of the participants acquired their stories by searching, meaning they had a previous information need in mind. The other half of the participants acquired their stories by surfing, with no previous information need in mind. Heart rate, skin conductance, and corrugator activation were collected as measures of resource allocation, motivational activation, and unpleasantness, respectively, while participants read each story. Self-report valence and recognition accuracy were also measured. Stories acquired by searching elicited greater heart rate acceleration, skin conductance level, and corrugator activation during reading. These stories were rated as more unpleasant, and their details were recognized more accurately than similar stories that were acquired by surfing. Implications of these results for understanding how people process online media are discussed.

Keywords: web browsing, online news, cognition, emotion, psychophysiology

Introduction

People have different ways of finding information online. Sometimes they search the World Wide Web for specific content, such as answers to the following questions: “Did my team win last night? What is the weather going to be like this weekend?” Other times, people surf the Web without any desired information in mind. We suggest that these two ways of acquiring content, searching and surfing, lead to differences in cognition and emotion.

There are important reasons why it is useful to know whether searching and surfing lead to different processing outcomes. First of all, people spend a lot of time doing these things. A recent Pew Internet and American Life (2007) survey reported that, on any given day, 38% of all Internet users search for things via search engines, while 30% of all Internet users surf online for fun. The same survey reports that, besides email, searching and surfing are among the most frequent uses of computers. If these ways of acquiring content online generate differences in cognition and emotion, such differences would have ramifications for the design and implementation of online interfaces.

More importantly, studying such differences may also help to build theories about how people process Web-based information. This paper seeks to contribute to this endeavor by testing hypotheses derived from existing media-effects research about how searching and surfing differentially impact emotion and cognition. This process will highlight the proposed interaction between the two different tasks associated with experiencing Web-based content – what we call “getting there” and “being there.” Getting there is what people do while they are looking (by searching or surfing) for content online. Being there is about what happens when that person is mentally processing the content he or she just acquired.

Differences Between Searching and Surfing: Getting There

While searching and, especially, surfing are terms generally associated with computer media, the tasks of finding and experiencing media content are not new to computer media, and previous research on other media informs this distinction. For example, research from the uses and gratifications perspective distinguishes between ritualized and instrumental use of media. Ritualized use is defined as the habitual use of a particular medium to pass time and as a diversion (Rubin, 1994). Instrumental media use, on the other hand, involves seeking specific media content for informational reasons. Clearly, surfing and searching can easily be construed as ritualized and instrumental media use, respectively.

These two motives have been shown to correlate with different types of audience activity. Rubin and Perse (1987) found that instrumental viewing of television news correlated with self-reported intentionality and involvement, while ritualized viewing of television news correlated with...
nonselective exposure and coviewing distractions. To the extent that instrumental and ritualized television viewing can be equated to searching and surfing the Web, this line of research may suggest that searching is more effortful than surfing. This difference may best be described as motivational; searching is more effortful than surfing because the search has a goal. Gantz (1978) describes motivation as important to the uses and gratifications approach and relevant to learning, although substantial evidence also suggests that people learn through heuristic or peripheral processing (i.e., Chaiken, 1980; Petty & Cacioppo, 1996). Having identified a possible motivational difference between searching and surfing, we now explore behavioral differences between them.

Both searching and surfing involve scanning arrays of options, then selecting a target from those options. Purposeful searching requires a person to evaluate each option as a hit or a miss. Presumably, there is a right or best option. As practical evidence of this, many search engines provide relevance scores as a measure of how well a link fits a particular search query. Random surfing, on the other hand, only requires a person to find an acceptable option. While some options might be better than others, the criterion is acceptability rather than best fit. Using terms borrowed from research on decision-making, we propose that searching is an optimizing task while surfing is a satisfying task. Optimizing occurs when a person searches attentively for the best option among an array of possible options, while satisfying occurs when a person simply chooses the first satisfactory option she or he encounters (Krosnick, 1991).

This further distinguishes searching from surfing in terms of required effort. As an optimizing task, searching should be more effortful than surfing. Searching requires a mental target to be established and then compared against each option in an array. This process includes effortful memory scan and integration of new information. Surfing, on the other hand, requires fewer of these resources, because options in an array are being compared to one another rather than being compared with a mental target. The comparison is perceptual rather than conceptual: Items are compared to other items as perceived in a visual array, rather than being compared to a mental concept.

To summarize, previous research suggests both motivational and behavioral differences between searching and surfing. In terms of the getting there/being there distinction, these differences imply that searching is a more effortful way of getting there than surfing. If this is the case, how does this difference affect cognition and emotion once content has been acquired? The limited-capacity model of motivated mediated message processing (LC4MP; Lang, 2006) provides a framework for thinking about how the interaction of message content, message structure, and viewer goals affect cognitive and emotional responses to media. The next section describes the model, applies it to the getting there/being there distinction, and derives hypotheses that address how searching and surfing may lead to different processing outcomes.

The Limited Capacity Model of Motivated Mediated Message Processing (LC4MP)

The LC4MP (Lang, 2006) provides a theoretical framework for understanding how the human brain interacts with media over time. It has a few central assumptions: People have limited resources for processing information in the environment. Information processing consists of at least three major subprocesses: encoding, storage, and retrieval. These subprocesses occur continuously and simultaneously. The allocation of resources to these subprocesses can be either controlled or automatic. Controlled allocation of resources is purposeful and reflects a person’s current goals. Features of the message, on the other hand, elicit automatic allocation of resources. One indicator of automatic allocation of resources is the orienting response, which is a short-term slowing down of the body, which has been theorized as supporting stimulus intake and is marked by heart rate deceleration and increased electrodermal response (Sokolov, 1963). The allocation of both controlled and automatic resources is also driven by the aversive and appetitive activation systems, which guide avoidance and approach behavior. These systems are activated by the motivational relevance and intensity of the message. The combined allocation of controlled and automatic processing resources to encoding, storage, and retrieval determines the cognitive and emotional outcomes of exposure to a particular message.

The LC4MP is derived primarily from research on television and radio. As Lang (2006) states, “research examining computer presentation of information and simple Web stimuli from the LC4MP perspective is still in its early stages” (p. S70). The current study seeks to further extend the LC4MP by exploring how information presented on the Web is processed. It follows a recent line of research that explores interactive media from the getting there/being there perspective. Specifically, this research has addressed how resources are allocated and elicited while getting there, and how this affects the allocation of resources while being there. In the more specific terms of the LC4MP, this research asks how different structural and content features of interactive media elicit (a) the controlled and/or automatic allocation of cognitive processing resources to the three subprocesses, and (b) aversive and appetitive activation. This research is reviewed in the next section.

Getting There/Being There

To this point, research on the relationship between getting there and being there has focused on the allocation of cognitive resources rather than on aversive and appetitive activation. Wise and Reeves (2007) looked at how people’s ability to control the onset of pictures (getting there) affected orienting responses, arousal, and valence once those pictures had been acquired. They had people look
at a series of pictures on a computer, with picture onset controlled either by the person (using a mouse) or by the computer. Their results showed that people oriented to emotional pictures whose onset was controlled by the computer, but didn’t orient to emotional pictures when they had control over onset. While the pictures that subjects controlled elicited greater physiological arousal, the unpleasant pictures that the computer controlled were rated as more unpleasant and arousing, even though all pictures had similar a priori ratings. In the context of the LC4MP, these results indicated that the controlled allocation of resources while getting there caused a reduction in the automatic resources allocated to encoding while being there.

Wise and Pepple (2008) looked at a similar relationship but manipulated the number of options rather than the exertion of control. They found that unpleasant pictures chosen from an extensive array of options failed to elicit orienting and were recognized less accurately than similar pictures chosen from a limited array of options. Again, these results demonstrated that the exertion of controlled resources while getting there caused a reduction in the automatic resources allocated to encoding while being there. Wise and colleagues (2008) also manipulated the number of options but instead of looking at orienting to pictures, they looked at longer-term controlled allocation of resources while reading unpleasant news stories. They found that more resources were allocated to encoding stories that were chosen from an extensive, rather than a limited array of options. In other words, increasing the required allocation of resources while getting there led to increased allocation of controlled resources while being there. In sum, these results suggest that structural features of interactive media that require greater allocation of controlled resources while acquiring content reduce the automatic allocation of resources to perceptual tasks like looking at pictures, yet increase the controlled allocation of resources to cognitive elaboration tasks such as reading words.

Combining this conclusion with the earlier proposition that searching is more effortful than surfing, one would expect that content acquired through searching would elicit fewer automatic resources allocated to encoding than content acquired through surfing. However, recent research suggests that this is not the case. Wise and Kim (2008) had participants look at unpleasant pictures selected from an online thumbnail gallery. One group of participants selected pictures according to whether or not they fit a target description (searching). The other group selected pictures without any target criteria, simply choosing pictures in the gallery that they wanted to take a better look at (surfing). This represented the getting-there phase. Once a participant had selected a particular picture, they were exposed to the picture for 6 s. This represented the being-there phase. While searching was, indeed, more effortful, pictures acquired by searching elicited orienting and were encoded better than pictures acquired by surfing. This finding contrasts with the previous findings that controlled processing while getting there diminishes automatic processing while being there.

One possible explanation for this result may be related to the differences between the getting-there tasks and how those differences influence the cognitive and motivational properties of the stimulus. In the first two studies described, the manipulations involved control over selection and size of array. Getting there was more effortful because either the user had to point or click to make something appear or the array of content from which the user had to choose was bigger. In the more recent experiment, however, in the surf condition, the user similarly chooses where to go from a large array but, in the search condition, the user must also choose something that matches a predetermined target. Anything that matches this target is a signal stimulus and we know that orienting occurs in response to signal stimuli (Sokolov, 1963). When surfing, on the other hand, there is no mental target, thus, no signal stimulus. In other words, once someone has made the choice to find something (when searching), that something becomes a signal stimulus. This would explain why pictures acquired by searching were oriented to and recognized better than pictures acquired by surfing.

The current study extends our understanding of the distinction between searching and surfing in some important ways. First of all, it addresses different content by looking at responses to text rather than pictures. If searching for pictures causes more resources to be allocated to encoding than surfing for pictures does, the same should be true of news stories. As was done with the pictures, looking at heart rate can indicate this. While the orienting response yields initial cardiac deceleration during picture perception, the processing that occurs during reading and mental imagery is associated with cardiac acceleration (Bradley, 2000; Lacey, Kagan, Lacey, & Moss, 1963). In one of the aforementioned studies, Wise and colleagues demonstrated that details of unpleasant news stories eliciting greater heart rate acceleration were more strongly encoded, establishing a link between heart rate acceleration and resource allocation to encoding text.

We propose that unpleasant stories acquired through searching are more motivationally relevant than stories acquired through surfing. As such, they should elicit greater controlled allocation of resources to encoding, which can be measured through heart rate (Lang, 1994). Therefore, the following hypothesis is proposed:

H1: News stories acquired through searching will elicit greater heart rate acceleration than news stories acquired through surfing.

In a study applying the uses and gratifications approach to
television news recall, Gantz (1978) reported that information seekers recalled more news items than recreation seekers. To the extent that informational and recreational television news viewing map onto searching and surfing online news, this suggests that people should more accurately recognize information from stories acquired by searching as opposed to surfing. This should also be the case if, as Hypothesis 1 suggests, more resources are allocated to encoding information contained in news stories acquired by searching. According to the LC4MP, recognition accuracy is an indicator of encoding (Lang, 2006). Based on this, the following is predicted:

H2: Details of online news stories acquired through searching will be recognized more accurately than details of news stories acquired through surfing.

This study also extends the LC4MP by looking at emotional experience, the other major component of motivational activation. One general indicator linked to both emotional experience and motivational activation is skin conductance. For example, Lang, Chung, Lee, and Zhao (2005) have shown that participants had higher skin conductance when viewing pictures of risky compared to nonrisky products and words. To the extent that stories acquired by searching are more motivationally relevant than stories acquired by surfing (as predicted in H1), one would expect them to elicit greater skin conductance. Furthermore, recent research has shown that words with signal (motivational relevance) properties elicit skin conductance responses (Dindo & Fowles, 2008). It follows, then, that stories with signal properties should elicit greater skin conductance while a person reads them. Therefore, the following hypothesis is proposed:

H3: News stories acquired through searching will elicit greater skin conductance than news stories acquired through surfing.

Another indicator of emotional experience is valence, or the experience of pleasantness and unpleasantness in response to media. How might the distinction between searching and surfing affect valence? The LC4MP would argue that emotional experience should be stronger during searching compared to surfing. This is because knowledge of the unpleasant nature of the target stimulus should automatically activate the aversive motivational system at the point where the user begins to search. Thus, the experience of unpleasant feelings, a correlate of aversive activation, will begin sooner for the searcher compared to the surfer. A great deal of research suggests that when the aversive system is already activated, the appearance of the expected negative stimulus facilitates the aversive response (e.g., leads to facilitated startles, greater negative emotional experience, and increased corrugator activation). On the other hand, during appetitive activation (and it is likely that surfing is a mildly appetitive state) the appearance of an unexpected negative stimulus leads to inhibited aversive reactivity (e.g., inhibited startles, less corrugator, and reduced negative emotional experience; Lang, 2006).

For example, let us say that a person is searching for information on Hurricane Katrina. The very thought of Hurricane Katrina should elicit aversive activation. When the story on Katrina is located, aversive activation and the associated negative emotional experience and increased corrugator activation should occur. The person who is simply surfing is appetitively approaching the stimulus looking for something interesting and/or amusing. When that person comes upon the Katrina story, the resultant aversive activation should be inhibited by the concurrent appetitive activation and lead to less negative emotional experience and less corrugator activation. Therefore, the following is predicted:

H4a: News stories acquired through searching will elicit greater corrugator activation than news stories acquired through surfing.

H4b: News stories acquired through searching will be rated as more unpleasant than news stories acquired through surfing.

These issues were explored through an experiment in which people selected (by pointing and clicking) stories from an online news Web site. One group of people selected their stories according to whether or not the headline matched a predetermined interest (searching). The other group selected their stories with no criteria, simply choosing headlines that looked interesting (surfing). This represented the getting-there phase. Once someone selected a particular story, they read it. This represented the being-there phase. While reading each story, participants’ heart rate, skin conductance, and corrugator activation was recorded. Participants also rated the unpleasantness of each story they read. Later, their ability to recognize details from each story was tested.

Method

Participants

Ninety-two undergraduate students from an introductory advertising class at a large Midwestern university participated in this study for course credit. Physiological data from 10 participants had to be discarded because of experimenter error or equipment malfunction. Heart rate data from an additional six subjects had to be discarded because of excessive noise leading to an untenable waveform. Thus, skin conductance and corrugator data from 82 participants and heart rate data from 76 participants are reported here.
This study used a 2 (search type) × 3 (repetition) mixed design. Search type was a between-participants factor that referred to the manner in which participants selected news items from a Web site. The two levels for search type were surf, in which participants chose stories freely, and search, in which participants searched for stories from a list of descriptions provided before exposure to the Web site. This factor was intended to mimic the process of searching for content to fulfill either a temporary whim (surf) or a predetermined goal (search). Participants were randomly assigned to one of these conditions. Each participant chose and read three stories, which comprised the within-participants repetition factor.

Stimuli

The experimental stimuli consisted of a news Web site containing 20 hyperlinks, shown in Figure 1. Each hyperlink consisted of a picture and a headline, and was connected to a short news story that appeared when a participant clicked on the hyperlink with a mouse. The hyperlink pictures were selected from the International Affective Picture System (IAPS; Center for the Study of Emotion and Attention, 2001). The IAPS includes a wide variety of digitized pho-
For this study, we selected mildly unpleasant pictures (M = 3.39, SD = .57, where 1 = very unpleasant and 9 = very pleasant) that approached the midpoint of the arousal dimension (M = 4.56, SD = .44, where 1 = not arousing at all and 9 = highly arousing) to avoid confounding valence with arousal. An undergraduate journalism student enrolled in a news reporting class wrote two generic headlines that corresponded to each picture, totaling 40 headlines. To minimize the chance that a particular headline would unduly arouse or interest participants, 15 students rated all headlines using the Self-Assessment Manikin (SAM; Bradley & Lang, 1994), which is traditionally used to rate the arousal of IAPS pictures. Students also rated how interested they would be in reading a story based on each headline if they saw it on a news Web site, using a seven-point scale anchored by not interested and very interested.

From these ratings, 20 headlines were chosen that clustered around the mean of both arousal (M = 4.49, SD = .53) and interest (M = 5.44, SD = .62). Pairwise comparisons yielded no significant differences for these measures among the chosen headlines. After the headlines had been chosen, the same student wrote a short (110–130 words) fictitious news story for each of the 20 headlines. The picture/headline combinations and stories comprised the news Web site, which was identical across both levels of search.

Procedure

Each participant arrived at the laboratory and provided written informed consent. They were randomly assigned to either the search or surf condition. In the search condition, participants saw a list that provided short descriptions of the news stories. Participants were instructed to first make a mental note of which description they’d like to read more about, then click on the hyperlink that corresponded to that topic when the news Web site appeared. In the surf condition, participants saw no such list of descriptions; each participant was only told to choose any headline that interested them once the Web site appeared. This manipulation gave participants in the search condition a predetermined goal to meet by finding a particular piece of content upon exposure to the Web site. Participants in the surf condition had no such goal.

Stimuli presentation began with an instruction screen that reiterated the procedure, followed by a black screen lasting for 5 s as a baseline period. After the baseline period, the news Web site appeared on the screen. Participants were asked to choose the desired headline by clicking on it. There was no time limit; participants could take as much time as they wanted to either surf or search for a headline.

When a participant clicked on a headline, the array of thumbnail pictures disappeared and was replaced by the individual news story related to the headline that the participant had just selected. After reading the story with no time limit, the participant clicked a “continue” button and the page of 20 headlines reappeared. After reading each story, participants rated it using the SAM (Bradley & Lang, 1994) scales for arousal and valence. Participants repeated this task two more times, selecting, reading, and evaluating a total of three stories.

Next, participants participated in an unrelated experiment that served as a distracter task for this study. While participants were involved in the distraction task, the researchers prepared a recognition test from the three news stories that each participant had chosen previously. The recognition test consisted of four multiple-choice questions based on verbatim statements from each story that participants have chosen and read earlier. At the end of the recognition test, the researchers debriefed, thanked, and dismissed the participants. The experiment lasted approximately 50 min.

Physiological Measures

Physiological signals were measured, amplified, and recorded using Coulbourn modules linked to a PC computer. The VPM software program (Cook, Atkinson, & Lang, 1987) coordinated the sampling and storage of physiology data.

Heart Rate

Two 8 mm Ag/AgCl (silver/silver-chloride) electrodes were placed on each participant’s forearms, a few inches above the wrist. The signal was amplified and filtered by a Coulbourn bioamplifier equipped with high- and low-pass filtering. A Schmitt trigger interrupted the PC every time it detected the R-spike of the cardiac wave. Data were initially collected as interbeat intervals, or milliseconds between consecutive R-spike in the QRS complex of the cardiac cycle. Data were then cleaned for movement artifacts and transformed to an average beat per minute value for each second of data collection.

Skin Conductance

Two 8 mm Ag/AgCl electrodes were placed on the palm of each participant’s nondominant hand. The electrodes were attached to a Coulbourn isolated skin conductance coupler. This signal was sampled 20 times per second and converted to conductance values in microsiemens (μS).

Corrugator EMG Activity

Two 4 mm Ag/AgCl electrodes were placed above the left eyebrow of each participant, along the corrugator supercilii
muscle. A Coulbourn bioamplifier amplified the raw signal at 50 kHz and filtered out frequencies below 13 Hz and above 1000 Hz. The signal was sampled 20 times per second and converted to microVolts (μV).

Data Reduction

Response curves were created for all physiological signals by computing change scores across the period when participants read each story. Because of individual differences in reading speed, the time spent reading each article varied across participants. In order to use time as a repeated measure in these analyses, it was necessary to transform these reading periods into uniform lengths. This was done by dividing each reading period into thirds (i.e., beginning, middle, end), then computing the average value for each third. For example, if a participant took 30 s to read a particular story, that period was divided into three equal segments of 10 s each. The average physiological signal during each of those 10-s segments was then computed. Finally, each 10-s average was subtracted from the value taken in the second immediately prior to the appearance of the story.

If the time spent reading a particular story was not divisible by three, remaining seconds were divided among the first two segments. For instance, a 32 s reading period would have been divided into segments of 11, 11, and 10 s. This technique yielded an equal number of segments that allowed repeated measures analyses of physiological data.

Each question on the recognition test was scored as either a 1 (hit) or 0 (miss). Percentage accuracy was computed for each story, then averaged for each participant, then averaged for each manipulation of search type.

Analyses

Heart rate, skin conductance, and corrugator data were analyzed with a 2 (Search Type) × 3 (Repetition) × 4 (Time) repeated-measures analysis of variance (ANOVA). Univariate analyses that violated the assumption of sphericity were adjusted with the Huynh-Feldt degrees of freedom correction. Recognition accuracy and self-report valence ratings were analyzed with a 2 (Search Type) × 3 (Repetition) repeated-measures ANOVA.

Prior to addressing hypotheses, independent samples t-tests were performed to ensure that the stories selected by participants in each group were comparable to one another. Three such analyses were run, one for each repetition. No significant differences emerged, t(91) = −0.64, 1.75, −0.45, respectively, demonstrating that certain stories were not selected with significantly different frequency as a function of search type.

Results

Hypothesis 1 predicted that news stories acquired through searching would elicit greater heart rate acceleration than news stories acquired through surfing. The cubic trend of the Search Type × Time interaction on participants’ heart rate while reading each story approached significance, \( F(1,75) = 3.33, p < .07, \text{partial-} \eta^2 = .04 \). As Figure 2 shows, stories acquired by searching elicited greater cardiac acceleration, indicative of resources allocated to encoding, than stories acquired by surfing. Hypothesis 1 was partially supported.

Hypothesis 2 predicted that details of news stories acquired through searching would be recognized more accurately than details of news stories acquired through surfing. The main effect of search type on recognition accuracy was significant, \( F(1,91) = 4.14, p < .05, \text{partial-} \eta^2 = .04 \). Participants recognized details from stories acquired through searching (\( M = .82, SD = .02 \)) more accurately than they recognized details from stories acquired through surfing (\( M = .76, SD = .02 \)). Hypothesis 2 was supported.
Hypothesis 3 predicted that news stories acquired through searching would elicit greater skin conductance than news stories acquired through surfing. The cubic trend of the Search Type × Time interaction on participants’ skin conductance level while reading each story approached significance, \( F(1, 82) = 3.63, p < .06, \text{partial-}\eta^2 = .04 \). As Figure 3 shows, stories acquired by searching elicited greater skin conductance, indicative of sympathetic activation, than stories acquired by surfing. Hypothesis 3 was partially supported.

Hypothesis 4a predicted that news stories acquired through searching would elicit greater corrugator activation than news stories acquired through surfing. The cubic trend of the Search Type × Time interaction on participants’ corrugator activation while reading each story approached significance, \( F(1, 82) = 3.15, p < .08, \text{partial-}\eta^2 = .04 \). As Figure 4 shows, stories acquired by searching elicited greater corrugator activation, indicative of aversive activation, than stories acquired by surfing. Hypothesis 4a was partially supported.

Hypothesis 4b predicted that news stories acquired through searching would be rated as more unpleasant than news stories acquired through surfing. The main effect of search type on self-reported valence was significant, \( F(1, 91) = 4.11, p < .05, \text{partial-}\eta^2 = .04 \). Participants who searched for stories rated those stories as more unpleasant (\( M = 3.05, SD = .15 \)) than did the participants who surfed for stories (\( M = 3.48, SD = .14 \)). Hypothesis 4b was supported.

Discussion

This paper explored how different ways of acquiring content online, searching and surfing, affect the cognitive and emotional processing of unpleasant online news. These results tentatively support two theoretical conclusions. First, content acquired by searching is more motivationally relevant and elicits more encoding resources than content acquired by surfing. Second, searching for unpleasant content leads to greater aversive activation than surfing does. These conclusions extend theory in a few ways. First, they demonstrate differences in processing text and images, two modes that make up a great deal of online media, and they combine these differences with different ways of acquiring interactive media. They extend the LC4MP by suggesting that different ways of acquiring information may affect aversive and appetitive activation, which are crucial in determining cognitive and emotional outcomes. They also provide further evidence of the importance of distinguishing between “getting there” and “being there” when studying cognitive and emotional responses to interactive media.

The finding that content acquired by searching is more motivationally relevant than content acquired by surfing should come as little surprise. Nonetheless, demonstrating this helps extend understanding of how different ways of getting there affect processing while being there, and how the attributes of different stimuli may affect this relationship. Previous work on how the exertion of control (Wise & Reeves, 2007) and the extent of available choice (Wise & Pepple, 2008) affected picture processing suggested that more effortful ways of getting there led to fewer automatic resources allocated to encoding while being there. However, when the acquisition of content becomes motivationally relevant (because one is searching for something specific), effort in getting there leads to more resources allocated to encoding while being there (Wise & Kim, 2008). Taken together, this suggests that while structural features of interactive media that increase required effort may diminish the allocation of automatic resources when processing pictures, this is trumped by attributes of getting there that increase motivational relevance.

When looking at text, on the other hand, it appears that both structural features that make getting there more effortful (Wise, Bolls, & Schaefer, 2008) and attributes increasing motivational relevance (this study) lead to greater allocation of resources while being there. At this point, it is not clear which structural feature is dominant in terms of encouraging resource allocation. Intuitively it would seem that motivational relevance is more important. Looking at this would require a study in which both required effort and motivational relevance are manipulated and compared directly to one another.

Combined, this research reinforces the importance of looking at different stimulus packages. What does it tell us about pictures and words, perhaps the most prevalent types of content that people encounter on the Web? Obviously pictures and words are different. Pictures require perceptual encoding and little imagery. Words, on the other hand, encourage mental imagery and require more cognitive elaboration. This is the second study to look at the getting there/being there distinction in terms of its effect on processing text news. The first (Wise, Bolls, & Schaefer, 2008) manipulated the number of hyperlink options and, like this study, found that more effortful ways of getting there lead to greater encoding while being there. The authors of that study suggested a “hardwired for news” (Shoemaker, 1996) explanation: When looking at lots of options, it is easier for someone to find an option that is more motivationally relevant, which in turn leads to greater resource allocation.
This study manipulated the search task and looked at its effect on motivational relevance. Both of these studies suggest that effort in acquiring online media may enhance motivational relevance, whether perceived or real.

However, it is possible that imagery processing, along with motivational relevance, is another mechanism at work. It makes sense that a person searching for something specific would have more emotional details accessible at the moment they encounter a news story than would someone who acquires the same story by surfing. Previous research has shown that imagery processing leads to increased heart rate and more resources allocated to encoding while listening to radio commercials (Bolls, 2002), a similar pattern of results to those reported here. It also makes sense that motivationally relevant stimuli would promote more imagery processing: Something that has consequences requires people to imagine ways to approach the good and avoid the bad. Someone standing beneath a tree that is about to fall would be well served to imagine in which direction it might fall and how much ground it will cover so as to get out of the way when it happens. Perhaps the same is true when reading news online. To our knowledge, research comparing the role of motivational relevance and imagery processing in online media has not yet been conducted.

The second theoretical conclusion these data support is that searching for unpleasant online news leads to greater aversive activation than surfing does. Media content that one just wanders upon doesn’t have the same emotional impact as that which one seeks out. Theoretically, this advances the LC4MP by demonstrating how different ways of acquiring information affect aversive and appetitive activation, and how this in turn affects the emotional experience of online news. These data support the possibility that surfing is an inherently appetitive task, which makes theoretical sense given that the appetitive system drives exploration of the environment (Lang, 2006). This was part of the rationale for the hypothesis that unpleasant content would be more emotionally compelling when searched for than when surfed for. It would be interesting to see if the same holds true for pleasant content.

For example, let us say that someone is searching online for a story about his favorite team winning a recent game. Pleasant imagery associated with thoughts of that topic should engage the appetitive system. On the other hand, if the same person comes across the same story while surfing, which was suggested earlier to be an inherently appetitive task, which method of acquiring news leads to the most pleasant emotional experience? In practice, if surfing is inherently appetitive, how might Web advertisers and search engine result sponsors take advantage of this? This is another possible avenue for future research.

These findings also have consequences for those who have promoted the Web’s ability to promote what research in information systems has dubbed the “opportunistic acquisition of information” (i.e., Erdelez, 2005). While it is likely that people do acquire meaningful information when surfing online, these data suggest that short-term encoding and emotional impact of such information may be limited.

These results and the discussion of imagery processing also point out the need for future research on how different attributes of text affect cognitive, affective, and physiological responses to media. Prior research on the psychophysiology of reading is surprisingly thin. Such future research is important for several reasons. One goal of this research was to apply the LC4MP to new media. In spite of the attention given to increased audiovisual capabilities of online media because of stronger processors, faster broadband connections, etc., the fact remains that a great deal of the time that people spend online is time spent reading (Pew Internet and American Life Project, 2007). To the extent that researchers consider online media as relevant to processes and effects research, there is a need for research that explores how the interaction of text, audio, and video affects cognition and emotion.

These data also provide some information concerning the time course of the possible physiological differences between searching and surfing. Inspection of all three figures shows that the difference between searching and surfing was maximized during the first segment, and then merged during the second segment. This suggests that these differences may be short in duration.

There are some limitations to this study. One important limitation is the modest effect sizes found here, especially with regard to the physiological data. All three physiological measures approached but did not surpass the .05 level of significance. Power estimates indicate that lack of statistical power is the likely reason that these data did not surpass the .05 criterion. This is probably a function of the primary variable being manipulated between-subjects rather than within-subjects. Because there are dramatic individual differences in both tonic and phasic psychophysiological reactivity, it is much more advantageous to do within-subjects manipulations when measuring physiological responses. This was not done here because of the nature of this manipulation as well as the limits on the stimulus package. Furthermore, physiological effect sizes are typically small; there are so many sources of variance that it is always hard to attribute a particular response to media features, especially in this case where there was no audiovisual manipulation.

It is possible that the slight difference in corrugator activation between searching and surfing reflected effortful attention rather than emotional experience while reading. Previous research has shown increased corrugator activation with changes in auditory attention (Cohen, Davidson, Senulis, Saron, & Weisman, 1992) and reading (vs. watching) news messages (Ravaja, Saari, Kallinen, & Laarni, 2006). Again, one of the drawbacks in using psychophysiology is that in such an interconnected dynamic system it is often difficult to isolate potential sources of variance in physiological response. Nonetheless, we have self-report unpleasantness data to back up the emotional experience explanation for corrugator; even if the corrugator were entirely attributable to concentration, the self-report data still supports the conclusion that news acquired through searching is more subjectively unpleasant.

Related to this limitation is the possibility that these results merely indicate that people concentrate more on reading information acquired by searching than they do on reading in-
formation acquired by surfing. While this might explain the physiological results, Zajonc (1980) has demonstrated that affective judgments can occur independently of encoding. Therefore, even if people do concentrate more on encoding information acquired through searching, this wouldn’t necessarily explain the differences in both physiological and subjective indicators of unpleasantness. The LC4MP suggests that motivational activation occurs first and dictates both cognitive resource allocation and emotional experience. Based on this suggestion, the hypothesis concerning emotional experience was derived from the idea that aversive activation generated through the process of identifying a mental target for the sake of doing an online search (in this case, an unpleasant one) would contribute to greater subjective unpleasantness, which is exactly what these results demonstrated. This reinforces the utility of the LC4MP in allowing researchers to predict cognitive and emotional outcomes based on the way in which content and structural features affect aversive and appetitive activation, as well as the time course in which these processes occur.

These data were obtained in highly controlled laboratory conditions during a single period of time. Thus, future research is needed to replicate these results in a more natural setting. Another limitation is related to the content employed in this study. Even though reading news stories is a common online activity, technology allows richer content to be experienced online. As mentioned earlier, future research needs to look at the relationship between searching and surfing with different stimuli (i.e., audio, video). The need to explore this relationship with pleasant news was also mentioned earlier. Unpleasant news was chosen, as a starting point, because previous research has shown that combinations of unpleasant news and pictures are more attention grabbing than pleasant news and pictures (Knobloch, Hastall, Zillmann, & Callison, 2003).

Future research should also refine these manipulations of searching and surfing so that they are less constraining. For example, people commonly search for information online by using a search engine and then selecting from a set of options according to how relevant those options are to the information need. Likewise, it could be argued that people surf online as a way of seeking a nonspecific gratification and, in a less constrained environment, may have gone away from the content options offered here. Both searching and surfing were severely constrained in this study in order to allow meaningful comparisons to be made between them. Giving people the opportunity to search for their own topic of interest or surf without any constraints would have introduced all kinds of confounds in terms of the content acquired. The manipulation used here served as a starting point for understanding different ways of acquiring content; the essence of the manipulation was the presence of a mental target in the search condition and the absence of a mental target in the surf condition prior to the onset of an array of options.

In spite of these limitations, these results further demonstrate how looking at the relationship between getting there and being there, combined with the LC4MP, can lead to interesting, albeit preliminary, theoretical conclusions about how people process content online. Clearly, the way in which people acquire content online, along with the structural and content features of Web sites and physical demands of interactive media affect ongoing processing. It is hoped that time and future research will yield additional features that affect this relationship so that these theoretical ideas can be expanded and refined.

References

Bolls, P.D. (2002). I can hear you, but can I see you? The use of visual cognition during exposure to high-imagery radio advertisements. Communication Research, 29, 537–563.


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