THE PSYCHOLOGICAL SIGNIFICANCE OF POP-UP WINDOWS IN ONLINE INFORMATION PROCESSING

A Thesis in
Mass Communication
by
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Abstract

Used by User Interface designers and abused by online advertisers, pop-up windows are one of the most prevalent modalities in computing environments. Most often associated with delivering advertising content (which made them infamous) online, pop-up windows are also common offline where they deliver warnings, alerts, or other system information to computer users. Yet, little is known about how pop-ups affect the processing of information in and around themselves. The present study proposes that three different mechanisms, derived from attentional spotlight, limited capacity, and affect-as-information models, could explain the effects of pop-up presence on the extent and nature of information processing on a Web page. A 2 (same vs. different pop-up location) x 2 (number of pop-ups—one versus three) x 2 (pop-up content—advertisements vs. factoids) factorial experiment was employed to test the above-mentioned mechanisms. Free recall and recognition of the various news stories on the Web pages where pop-ups appeared were used to indicate the extent and nature of information processing. At the same time, facial EMG, skin conductance responses and heart-rate measures were measured in order to assess the attention-getting, interruptive, and annoying nature of pop-up windows that are implied in the three mechanisms. The findings suggest that pop-ups direct users’ attention towards a specific location on the screen, and that information located in their vicinity benefits from this movement of the attentional spotlight. Theoretical and practical implications are discussed.
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Chapter 1

Introduction

Since its inception in 1989, the World Wide Web has changed the entire architecture of the Internet. Not only has it made the Internet an extremely popular medium, but it has also provided it with new affordances. Features such as hypertext and multimodality were introduced, and they are now defining characteristics of the Internet (CBC News Online, 2006; Shannon, n.d.). Recently, new media modalities have received increasing attention from communication scholars as well (Newhagen & Rafaeli, 1996; Sundar, 2000). Social scientists are now attempting to understand the psychological importance of new modalities, especially when they are presented on the web in various combinations (Sundar, 2000). As such, multimodality has become one of the main foci for Internet researchers (Marmolin, 1992; Hoogeveen, 1997; Sundar, 2000). Although the multimodality (multimedia) terminology was initially used to depict audio or video messages accompanying textual information, its definition has now been broadened to include multiple modalities or channels used at the same time in transmitting information (Marmolin, 1992). Since multimodality is therefore seen as a property of the system allowing for an integrated use of multiple perceptual representation media such as speech, music, text, still, graphic, animation, and video (Hoogeveen, 1997), it results that a new modality is a way of delivering information that evokes a different perceptual representation in media users.

Along with audio and video streaming, which are not exclusive characteristics of the Internet, http and html\(^1\) allowed for truly new ways of presenting content over the Internet. One of these new modalities native to the computing environment is the pop-up window. Pop-up windows are specific to computer interfaces, and they are common both offline and online. In both settings, pop-ups consist of secondary windows that are
launched either by the system or by the user, usually on top of the primary window within which the user performs the main task.

In an offline setting, pop-up windows are basic dialogue-type boxes that allow or call for computer-user interactions. Command windows, property windows, error and warning windows, or simply dialogue boxes are examples of pop-ups used in an offline context; they also illustrate the diversity of functions that offline pop-ups perform (de-Baar, Foley, & Mullet, 1992; Kautz, Selman, Coen, Ketchpel, & Ramming, 1994). While maybe still intrusive and interruptive, these types of offline pop-up windows are effective in providing useful information and raising users’ awareness about the current state of the system (Bailey, Konstan, & Carlis, 2000a, 2000b, 2001).

In an online context, pop-ups are either user-initiated via hyperlinks (Betrancourt & Bisseret, 1998) or they are system-initiated in which case they usually take the form of pop-up ads. While the social scientific literature is scarce in terms of pop-up research in general, within the body of literature that does exist, pop-up ads have received most of the attention from both industry researchers and academics (BBC News, 2001; Diao, 2001; Diao & Sundar, 2004; Kyrnin, n.d.; Robinson, 2000; Stavrositu, 2003).

According to Diao and Sundar (2004), a pop-up ad consists of a secondary window that pops up over the main browser window and contains text, graphics, and any other information designed to enhance advertising effectiveness. Moreover, this window that arrives uninvited can jump into sight when one enters a site, browses a site, and sometimes when leaving it (Beard, 2001). Considered initially a magic formula by online advertisers facing an increasing banner blindness phenomenon (Benway & Lane, 1998; Kyrnin, n.d.; Pagendarm & Schaumburg, 2001), they are known to be quite effective in grabbing Web users’ attention (Diao, 2001; Diao & Sundar, 2004). Pop-up ads, for example, have been shown to be more effective than banner ads, having a click-through rate of 6.5%,
compared to a .3% click-through rate for the banner ads (Kyrnin, n.d.). At the same time, users began to react against the exaggerated use of pop-up ads, showing increasing signs of frustration and annoyance (BBC News, 2001; Best, 2004; Edwards, Li, & Lee, 2002; Robinson, 2000). Quite intriguingly, a similar effect is assumed to accompany the onset of an offline pop-up window – although considered to carry a high information value, such pop-up windows are also thought to be intrusive and annoying (Bailey et al., 2000a, 2000b, 2001). In the online context, the intensified user reactance to pop-ups raised the concerns of Web designers and providers so much that ISPs such as Earthlink and search engines such as Google have completely banned pop-up ads (Olsen, 2002; Parker, 2003), whereas browser developers such as Microsoft, Netscape, or Mozilla felt compelled to design pop-up blockers.

The assumption that industry leaders such as Earthlink, Google, Microsoft, or Netscape are making when banning or blocking pop-up ads is that associating their sites or browsers with pop-ups will have a boomerang effect and will come to negatively impact users’ perceptions and attitudes towards their own websites or browsers. A handful of researchers have studied this issue and showed that, to a certain extent, pop-up ads negatively influence website credibility (Edwards, Li, & Lee, 2002; Fogg et al., 2002; Stavrositu, 2003). While the type of perceptions and attitudes users develop towards websites hosting pop-up ads is a real concern, there is virtually no research looking at how pop-up windows influence the processing of information on the hosting site. Moreover, the psychological mechanisms underlying the users’ reactions to pop-up windows are not well understood. On the one hand, users’ increased reactance against the pop-ups would suggest a psychological transfer of affect generated by content to the modality itself. That is, just because advertisers have overused this technology, the pop-up window as a modality is viewed in a negative light. On the other hand, it might be that the pop-up is
viewed with disdain because of its action, not because of its content. As mentioned above, Bailey et al. (2000a, 2000b, 2001) have shown that even offline pop-up windows – those that carry information by way of error messages and dialog boxes – are considered by users to be intrusive and annoying.

In summary, the intrusiveness of pop-up windows is met with such strong psychological reactance precisely because it is so effective in hijacking user attention. However, it is unclear exactly how this attention is disbursed once it is captured by the arrival of pop-ups on the screen. The current study was designed to answer this question by exploring how users process pop-ups and how pop-up processing affects their concurrent computing activities. It is proposed here that the arrival of a pop-up window on the computer screen impacts the processing of information displayed not only in, but also around the pop-up. The sudden onset of a pop-up window, for example, could induce a shift of attention toward the pop-up and away from other information displayed on the screen. This attentional shift could also help in redirecting users’ attention to the content surrounding the pop-up. At the same time, pop-up windows might influence the extent and nature of information intake only indirectly, via the negative affect they elicit in users. Therefore, three mechanisms must be considered when examining the role of pop-ups in information processing: 1) an attentional spotlight mechanism, 2) a cognitive load mechanism, and 3) an affective bias mechanism. An extensive discussion of these three mechanisms in the context of their associated theoretical arguments is presented in Chapter 2. Prior to delineating these mechanisms, one must establish whether the underlying assumptions are met. Both the attentional spotlight and the cognitive load mechanisms rely on pop-ups’ ability to attract involuntary attention, whereas the affective bias mechanism implies that pop-up windows elicit negative affect. Thus, theoretical
arguments for the corresponding assumption precede the discussion of each mechanism in Chapter 2.

The third chapter presents the methods used to test the proposed hypotheses. This chapter reviews the procedures and results of a pretest, and includes detailed descriptions of the experimental design, stimulus material, independent and dependent variables, and experimental procedures. The fourth chapter presents the results of the experiment and indicates which hypotheses were supported by empirical data and which ones were not. The last chapter discusses the theoretical and practical implications of the findings, outlines the limitations of the current study, and suggests directions for further research.
Chapter 2

Literature Review

Pop-up windows are said to attract attention in an automatic manner (Diao & Sundar, 2004) and thus increase users’ awareness of the information they deliver (Bailey et al., 2000b). Pop-ups are also perceived as interruptions, making ongoing tasks difficult to complete (Bailey et al., 2001). Moreover, their interruptive effect has consequences not only for task performance, but also for users’ emotional states, by eliciting frustration, annoyance, and anxiety (Li, Edwards, & Lee, 2002). At the same time, it is argued that pop-ups’ potential to orient attention, interrupt, and elicit negative affect impacts further information intake. There is a possibility that overt orientation toward a pop-up may increase attention paid to a location on the screen and therefore increase processing of information located in its vicinity. Conversely, the attentional and cognitive load may be substantially hyphened by the appearance of a pop-up window, leading to a decline in information processing. A third possibility is that the negative affect elicited by pop-up occurrences may change the nature rather than the extent of processing by orienting attention more toward details and less toward general information. Justification for these mechanisms comes from various theories in visual cognition, social psychology, and human-computer interaction, including selective attention, limited capacity, and affect-as-information models. Each theoretical argument is detailed in the following sections. First, selective attention theories are used to explain pop-ups’ ability to attract attention. The orienting potential of pop-up windows constitutes the main assumption for both the attentional spotlight and the cognitive load mechanism. Second, the first mechanism – attentional spotlight – is described. Space-based models of attention, and in particular attentional spotlight models, indicate how shifts in attentional focus are based on pop-up locations and argue that information positioned in and around the pop-ups is processed
more efficiently. Third, the cognitive load mechanism is explained. Selective attention and limited capacity theory are used to predict an attentional shift toward the pop-up and away from other information displayed on the screen. Fourth, the frustrating nature of pop-up windows finds justification in their interruptive nature. This constitutes a necessary assumption for the affective bias mechanism. Lastly, the affective bias mechanism is described in the context of user frustration. The build-and-broaden and the affect-as-information models propose that pop-up-induced negative affect could change the nature of information processing by narrowing the scope of attention and emphasizing a focus on details over the big picture.

1. Do Pop-Up Windows Elicit Orienting Responses?

Establishing that pop-up windows trigger reflexive orientation is an essential assumption for both the attentional spotlight and the cognitive load mechanisms. Fortunately, previous research suggests that pop-ups do elicit strong orienting responses (Diao, 2001; Diao & Sundar, 2004) and thus they are very effective in increasing information awareness in users (Bailey et al., 2000a, 2000b, 2001). According to Diao and Sundar (2004), for example, the appearance of a pop-up window creates a sudden change in the visual field, leading to the visual sensation of an unexpected stimulus. Following their argumentation, the effect of such a visual change can be explained by several theories, most notably visual attention theories regarding selective attention processes (Diao, 2001; Diao & Sundar, 2004). It is assumed that the human visual system can process only a limited amount of information and that selection processes are needed to order and systematize external information for processing purposes. It is also argued that whereas some of the attentional selectivity is based on voluntary decisions, external stimuli can attract and re-orient humans’ attention as well. Exogenous cues such as
novelty or sudden onsets, for example, are stimulus characteristics commonly associated with orienting responses. The next three sub-sections offer a more detailed overview of selective attention theories, which provide a substantive basis for understanding the orienting potential of pop-up windows. A fourth subsection follows with applying these theories to the case of pop-up windows, and proposes that both the onset and the offset of pop-ups elicit orienting responses.

Selective Attention and Capacity Limitations

It is generally accepted among information processing theorists that the human visual information-processing system has severe capacity limitations (Averbach & Coriell, 1961; Broadbent, 1971; Bundesen, 1990; Folk & Egeth, 1989; Kahneman, 1973; Neisser, 1967; Sperling, 1960; Theeuwes, 1993; Treisman, 1988; Treisman & Gelade, 1980; Van der Heijden, 1992, 1996). Consequently, it is suggested that not all the available visual information gets processed. Instead, the visual scene is subject to filtering processes that allow significant information to be selected, while eliminating irrelevant information.

Broadly speaking, selective attention refers to the visual system’s tendency of focusing on some information, while ignoring others, regardless of how the attention has been drawn to that particular piece of information. It has been argued that in order “[t]o produce coherent and pertinent behavior in the face of competing and distracting sources of stimulation in the environment, some things must be selected and others ignored” (Johnson & Proctor, 2004, p.57). For this to happen, focus and concentration are needed and thus considered to be the essence of attention (James, 1890/1950, as cited in Johnson & Proctor, 2004, p. 57). However, despite the broad consensus of visual processing researchers on the ubiquitous nature of attentional selectivity, the locus and functions of selectivity remain controversial topics. As Johnson and Proctor (2004) point out,
sometimes selection seems to occur at an early, perceptual stage of processing, with some stimuli being processed and others ignored, whereas at other times selection seems to occur only after perceived information has achieved a certain degree of semantic processing, with stimuli that should have been otherwise ignored having a significant impact on performance.

In spite of the differing points of view regarding the locus of information filtering (i.e., whether selection happens before or after stimulus perception) or the actual role of a pre-attentive stage in visual processing (Folk & Egeth, 1989; Treisman & Gelade, 1980; Van der Heijden, 1992, 1996), most theorists do agree that the human visual system has severe attentional, if not processing, limitations (Averbach & Coriell, 1961; Broadbent, 1971; Bundesen, 1990; Kahneman, 1973; Neisser, 1967; Sperling, 1960; Theeuwes, 1993; Treisman, 1988). Consequently, it seems reasonable to assume that 1) not all the visual information available in the world is processed, and 2) selection is necessary, and attention plays a key role in this process.

**Voluntary versus Involuntary Attention**

Traditionally, attention is thought to be directed by individual goals and motivations and by external stimulation. Following this distinction, shifts in visual attention are often described as either goal-directed or stimulus-driven (James, 1950/1891; Franconeri & Simons, 2003). Goal-directed shifts are those attentional shifts generated voluntarily and “based on an observer’s beliefs about the best place or attributes to attend” (Franconeri & Simons, 2003, p. 999). Voluntary attention, also known as endogenous orientation (Johnson & Procter, 2004), is thus based on factors within the observer. As applied to online contexts, for example, voluntary attention refers to information Web users choose to attend and it usually reflects task demands in experimental studies.
In contrast to goal-directed attentional shifts, stimulus-driven shifts “are independent of explicit goals and beliefs” (Franconeri & Simons, 2003, p. 999). These shifts are entirely reflexive and are often called exogenous orientation, indicating that they are driven by external stimuli and not by users’ goals and beliefs. However, not all external stimuli attract involuntary attention; those stimuli that do elicit reflexive orientation have certain attributes often referred to as exogenous cues. Consequently, exogenous orienting is described as being under stimulus control such that orienting occurs reflexively in response to the onset of an exogenous cue (Johnson & Proctor, 2004).

**Exogenous Cues and Involuntary Attention**

Several types of dynamic cues (e.g. abrupt onsets, motion) have been shown to act as exogenous cues and draw involuntary attention in visual search tasks even when they are irrelevant to the task at hand (Ben-Shakhar & Gati, 1987; Ben-Shakhar, Gati, & Salamon, 1995; Franconeri, & Simons, 2003; Franconeri, Simons, & Junge, 2004). For example, cues such as loud sounds, suddenly appearing bright lights, or changes in contours and movements in the peripheral visual field that are not predictable occurrences have been all identified as triggers of reflexive orientation (Coren, Ward, & Enns, 1994). In addition to loud sounds and changes in the peripheral visual field, numerous media stimuli such as scene changes, cuts, edits, movement, and commercial onsets during television viewing (A. Lang, 1990; Reeves & Nass, 1996), low-intensity sounds (Turpin & Siddle, 1983), sudden sounds or sound changes (Potter, 2000, 2006) have been linked to orienting responses as well.
**Sudden or Unexpected Events.** Unexpected events have also been said to trigger similar exogenous cueing, as they prompt a reaction of reflexive orientation to the surprising or newly appearing stimuli (Seligman & Yellen, 1987). Moreover, not only an unexpected event, but also a sudden one is said to elicit same-type reactions. Supporting this assertion, visual attention theory claims that the abrupt onset of a visual stimulus elicits involuntary attention (Jonides & Yantis, 1988; Nakayama & Mackeben, 1989). In an adaptive sense, both sudden and unexpected changes in the visual field have been argued to capture one’s involuntary attention for the sole purpose of stimulus identification (A. Lang, 2000; Sokolov, 1963). Yantis and Jonides, for example, have showed that the abrupt appearance of a stimulus in the visual field captures one’s attention and gives that stimulus an advantage in terms of how quickly or accurately it can be responded to (Yantis & Jonides, 1984; Jonides & Yantis, 1988). Extensive research in psychology and neuropsychology provided support for the idea that stimuli with abrupt visual onsets capture involuntary attention, that is, in a stimulus driven manner (Gibson & Kelsey, 1998; Jonides, 1981; Jonides & Yantis, 1988; Lambert, Spencer, & Mohindra, 1987; Muller & Rabbitt, 1989; Nakayama & Mackeben, 1989; Yantis & Hillstrom, 1994; Yantis & Johnson, 1990; Yantis & Jones, 1991; Yantis & Jonides, 1984, 1990, 1996). Similarly, a variety of behaviors associated with orienting responses were shown to follow a sudden event, such as postural adjustments, skin conductance changes, pupil dilation, decrease in heart rate, a pause in breathing, and constriction of the peripheral blood vessels (Rohrbaugh, 1984).

**Visual Changes and Novelty.** Along with sudden and unexpected events, other cues are also said to attract involuntary attention, such as novelty and significance (Gati & Ben-Shakhar, 1990), or motion and animation (Reeves & Nass, 1996; Borse & A. Lang, 2000). Among those, novelty has received considerable attention and has been extensively
documented as a trigger of reflexive orientation. Generally, novel stimuli have been conceptualized as a “change or an unexpected occurrence in the environment” (A. Lang, 2000, p. 49). In this respect, novelty is a relative term since a novel stimulus can be novel or unexpected in relation to the context in which it appears. At the same time, the novelty of a stimulus can be due to a variety of factors, including its structural features (e.g., physical attributes, a 3D object for someone who never saw 3D models previously or a 3D object imposed over a 2D background), its physical location, or abrupt onset.

Furthermore, various theoretical approaches maintain that novelty or relative changes in the visual field trigger significant orienting responses. The limited capacity model of mediated message processing (A. Lang, 2000; A. Lang, Borse, Wise, & David, 2002), for example, posits that novel stimuli are one of the sources of automatic selection processes that lead to encoding of information. Consequently, the automatic response towards novel stimuli is manifested through orienting responses (OR), which are associated with a host of psycho-physiological and behavioral reactions such as increases in skin conductance and decreases in heart rates that have been long used as measures of attention and stimulus intake (A. Lang, 2000; A. Lang et al., 2002). Novel stimuli have also been found to attract attention by distracting an individual’s self focus away from an internal state, thus increasing attention toward the environment (Carver & Scheier, 1981). The shift in focus to the environment marks the first step necessary in stimulus processing. Additionally, previous research supports the idea that novel stimuli elicit and enhance a person’s exploratory behavior (Spielberger & Starr, 1994). Along the same lines, novelty represents situation interest as well, and the argument has been made that, as the visual system is designed to attend to something, in the absence of an object of attention it becomes sensitive to new events (Coren et al., 1994).
**Pop-up Windows and Involuntary Attention**

In the case of online stimuli, research has been focused almost entirely on stimulus-driven attention, whereas goal-directed attention has been attributed to either Web user characteristics or task demands. Moreover, a special consideration has been given to stimulus characteristics that attract (involuntary) attention, and to the involuntary attention itself, along with cognitive, affective, and physiological reactions following this allocation of attention. Thus, warnings and animated banner advertisements (A. Lang et al., 2002), as well as pop-up advertisements (Diao, 2001; Diao & Sundar, 2004), have been shown to elicit cardiac responses associated with reflexive orientation.

To justify this effect in the case of pop-ups, some of the exogenous cues associated with orienting responses (ORs) in other contexts have been also attributed to pop-up appearances. Thus, it is argued that pop-up windows appear suddenly and most likely in the periphery of the visual field. Their sudden onset is presumed to prompt a change in the visual domain and is regarded as a novel and unexpected stimulus that elicits automatic orientation. Worth noting here is that stimulus novelty in the case of pop-up windows has been defined as changes in object characteristics relative to previously seen objects, which is consistent with a novelty-as-change approach (Diao, 2001; Diao & Sundar, 2004; Gati, Ben-Shakhar, & Avni-Liberty, 1996; Ben-Shakhar, 1994). Following this definition, pop-up occurrences can be regarded as novel stimuli despite users’ exposure to pop-up windows during previous Web visits.

All the aforementioned characteristics of pop-ups windows (triggered changes within the visual field, novelty, un-expectancy) offer a compelling argument for the idea that pop-up windows attract involuntary attention. It is thus proposed, in accordance with previous research, that the appearance of pop-up windows would trigger orientation:

*H1a: The onset of pop-ups will elicit orienting responses.*
In addition, Theeuwes (1991) found that not only stimulus onset, but also stimulus offsets could attract attention. Although he initially suggested that the attention-grabbing effect of abrupt onsets or offsets may be due to changes in luminance that visual stimuli create, it has been later shown that when sudden, not only the offset of a light but also that of a sound that has been on continuously can elicit an orienting reflex as well (Coren et al., 1994). It is thus reasonable to believe that a sudden change in the visual field will follow not only the onset, but also the offset of a pop-up window:

\[ H1b: \text{The offset of pop-ups will elicit orienting responses.} \]

2. **Mechanism 1: The Attentional Spotlight**

   Even though there seems to be strong evidence suggesting that pop-up windows elicit orientation, one has to wonder whether computer users would attend to them overtly or not. It is thus important to make the distinction here between overt and covert orienting reflexes (Coren et al., 1994; Johnson & Proctor, 2004). While both are stimulus-driven or reflexive shifts in attention, overt orientation reflects changes in the positioning of the senses to improve the perception of a stimulus object (e.g., by making head or eye movements), whereas covert orientation allows attention to be directed to a location other than the focus of the eyes (Johnson & Proctor, 2004). One can thus argue that overt orientation might have more durable implications for task performance.

   Although there is no direct physiological evidence in this sense, pop-up windows seem likely to elicit overt orientation given the high reported level of intrusiveness and their interrupting potential (Bailey et al., 2000b, 2001; Chan, Dodd, & Stevens, 2004; Edwards et al., 2002; McCoy, Everard, Galletta, & Polak, 2004). Besides, stimuli that appear suddenly in the visual scene – as pop-ups are said to do (Diao, 2001; Diao &
Sundar, 2004) – tend to attract reflexive (i.e., uncontrolled) eye movements indicating overt orientation towards the location of the stimulus (Posner, 1978; Van der Lubbe, Keus, & Stoffels, 1996).

Therefore, if pop-up windows elicit overt orientation, it then follows that the visual focus of computer users will be directed towards the location of pop-ups on the screen. In this event, “space-based” models of attention (Johnson & Proctor, 2004) could explain the impact of pop-up windows on the processing of website information.

The space-based models have also been called spotlight models of attention (Posner, 1980), since it is proposed that an attentional spotlight exists based on the location of the stimulus, and a spatial gradient surrounds the attended locations such that stimuli closer to the focus of attention are processed more efficiently than those farther away (Yantis, 2000). Connected to this model, two types of cues are hypothesized to trigger movement of attentional spotlights to a location, with different consequences on processing level – endogenous cues responsible for triggering voluntary attention and exogenous cues that trigger involuntary attentional shifts. Furthermore, the exogenous cues are external events such as the abrupt onset of a stimulus at a peripheral location that involuntarily draws the spotlight to its location, while the endogenous cues are typically mental symbols that must be identified in order for a voluntary shift in attention to the designated location to be made (Klein & Shore, 2000; Johnson & Proctor, 2004). It is also argued that exogenous cues produce rapid performance benefits that dissipate quickly, while the benefits of endogenous cues take longer to develop but are sustained for longer periods of time and thus indicate a conscious control over the attentional spotlight (Johnson & Proctor, 2004).

Visual attention research has extensively documented the predominance of space-based attention. Thus, using precues that directed participants’ attention to a specific
location, Posner (1980) and Theeuwes (1989) showed that the reaction time needed to perform stimuli discrimination or identification tasks was lower when the target was presented in the same location as the precues. As such, stimuli that appear in the visual focus are processed more rapidly. Moreover, Tsal and Lamy (2000) have recently argued that attending to a non-spatial feature of an object (e.g., its color) implies that its location is also selected. Based on this type of evidence, some visual processing theorists proposed that spatial position has a special role in visual selection (see also Van der Heijden, 1993). In other words, attention seems to function within a spatial representation of the visual space. This in fact would not be surprising, as attention is generally oriented to a location within the visual field.

Additional support for a location-based model of attention comes from neuropsychological studies. Using fMRI, several researchers have confirmed that visual attention directed to a specific location within the visual field results in increased brain activation in portions of the visual cortex corresponding to the neural representations of those locations as indicated by retinotopic coordinates (Brefczynski & DeYoe, 1999; Somers, Dale, Seiffert, & Tootell, 1999; DeYoe & Brefczynski, 2005). The average topography is also consistent with a gradient model of attention, indicating gradient-type activation in attentional field maps (Downing & Pinker, 1985).

If identifying objects does entail their location, then web users’ automatic orientation towards pop-up windows will result in users’ attentional focus being directed to the location on the screen where the pop-up window appears. Following this shift, the website information appearing in the attentional spotlight (the information surrounding the pop-up or under the pop-up once the pop-up window is closed) is likely to be processed more efficiently, as attended stimuli are detected more accurately, and are better remembered than unattended stimuli (Hillyard & Hansen, 1986). Thus,
**H2: Significant location-specific recall and recognition is expected based on attentional spotlight mechanisms, with higher recall and recognition for website information positioned near the pop-ups on the screen compared to information positioned away from the pop-ups.**

**Is The Attentional Spotlight A Novelty or A Structural Effect?**

Previous arguments suggest that pop-up windows impact memory for Web page information by moving the focus of attention to the location of pop-ups on the screen. The extent to which the impact of pop-up windows on memory is a lasting phenomenon, however, is dependent on the attribute considered responsible for triggering orienting responses, and thus for moving one’s attentional spotlight to a given location within the visual field. Following an earlier argument, pop-ups may attract reflexive orientation given their novelty relative to the previous visual scene. In this case, visual attention theories would predict that repeated exposure to pop-ups would be accompanied by a gradual decline in reflexive orientation. In other words, a novel stimulus is subject to habituation processes and, as a result, memory for focal information is expected to decline for future Web page – pop-up instantiations. On the other hand, it is possible that pop-up windows elicit orienting responses given structural features such as abrupt onset or sudden appearance on the screen. In this event, it is likely that pop-up windows elicit constant orientation without habituating, such that memory for focal information does not decrease over time. Both mechanisms are reviewed in the following sections, and two alternative hypotheses based on novelty versus structural effects are then proposed. It is argued that novelty is subject to habituation, whereas structural features are not.
Novelty. As previously suggested, pop-up windows may attract one’s attention because they are novel; that is, they introduce a significant change in one’s visual environment. It has been argued that changes in the visual space elicited by pop-up windows (Diao, 2001; Diao & Sundar, 2004) prompt pop-ups to behave as novel stimuli and consequently induce reflexive orientation toward the location of the stimulus.

At a general level, the ability to detect novelty is a fundamental characteristic of all mammalian nervous systems (Sokolov, 1963), and it plays a critical role in memory in the sense that items that are novel, or distinctive, are remembered better than those that are less distinct (e.g., Hunt, 1995; Kinsbourne & George, 1974; Parker, Wilding, & Ackerman, 1998; Tulving & Kroll, 1995; von Restorff, 1933; Wallace, 1965). Novel stimuli have been conceptualized as a “change or an unexpected occurrence in the environment” (A. Lang, 2000, p. 49). It then follows that novelty is a relative term since a stimulus can be novel in relation to the context in which it appears. This concept of novelty-change was originally introduced by Pavlov (1927) when describing the orienting reflex as the reflex that brings about an immediate response to the slightest change in the environment. Extensive research has been conducted on the basis of this conceptualization of novelty, producing both confirmatory (Corman, 1967; Zimny & Schwabe, 1965) and discrepant results (Barry, 1982; Furedy, 1968). Thus, some researchers have failed to observe an orienting response (OR) following a change in the order of stimulus presentation (Furedy, 1968), or following an unexpected occurrence inserted within a series of similar stimuli (Zimny, Pawtick, & Saur, 1969). Other researchers have obtained significant orienting responses to a stimulus change only across but not within stimulus modality (Houck & Mefferd, 1969). More recently Sanocki and Sellers (2001) have found that when eyes and attention are allowed to shift towards a newly appearing object, the success of the object identification depends on the properties of the object. While new
object occurrences have been traditionally associated with automatic orientation directed to the object location (e.g., Hillstrom & Yantis, 1994; Theeuwes, Kramer, Hahn, & Irwin, 1998; Yantis & Hillstrom, 1994; Yantis & Jonides, 1984), Sanocki and Sellers argue that not all newly appearing objects will trigger successful shifts in attention. Following their reasoning, the ability of an object to trigger an attentional shift, and the success of the shift itself, may vary with properties of the stimulus object.

As expected as a result of these empirically documented discrepancies, Pavlov’s approach has raised controversies, mainly revolving around the necessary and sufficient conditions for orientation. The conventional interpretation of Pavlov's (1927) and Sokolov's (1963) conceptualizations is that any perceived change in stimulation is sufficient to produce an orientating reaction. In light of mixed evidence, however, some argue that a constant orientation to change is unlikely especially given the great variability of the natural environment; a mechanism that produces an orientation to the slightest change in the environment would certainly not be functional (Gati & Ben-Shakhar, 1990).

The previous body of literature on novelty-change and the resulting orientation hardly helps in settling this dispute, as most research involving novel stimuli or novelty effects makes use of extreme stimuli, which are very dissimilar to stimuli preceding them, and thus easily identifiable. In these extreme cases, novel stimuli have been showed to attract attention; in other cases, however, the strength and length of novelty effects are widely disputed.

*Habituation.* Even when novel stimuli are shown to elicit reflexive orientation, the response seems to wear off over time or with repeated exposure to similar objects (Ben-Shakhar & Lieblich, 1982; Connolly & Frith, 1978; Houck & Mefferd, 1969). Some researchers indicated habituation processes as responsible for inconsistent or fading
effects of novel objects. According to this argument, the visual system is designed to attend to something and, in the absence of an object of attention, it becomes sensitive to new events. However, attending to a new stimulus involves an update of the model of the world that someone has; if the same stimulus appears repeatedly, it becomes an expected part of one’s model of the world and thus one’s orienting reflex becomes weaker, even if the stimulus is quite strong (Coren et al., 1994). In this context, novelty has been usually contrasted with a habituation of responses. It has been further suggested that repeated presentations of a given stimulus result in an internal representation of that stimulus (Sokolov, 1963). This representation, called “neuronal model” by Sokolov, contains the parameters or attributes of the stimulus. All incoming information is then compared with the existing neuronal models and a discrepancy between a new stimulus input and the current models will result in reflexive orientation. At the same time, if the input matched the existing models, the orienting reflex would be inhibited (Sokolov, 1963).

As mere changes in the environment were shown not to be sufficient for arousing reflexive orientation (Furedy, 1968; Zimny, Pawtick, & Saur, 1969), some have suggested that habituation of responses applies not only to individual objects but also to entire classes or categories of objects. The term generalization of habituation was thus proposed to indicate that habituation processes may generalize across a whole set of stimuli belonging to a given category (Ben-Shakhar & Lieblich, 1982; Connolly & Frith, 1978; Houck & Mefferd, 1969; Mino & Miyata, 1975). The concept of generalization of habituation implies that neuronal models may represent stimulus categories rather than individual stimuli; according to this approach, a stimulus change within a given category would not be expected to produce reflexive orientation.

The effect of novel stimuli on mental models has also been studied in the context of web objects, where it is said to rely on schema violation effects. As most cognitive
psychology theories, especially since priming and dual process theories, this approach adopts the belief that people are cognitive misers and use shortcuts in developing judgments and evaluations. Humans are assumed to oftentimes use categorical scripts to interpret the world. New information is processed according to how it fits into these scripts, called schemas (Bartlett, 1932). Schemas can then be used to predict a new situation occurring in a familiar environment. In this sense, Internet users form a schema as to how a website or web page is typically organized (Bernard, 2001, 2002). At the same time, when a novel and surprising stimulus is presented, a violation of the existent schema is likely to occur. The consequent mental processes would most likely try to reconcile the new information with the old schemas, resulting in Web users either ignoring the new information, re-categorizing it so that it fits the old schemas, revising the existing schemas so that they could include the new information, or accepting contradicting information.

A similar attempt at explaining the effects of unexpected or novel stimuli was made by Reisenzein, Meyer, and Schutzwohl (1996), who proposed a “cognitive psycho-evolutionary model” of the mental and behavioral processes elicited by surprise events. Within the limits of the model, it is assumed that surprise-eliciting events initiate a series of mental processes that begin with the appraisal of a cognized event as exceeding some threshold value of schema-discrepancy (or unexpectedness), continue with the occurrence of a surprise experience and, simultaneously, the interruption of ongoing information processing and the reallocation of processing resources to the schema-discrepant event, and culminate in an analysis and evaluation of the event plus - if deemed necessary - an updating, extension, or revision of the relevant schema. Depending on which of these processes occur (i.e., formation or new schemas, re-categorization of new information to fit the old schemas, etc.), the effects of novel and surprising stimuli are expected to decrease over time, resulting in either novelty (when responses are believed to disappear
immediately after the initial stimulus exposure) or habituation effects (when responses are
believed to slowly decrease over time).

Whether it applies to individual or categories of stimuli, visual habituation is
nonetheless among the most widely used paradigms in the study of attention, perception,
and cognition in humans. According to this view, repetitive stimulus presentations are
made with the expectation that the individual’s attentional responses will decline in
strength across multiple presentations. Therefore, habituation has been generally defined
as the decrease in response strength due to repeated exposure to a particular stimulus or
category of stimuli. This decline in attention has been theoretically attributed to cognitive
processes that involve the formation of an “engram,” or internal representation of the
stimulus, and the continuing revision of that engram that occurs when the engram is
compared with subsequent instantiations of the actual stimulus itself (Sokolov, 1963).

The declining interest in previously presented stimuli has been mostly studied
relative to the orienting response elicited by the stimulus in question. As suggested by
previous research in visual processing, this reaction is widely spread across a variety of
visual stimuli, and can be operationally defined as any response that (1) is elicited by
novel stimuli of any modality, and (2) decreases in intensity upon stimulus repetition. The
former part of the definition makes clear that the orienting reaction is directed toward
novelty and thus plays an important role in the exploration of the environment. The latter
part describes the connection between the orienting reaction and habituation: each time a
novel stimulus is presented, the orienting response will become weaker (Wang, 1995).
This could result from an increased threshold for response generation or put another way,
decreased sensitivity to the eliciting stimulus. Habituation thus occurs when a stimulus is
entirely expected in terms of previous events (Balkenius, 2000).
Visual habituation processes have been widely documented via psycho-physiological responses. Gati and Ben-Shakhar (1990), for example, showed that responsivity as measured through skin responses is negatively related to the similarity between the input and the preceding stimuli. In other words, habituation is likely to occur in terms of physiological reactions when a new stimulus is presented repeatedly. The same has been observed in terms of EEG and heart rate changes (Siddle, Stephenson, & Spinks, 1983).

In keeping with these arguments, if pop-up windows were to elicit overt orientation due merely to their novelty attribute, it would be expected for these effects to decrease with repeated exposure to pop-ups. Hence,

\[ H3a: \text{If pop-ups elicit overt orientation due to their novelty, a significant decline in location-specific recall and recognition will be expected following multiple exposures to pop-up windows.} \]

**Structural Effects.** Although stimulus novelty has been systematically associated with habituation, several other cues evoking ORs such as motion and abrupt onsets lead to constant orienting without habituation (Borse & A. Lang, 2000; Reeves & Nass, 1996). One argument favoring the continuous effects of animated online stimuli, for instance, is rooted on motion perception theories. A general assumption of this approach is that humans have embedded an inherent predisposition toward moving objects. Humans perceive motion, in an adaptive sense, as either a threat or opportunity (Reeves & Nass, 1996), and thus tend to orient immediately to the source of motion. An abrupt onset may also fulfill a similar adaptive function. Justification for this argument comes from communication research, which indicates a constant association between orienting
responses from TV viewers and the presence of cuts, edits, and movement in television commercials (Reeves et al., 1985).

Following this line of reasoning, if the orienting response elicited by pop-up windows were due merely to their abrupt onset instead of their relative novelty, then responses to pop-pus would not habituate over multiple exposures. Therefore:

\textit{H3b: If pop-ups elicit overt orientation due to their structural features, no significant decline in location-specific recall and recognition will follow after multiple exposures to pop-up windows.}

3. \textit{Mechanism 3: - The Attentional and Cognitive Load}

It is argued here that pop-up windows might attract users’ attention toward themselves and away from concurrent Internet activities. For this to be possible, pop-up windows have to elicit orienting responses, and also to interrupt Web activities. The orienting ability of pop-up windows has been described previously. The following section follows by explaining the interruptive nature of pop-ups and its influence on information processing via cognitive load.

\textit{Pop-ups as Interruptions}

It has been argued that forced exposure to pop-up windows in an online context has a negative impact on web users’ cognitive processing (Bailey et al., 2000b, 2001; Chan et al., 2004; Edwards et al., 2002; McCoy et al., 2004). Pop-up messages, for example, are often said to interfere with the user’s experience on the hosting site as they block visibility of part of the page (Moe, 2006). As such, pop-up windows interrupt a Web user’s browsing and interfere with his or her goals (Edwards et al., 2002). Since they
interfere with web users’ primary tasks, they are an unwanted interruption (Chan et al., 2004) and require more attention and effort (McCoy et al., 2004).

Within this context, pop-up windows are often conceptualized as interruptions. Interruptions have been defined as “an externally generated randomly occurring, discrete event[s] that break[s] continuity of cognitive focus on a primary task” (Coraggio, 1990, p. 12). Research in psychology and human-computer interaction has shown that interruptions have a moderating impact on cognitive processes (Xia & Sudharshan, 2002). For example, it has been argued that they increase frustration and, subsequently, lead to inconsistent performance (Baron, Baron, & Miller, 1973), or that they increase the time necessary to perform the primary task as extra time is necessary to backtrack and recover from the interruptions (Laird, Laird, & Fruehling, 1983). At the same time, it has been suggested that interruptions are severe attentional distractions and that they place greater demands on cognitive processing resources than the available capacity can handle (Normon & Bobrow, 1975). It has also been suggested that these interruption effects are due to the way thinking progresses. Thus, thinking spreads along associative networks or established pathways that exist between related thoughts. If the information is presented in an order that replicates the way in which the information is linked in memory, then processing is somewhat effortless. However, when unexpected information (e.g., pop-up interruptions) that does not have links to the preceding information is introduced, thinking becomes more difficult (Geiger & Reeves, 1993; Reeves & Nass, 1996).

Supporting this assumption, previous research has indicated that interruptions have disruptive effects on task performance, with users performing slower on an interrupted compared to a non-interrupted task (Bailey et al., 2000b) or perceiving an interrupted task to be more difficult to complete than a non-interrupted task (Bailey et al., 2001). Tasks are also found to take longer to process and return back to after an interruption, especially
when the interruption is unrelated to the task at hand (Cutrell, Czerwinski, & Horvitz, 2001; Reeves & Nass, 1996). The added memory load seems to make a task difficult to resume and one might find it particularly hard to remember what task-related information was being processed prior to the interruption (Burmistrov & Leonova, 1996; Dix, Ramduny, & Wilkinson, 1995). Consequently, it has been argued that the significant degradation in task performance may be due to the cognitive load imposed by task re-orientation after an interruption (Altmann & Trafton, 2002; Burmistrov & Leonova, 2003; Edwards & Gronlund, 1998). And since pop-up windows have been attributed with a high interruptive potential (Edwards at al., 2002; Xia & Sudharshan, 2002), it seems plausible for them to create an attention overload and thus make other Web activities difficult to resume. Moreover, as mentioned above, the attentional overload is likely to significantly affect task performance by moving one’s attention away from the task and making the return to the task difficult and effortful. In this context, attentional and cognitive load theories provide a substantive theoretical basis for understanding the distracting potential of pop-up windows relative to other information intake. The following two sections review the limited capacity approach as it refers to both attentional and cognitive limitations of the human visual system, and discuss the impact of pop-up windows and other OR-eliciting stimuli on information processing in light of such attentional and cognitive limitations.

**Attentional and Cognitive Load Theories**

Attention load theories are rooted in the assumption that not all the visual information available in the world is processed, and that selection is necessary, and attention plays a key role in this process (Kahneman & Treisman, 1984; Van der Heijden,
1996). This understanding brought theorists’ attention towards the limitations of human perceptual and cognitive systems.

Although limitations in the capacity of processing visual information are generally accepted, the locus of such limitations is widely contested. Thus, it is sometimes argued that selection happens at the sensory level prior to any processing (Van der Heijden, 1996), whereas other times it is suggested that selection happens after some stimuli attributes have been processed at least in part (Broadbent, 1958; Kahneman & Treisman, 1984). More specifically, the debate concerning the locus of selectivity has centered on the question of whether selectivity occurs at a perceptual/attentional level, or whether it occurs at a processing level. For most theorists, this information filter is located at the attentional level (Broadbent, 1971; Kahneman, 1973; Neisser, 1967); thus, selective attention is considered responsible for filtering in relevant and filtering out irrelevant visual information. In the light of this understanding, some have proposed that there are two stages in visual information processing that act sequentially (Broadbent, 1971; Kahneman, 1973; Neisser, 1967). Supporters of the two-stage paradigm argue that all available information is only partly processed during the initial stage, while only part of the information is processed, but completely during the second stage (Broadbent, 1971; Bundesen, 1990; Folk & Egeth, 1989; Kahneman, 1973; Neisser, 1967; Theeuwes, 1993; Treisman, 1988; Treisman & Gelade, 1980). It is thus suggested that stimuli are somehow surveyed early during a pre-attentional stage, when some stimuli units are also isolated based on characteristics such as color, size, or direction of movement (Folk & Egeth, 1989; Treisman & Gelade, 1980). At a later stage, certain stimulus attributes gain precedence and are scrutinized more closely.

Deepening the debate concerning the locus of selectivity, researchers adopting the two-stage model of attention are also split on whether they believe selectivity to take place
during the early stage or during the late stage of visual processing. For early-selection theorists, the filter operates at the early, pre-categorical level (Broadbent, 1971; Treisman, 1960). For late-selection theorists, on the other hand, information filtering occurs at a later, attentional stage, when some of the stimuli units isolated earlier receive greater “figural emphasis” than others (Norman, 1968). Yet other researchers question the role of a pre-attentive stage in visual information processing altogether. Opposing a two-stage model of visual processing, these theorists argue that one of the stages becomes automatically superfluous depending on when selection occurs; it therefore follows that visual perception develops in one phase only, in which case stimulus filtering happens at the sensory rather than processing level (Van der Heijden, 1992, 1996). Therefore, the limitations are to be found in our senses, not in our minds.

The debate concerning the locus of selection has also important consequences relative to the functions performed by attention. As such, early-stage theorists argue that attention is necessary for perception (that is, attention is needed in order to select stimuli or stimuli attributes for perceptual processing). Single-stage theorists, on the other hand, express the opposite view that perception is needed for attention rather than the other way around (Johnson & Proceter, 2004). Yet others argue that attentional selectivity might be needed for completely different purposes, such as imposing constraints on the range of possible actions, instead of being linked to the presumed limitations of the visual system (Allport, 1987).

Be it at the perceptual or cognitive level, capacity limitations have significant consequences for information processing. In this context, substantial support for a limited capacity of one’s attentional and cognitive resources comes also from the orienting responses literature, where orientation is linked with the amount of resources allocated for information processing.
In much of contemporary psychophysiological research, orienting has been placed within an information-processing framework and related to the notion of processing resources. Ohman, for example, (Ohman, 1992; Öhman, Hamm, & Hugdahl, 2000) suggested that the orienting response reflects the selection of a stimulus for resource limited processing. Thus, the extent of orienting as reflected in the amplitude of the phasic skin conductance response is proportional to the amount of cognitive resources allocated to process the stimulus (Neumann, Lipp, & Siddle, 2002; Ohman, 1992). In the case of novel stimuli, these resources may be automatically allocated to stimulus identification. If this were the case, then novel stimuli, along with all other stimuli eliciting orienting responses, would be associated with greater recall and recognition of stimulus-related information. Support for this prediction has been brought from various lines of research in visual cognition and communication areas, focusing on both novelty and motion effects.

Thus, Tulving and Kroll (1995) demonstrated that novel information is better recognized than familiar information, and proposed the novelty/encoding hypothesis (NEH) to account for this effect. This hypothesis states that novel information is more efficiently encoded into long-term memory than familiar information, as priority for higher-order processing is given to novel information. Novelty detectors in the brain assess incoming information with respect to its degree of novelty, and the information judged as novel is given priority in higher-level encoding operations.

Other researchers have also found that items that are novel, or distinctive, are remembered better than those that are less distinct (e.g., Hunt, 1995; Parker, Wilding, & Ackerman, 1998). Subsequently, this effect of novelty on memory has been shown to extend from recognition to recall for novel information. Hunt (1995), for example, found that participants in a study exhibited enhanced recall for novel, as compared with non-
novel, items; this effect seems to be extremely robust and has been observed when items are made novel on a variety of stimulus dimensions, such as color, size, brightness, and semantic category (e.g., Cimbalio, 1978; Hunt, 1995; Wallace, 1965).

Not only novelty, but also motion or animation has been linked to increased memory performance. Within communication research, animated ads have been found to result in a better memory for ad content compared to static ads (Borse & A. Lang, 2000; Li & Bukovac, 1999). It appears that, in general, stimuli triggering orienting responses are better remembered overall. However, this increased memory for OR information comes at the expense of memory for non-OR information. When the OR stimulus is a distractor, the memory performance for the main task information decreases substantially as a consequence of attentional shift directed toward the OR stimulus. Along these lines, animation as non-primary information has been showed to significantly reduce information-seeking performance, and consequently reduce memory performance in a web-based environment (Zhang, 2000).

Supporting this point of view, limited capacity theory – developed within the processing resources paradigm – posits that translating an environmental stimulus into a mental representation involves three subprocesses: encoding, storage, and retrieval (A. Lang, 2000). In turn, the model suggests that novel and unexpected stimuli would trigger involuntary attention, calling for distraction and thus impeding the above-mentioned mental processes involving task-related information. The divided attention theory, then, predicts an influence of the distractor on task recall performance, which is dependent on the sub-processes emphasized by LCT. Thus, if a stimulus-distractor is presented during the encoding stage of information, subsequent recall of information generally decreases (Baddeley, Lewis, Eldridge, & Thomson, 1984).
A similar prediction arising from shifts in visual attention is supported by object-based theories. This set of theories within visual cognition asserts that a single stimulus among multiple constitutes an individual object. When a new stimulus is introduced, though, an object file is created, demanding visual attention (Kanwisher & Driver, 1992). As a result of lacking enough cognitive resources (LCT) to encode both the stimulus- and the task-related information, however, recall performance on task-related information is lowered.

Yet another theory indicating degradation in task performance when faced with a distracting interruption bases its assumptions on so-called visual surprise processes. Surprise-attention theory asserts that unexpected events prompt a reaction of orienting attention to unexpected stimuli (Seligman & Yellen, 1987). A surprising visual image is thus likely to shift the attention away from the task. Not only an unexpected event, but also a sudden one is shown to elicit a similar reaction. In this case, visual attention theories claim that an abrupt visual stimulus captures involuntary attention (Jonides & Yantis, 1988; Nakayama & Mackeben, 1989). The sudden onset of online stimuli is thus likely to arouse a selective response directed towards the stimulus and negatively affect performance on a main task, as the newly appearing stimulus will compete with the task information for attentional and, ultimately, cognitive resources. Therefore,

*H4a*: Based on attentional and cognitive load theories, degradation in one’s recall and recognition for website information is expected when experiencing interruptions (pop-up windows).

*H4b*: Greater recognition for pop-up information will be associated with lower recall for website information.
Research on human-computer interaction and visual cognition support the idea that computer-initiated interruptions\(^3\) have disruptive effects on a user’s task performance (Adamczyk & Bailey, 2004; Bailey et al., 2000b, 2001). Moreover, several characteristics of interruptions are showed to be more taxing and thus increase this effect. For example, the number of surprising stimuli, along with the frequency and duration of interruptions (Brixey, Walji, Zhang, Johnson, & Turley, 2004; Horstmann, 2006) increase the demands imposed on cognitive resources. Consequently, these characteristics will reflect both behaviorally (that is, the time needed for returning to the initial task) and cognitively (i.e., memory for task-related information). Support for these effects has been provided also in the context of visual search tasks in a Web environment, where it was shown that animated distractors that appear and disappear repeatedly have a greater effect on performance compared to animated stimuli that are continuously present on the screen (Zhang & Massad, 2003). It is thus apparent that more interruptions would be more disruptive to one’s cognitive performance, especially when there is a proportional increase in the effort expenditure needed to eliminate the source of interruptions as it is with pop-up windows (Chan et al., 2004; McCoy et al., 2004). Thus,

\[ H4c: \text{Based on attentional and cognitive load theories, the degradation in one’s recall and recognition for website information will be more severe when experiencing multiple interruptions (pop-up windows) as opposed to one interruption.} \]

4. Do Pop-Ups Elicit Negative Affect?

An additional effect of interruptions, besides the attentional load, is that of increased frustration experienced by users. Previous research has indicated that
interruptions have a disruptive effect not only in terms of user’s task performance, but also in terms of user’s emotional state by inducing frustration, annoyance and anxiety (Bailey et al., 2001). Interruptions are also said to increase the level of stress and arousal (Xia & Sudharshan; 2002).

Given their high interruptive potential, pop-up ads are also considered to be the most annoying type of advertisement by online users (Coursey, 2001). A few studies have looked at the emotional reactions elicited by pop-up ads and showed an increased negative reaction to this type of advertisements. One recent industry study, for example, has made the claim that online users actively penalize brands that use pop-ups and mistrust the companies that use and host pop-ups (Best, 2004). At the same time, another industry study (Jupiter Research, 1999) found that intrusive advertising formats such as interstitials have a “backlash risk,” with 69% of Web users estimated to find pop-ups as mildly to very annoying and 23% of them stating they will not visit the site again. Academic research, while scarce, has produced similar results. One recent study, for example, has showed that forced viewing of advertisements on the Internet can increase users’ perceived irritation and lead to behavioral reactance and avoidance phenomena (Edwards et al., 2002). These feelings of irritation and annoyance are likely to be evoked by perceived intrusiveness of pop-up windows (Bailey et al., 2000a; Edwards et al., 2002). To the extent ads are perceived as intrusive, feelings of irritation are likely to occur (Li et al., 2002).

Intrusiveness has been recognized as a leading cause of advertising annoyance in traditional advertising media as well (Bauer & Greyser, 1968), and web users are thought to perceive online advertisements as even more intrusive than those in other media given that their online behavior is highly goal-oriented (Li et al., 2002).

Therefore, the occurrence of pop-up windows in both an online and an offline setting is expected to elicit negative emotions (frustration, annoyance, anxiety). Hence,
H5a: The occurrence of pop-ups will be associated with negative emotions.

At the same time, subsequent exposures to novel stimuli are said to decrease the intensity of negative reactions. Thus, the affective models of mere exposure effects suggest that any novel stimulus presented for the first time elicits an instinctive fear reaction (Zajonc, 1968), but this response tends to habituate over multiple exposures to the stimulus (Zajonc, 1998). Moreover, some have proposed that humans develop affinities and preferences toward familiar stimuli, maybe for adaptive reasons (Bornstein, 1989).

Similar habituation processes to emotional stimuli have been proposed by other researchers as well. Previous studies have looked at physiological responses to emotional stimuli and showed habituation in amygdala (Wright et al., 2001), hippocampus activation, as well as activation in some parts of the medial and inferior temporal cortex (Fischer et al., 2003). Also, emotional habituation is said to occur relatively quickly for most stimuli (Bolger, DeLongis, Kessler, & Schilling, 1989).

There may be some stimuli, however, that are continuously eliciting, if not increasing, emotional reactions in humans. Daily stressors, for example, are thought to have an additive effect on one’s emotional functioning rather than habituate over multiple exposures; a similar effect is attributed to the persistence of one stressor (Silver & Wortman, 1980). Some media stimuli may have an enduring effect as well.

According to Detenber and Reeves (1996), attending to media is an inherently emotional experience and the Internet is no exception. Numerous studies have documented the emotional effects of media by demonstrating changes in audiences’ arousal levels as a function of both message elements and formal features (for overviews, see Reeves & Nass, 1996; Zillmann, 1990). At the same time, regardless of the valence of the elicited emotional reaction (i.e., positive or negative), the elevation of sympathetic
activity in the autonomic nervous system is likely to be no different, given the nonspecificity of physiological arousal (Zillmann, 1990). Based on the above-mentioned nonspecificity of physiological arousal, excitation-transfer theory posits that residual arousal from one stimulus will combine with arousal from a subsequent stimulus, thereby intensifying the affective reaction to the latter stimulus (Zillmann, 1971, 1978, 1983). In other words, excitation-transfer theory postulates emotional and behavioral consequences of transferred excitation. That is, excitation produced by a stimulus can potentially enhance one’s emotional reaction to not just another stimulus occurring subsequently, but to any situation following the initial arousing stimulus.

The excitation-transfer model has been successfully used by advertisers seeking to maximize, for example, audience reaction to an ad placed in the midst of a variety of other television stimuli (Reeves & Nass, 1996). In an online context, excitation-transfer theory has been used to explain emotional reactions to downloading speed and subsequent browsing behavior (Sundar & Wagner, 2002). More exactly, Sundar and Wagner (2002) proposed a transverse interaction explanation to account for the combined effect of content arousability and download speed on skin conductance levels (i.e., physiological correlates of autonomic arousal). The two researchers have found across a series of studies that whenever a stimulus has high arousability, it evokes significantly greater SCL when downloading slowly rather than quickly. However, this distinction between download speeds seems to be cancelled when considering a medium-arousal image and reversed for a low-arousal image, such that downloading speeds do not matter in the case of a medium-arousal image and the fast-downloading image evokes greater SCLs than the slow-downloading image if it carries a low arousing content. More importantly, the arousal elicited by certain images was also showed to transfer to subsequent browsing behavior.
such that increased arousal was associated with increased browsing activity through subsequent Websites (Sundar & Wagner, 2002).

Thus, not only that forced exposure to pop-ups would induce highly negative emotions such as irritation and frustration, but the emotional reaction to a set of pop-ups would also transfer to the following set and thus an increase in response intensity would be visible for pop-ups featured on subsequent pages. Therefore:

\[ H5b: \text{Skin conductance responses following pop-up occurrences will increase in amplitude for pop-ups appearing on subsequent pages.} \]

Based on excitation transfer, it is likely that the arousal elicited by exposure to multiple sets of pop-ups will transfer to Web pages as well. More specifically, in the absence of behavioral accounts used by Sundar and Wagner (2002), the increased negative attitudes towards the pop-up windows may lead not only to pop-up avoidance (Abernethy, 1991), but also to increased negative attitudes toward the Website itself (Chan et al., 2004). Thus,

\[ H5c: \text{Perceptions of the Web page and perceptions of the news stories will become more negative following exposure to multiple sets of pop-up windows.} \]

5. Mechanism 3: The Affective Bias

The affect elicited by pop-up windows has not only behavioral, but also cognitive consequences, impacting the way in which individuals process information. Thus, several theories developed in social psychology propose an association between emotional valence and locus of attention (that is, whether the visual information is processed at a local or a global level). According to this theoretical proposition, affect, be it mood or emotion, is said to influence not only the extent to which one processes (visual)
information, but also the level of processing (i.e., global or local). One of the first accounts of the affective impact on processing level pertains to Easterbrook (1959) who proposed that negative affective states, and in particular those associated with high arousal such as anxiety and fear, narrow the scope of attention making people miss the forest for the trees (see also Derryberry & Tucker, 1994; Tyler & Tucker, 1981). Building upon the same line of research, Derryberry and his colleagues (Derryberry & Tucker, 1994; Derryberry & Reed, 1998) also proposed that positive affective states have the complementary effect of broadening the scope of attention. Personality traits associated with negative emotions, such as anxiety and depression, for example, were shown to correlate with a local bias consistent with a narrowed attentional focus; by contrast, traits associated with positive emotions (optimism) correlate with a global bias consistent with a broadened attentional focus (Basso, Schefft, Ris, & Dember, 1996). Along the same lines, studies targeting positive affective states assessed global biases in attentional focus whereas the opposite was found for negative affective states (Basso et al., 1996; Derryberry & Reed, 1998; Gasper & Clore, 2002). To account for this influence of emotional states on the processing level, Fredrickson (1998, 2001) proposed the broaden-and-build theory of emotions, which hypothesizes that positive emotions broaden the scope of attention and thought-action repertoires whereas negative emotions narrow the scope of attention and thought-action repertoires. In two recent experiments, Fredrickson (2005) showed that positive emotions did broaden the scope of attention and thought-action repertoires compared to a neutral state, whereas negative emotions narrowed thought-action repertoires relative to the neutral state.

Not only emotions but also moods have been shown to have a similar effect. Thus, affect-as-information theory posits, based on experimental evidence, that people in happy moods tend to process the visual information at the global level, whereas people in sad
moods tend to process the visual information at a local level, focusing rather on details than on the whole picture (Clore & Gasper, 2001). At the same time, research on mood-induced processing biases indicates that people in sad moods process the information carefully, systematically, whereas people in happy moods tend to rely more on heuristics and mental schemas, and general information (Clore, Gasper, & Garvin, 2001). Consequently, two major factors seem to affect visual attention when mood-biased: the processing style, and the mode of attending to the information.

Based on these findings, Clore and his colleagues (Clore & Gasper, 2001; Clore et al., 2001) proposed a level of focus hypothesis stating the global processing biases of positive moods and the local biases associated with negative moods. Derived from action identification theory (Vallacher & Wegner, 1987) which states that whenever a situation becomes problematic individuals shift their focus from a global, general, abstract level of thought to a more local, specific, and detailed level of thought in order to help them figure out the problem, the level of focus hypothesis predicts that individuals in sad moods would attend to more local and fewer global features than those in happy moods. Consistent with this hypothesis, for example, Derryberry and Reed (1998) found that when individuals could lose points, trait anxiety was associated with quickly noticing local details.

There is not much surprise that research on both mood and emotional biases relative to processing level have found similar results, as they both use the same type of stimuli similar to the hierarchical visual stimuli used in Navon’s Object Identification Tasks (Navon, 1977). It is nonetheless noteworthy that social psychological research has found similar effects for discrete emotions, which have an object and are short-lived, as it has for moods, which have no object and are comparatively more enduring. According to the affect-as-information theory, for example, affective feelings should influence the
extent to which information is processed at a global versus local level, but only when experienced as task-relevant information (Gasper, 2002). Supporting these assumptions, recent studies (Gasper, 2002, 2004) have shown that when affective feelings are experienced as task relevant, they appear to guide whether one adopts a global or a more local focus. Moreover, sad moods decreased global processing relative to happier moods when feelings seemed relevant to the task and when criteria for responding were ambiguous, but not when feelings seemed irrelevant or when the criteria were unambiguous (Gasper, 2004). Also consistent with the idea that mood guides processing, increases in affect intensity were associated with faster reaction times. It is thus remarkable that similar effects apply to discrete emotions as well; according to the mood account, locus-of-processing effects would not occur for discrete emotions since the objects or causes of such affective responses are easily identifiable and thus the affective states are less likely to be misattributed as information about one’s performance on the current task.

Physiological Basis of Affective Biases in Visual Processing

Some justification for the association between affective valence and locus of attention comes from neuropsychological studies, which indicate that there may be a relationship between the brain regions activated when experiencing negative affect and those activated during local processing. It is thus suggested that the orientation of attention, a primary component of cognition, is dependent on both cognitive and emotional influences.

Some researchers have shown how attention (i.e., the ‘‘spotlighting’’ of neural processing resources) shapes perceptual and cognitive processing during various cognitive tasks with the help of electrophysiological techniques (Luck, Woodman, & Vogel, 2000;

Additionally, emotional states, emotion judgments, and emotional significance of stimuli also impact attention-sensitive ERPs (Bernat, Bunce, & Shevrin, 2001; Diedrich, Naumann, Maier, Becker, & Bartussek, 1997; Kayser, Bruder, Tenke, Stewart, & Quitkin, 2000; Keil et al., 2001; Pizzagalli, Regard, & Lehmann, 1999; Sato et al., 2001; Schupp et al., 2000; Smith, Cacioppo, Larsen, & Chartrand, 2003). Although accounts of ERP modulations in response to emotional stimuli suggest a possible biological relationship between attention and affect, it is somewhat difficult to show how and where emotional and cognitive processes are monitored and integrated to mediate allocation of attention and processing resources.

Some reports of interaction between emotions and attention or cognition suggest that negative emotion affects cognition differently in the two cerebral hemispheres (Hartikainen, Ogawa, & Knight, 2000; Stormark, Hugdahl, & Posner, 1999; Stormark, Nordby, & Hugdahl, 1995; Van Strien & Heijt, 1995; Van Strien & Luipen, 1999; Van Strien & Morpurgo, 1992). Hartikainen et al. (2000), for example, found that presentation of a brief aversive picture prior to a simple target event delayed detection response times
(RTs) for the Left Visual Field (right hemisphere) targets. They proposed that the emotional stimuli preferentially engaged the right hemisphere, thus interfering with subsequent target detection. In contrast, Van Strien and Morpurgo (1992) reported improved performance for right hemisphere targets following aversive emotional stimuli, further explained as emotional priming of the right hemisphere that facilitated cognitive processing.

Although both studies implicate the right hemisphere in negative emotional processing, several factors may account for the contradictory findings. On the one hand, the affect-eliciting stimuli might have been qualitatively different, so that the emotional response could have substantially differed from one study to the other. Hartikainen et al. (2000), for example, used disturbing pictures, whereas Van Strien and Luipen (1999) used negative emotion words. On the other hand, the time lag between the emotion-laden stimulus and the cognitive stimulus was not the same in the two studies, affecting not only the intensity of the emotional response but also the stage of the cognitive process engaged during the task (Codispoti, Bradley, & P. J. Lang, 2001). It may be that emotions influence early perceptual processes differently from later evaluative, decision, and memory-related processes (Dolan, 2002). Moreover, the cognitive processes engaged during the tasks may have triggered a difference in hemispheric dominance. Van Strien and Lupien’s use of emotionally laden words may have confounded the hemispheric influence of the negative emotion.

In general, the observation that the right hemisphere is more influenced by negative emotion evocation and concurrent cognitive processing is consistent with the valence hypothesis positing that the right hemisphere is more involved with emotion processing in general (Derryberry, 1990). Subsequent studies of emotion laterality have later modified the valence hypothesis, suggesting that the right hemisphere is dominant for
processing withdrawal-related emotions (e.g., fear, aversion) and that the left hemisphere
may play a greater role in approach-related emotion (e.g., joy; Adolphs, Jansari, & Tranel,
2001; Davidson, Ekman, Saron, Senulis, & Friesen, 1990; Davidson, Mednick, Moss,
Saron, & Schaffer, 1987). It is argued that both versions of the valence hypothesis (i.e., the
‗‗right hemisphere emotion‘‘ vs. the ‘‗‗left hemisphere approach versus right hemisphere
withdrawal emotion‘‘) are supported if the empirical evidence is split between the studies
requiring identification of emotion expression and the studies that involve experienced
emotions, respectively (Ley & Strauss, 1986; Van Strien & Van Beek, 2000).

To further test these hypotheses along with the physiological correlates of emotion,
Simon-Thomas, Role, and Knight (2005) have recently examined performance and
electrophysiological activity during a higher cognitive task that promoted lateralized
visual processing while presenting task-irrelevant, negative emotion eliciting pictures.
Aversive pictures were presented for approximately 1 sec to initiate an emotional response
immediately preceding visual presentation of cognitive task stimuli. The task involved a
numeric Stroop with a one-back working memory load designed to engage higher
cognitive processes including cognitive control, response inhibition, and working
memory. According to the study procedures, Stroops were presented to unilateral visual
hemifields (left and right visual hemifields, or LVF and RVF, respectively) to directly
investigate hemispheric specificity for the influence of bilaterally initiated negative
emotional processes on higher cognitive task related processing. The influence of negative
emotional experience on electrophysiological indices of attention and cognitive processing
was tested using millisecond resolution measurements of task performance and Stroop
stimulus-locked ERPs. The researchers found that emotional responses to aversive
pictures affected cognitive processing in the right and left cerebral hemispheres
differently. Performance accuracy was improved for task trials that involved negative
emotion elicitation and stimulus presentation to the right hemisphere. Neurophysiological indices of visual feature analysis, working memory, and decision-related processing were enhanced in the right hemisphere. In contrast, accuracy was reduced for the left hemisphere after aversive pictures were shown, and ERP components suggested a diminished left-to-right callosal transfer of visual information. Similarly, frontal SPs were enhanced for stimuli presented to the right hemisphere and showed greater sensitivity to concurrent emotion manipulation. These findings are generally consistent with Gray’s (2001) findings that negative emotional processing impairs verbal working memory shown to involve left hemisphere structures, while it facilitates mediated spatial working memory involving right hemisphere structures. Overall, the results provide behavioral and electrophysiological evidence of a link between negative emotional processing and the right hemisphere.

Interestingly, studies of experienced emotion laterality suggest as mentioned above that the right hemisphere is dominant for processing withdrawal-related (e.g., fear, aversion) emotions and that the left hemisphere may play a greater role in approach-related emotion (e.g., joy; Adolphs et al., 2001; Davidson et al., 1990; Davidson et al., 1987). At the same time, functional imaging (fMRI) and behavioral data show a right hemisphere bias for global level analysis with an asymmetric left hemisphere advantage for local level processing (Kimchi, 1991; Martin, 1979; Martinez et al., 1997; Sergent, 1982). Additionally, positive affect has been associated with global levels of focus, while negative affect has been associated with local levels of focus. Together, the evidence provided by these three lines of research suggests that previous activation of brain regions based on affective states might compete with higher-order cognitive performance so that other brain regions are forced to get activated during subsequent cognitive tasks. This
hypothesis is also supported by the idea that hemispherical asymmetry in global vs. local processing does not occur but in higher-order processing stages (Heinze et al., 1998).

Based on the reported empirical evidence of emotional biases on the locus of attention, and given the pop-ups potential of evoking negative emotions, it results that web users are more likely to process website information at a local level rather than at a global level. Moreover, the focus on local information should increase with the intensity of the negative emotions experienced, that is, with increased exposure to pop-ups. Therefore,

H6a: Based on affect theories, increased recall and recognition of local (detailed) Web page information is expected when pop-ups are present, irrespective of their location on the screen.

H6b: Based on affect theories, recall and recognition of local (detailed) Web page information is expected to increase with repeated exposure to pop-up windows.

Summary

As pop-up windows are expected to elicit both orienting responses and negative emotions in Web users, three different psychological mechanisms are proposed to explain the cognitive processes triggered by pop-ups occurrence. The first mechanism, built on the assumption that pop-up windows elicit overt orientation, predicts that users will direct their attentional spotlight towards the pop-up window. Consequently, the information on the Web page located near the pop-up will be processed more efficiently than the information located in the peripheral visual field, as an attentional gradient is presumed to surround the location of the attentional focus (for a visual representation of this mechanism see Figure 1). Moreover, the overt orientation of the attentional spotlight toward the location of pop-ups may or may not be enduring. If overt orientation is due to novelty effects, for example, a significant degradation in one’s location-based recall and
recognition is likely. In contrast, if overt orientation is due to structural features such as abrupt or sudden onsets, it is unlikely for such degradation in location-based recall and recognition to occur. The second mechanism, rooted in attentional and cognitive load theories, predicts that memory for Web page information will suffer whenever pop-up windows appear on the screen, as they impose both an attentional and a cognitive load on Web users. As the attentional load increases with multiple pop-up appearances on the screen, it is also expected that the memory for Web page information will be lowered by repeated exposure to pop-ups (Figure 2). The third mechanism, derived from the affect-as-information perspective, predicts that web users will likely focus on the details of a few stories rather than on the headlines of many, given that the negative affect elicited by pop-up windows (i.e., frustration, annoyance, anxiety) may redirect users’ attention to local rather than global information. Furthermore, the experienced arousal is likely to transfer to subsequent Web pages such that, whenever they are also associated with pop-ups, the propensity towards focusing on details will increase (Figure 3). Also, excitation transfer may lead to greater negative perceptions of subsequent Web pages compared to initial ones.

*Figure 1.* Recall and recognition outcomes predicted based on the attentional spotlight model
**Figure 2.** Recall and recognition outcomes predicted based on cognitive load

**Figure 3.** Recall and recognition outcomes predicted based on the affect-as-information model
Chapter 3

Methods

A between-subjects factorial experiment was designed to test the above-mentioned hypotheses. Participants were randomly assigned to one of nine conditions, with participants in a given condition being exposed to none, one, or three pop-ups per Web page. All participants saw two Web pages for a brief period of time, determined via a pretest. For those who saw at least pop-up, the pop-up windows were displayed in either the same location or a different location on the subsequent page. Both pages contained four news stories each, and the content of the pop-up windows was manipulated so that some Web pages were associated with pop-up advertisements and others with pop-up factoids. The exact placement of pop-ups on the page was determined via a pretest, so that they grabbed users’ attention without completely covering any of the four stories. All navigational behavior within a Web page was restricted. Physiological responses were recorded (ECG, facial EMG, GSR) during participants’ exposure to the two Web pages, and self-reported frustration levels and participants’ recall and recognition of the news stories and pop-up content were assessed via online questionnaires after each page.

Pretest

A pretest was conducted in order to determine 1) the appropriate placement of the pop-up windows relative to each of the four frames on the main webpage, and 2) the time for which each of the two Web pages needed to be on the screen. The time for which a webpage should have been on the screen was chosen so that participants in all conditions would be able to fully read at least one, but not all four stories featured on any given page. In this way, differential recall and recognition for local and global information, as well as for peripheral and focal information could have been tested. The placement of the pop-
ups was determined so that they could be spatially linked with one of the four stories without covering it completely; thus, focal recall and recognition could still be assessed. In other words, the pop-up windows needed to be placed so that they would be visible without completely impeding processing of associated stories. This placement, along with the time of exposure to the Web page, would then allow for a simultaneous testing of the three mechanisms proposed in H2, H4, and H6.

To test the appropriate time of exposure to the Web page and pop-up placement on the screen, a 2 (time of exposure to the Web page) x 3 (pop-up placement relative to an associated story) between-subjects experiment was conducted. Participants were randomly assigned to one of six conditions and exposed to two different Web pages. For any given participant, both pages were shown on the screen for the same amount of time and the pop-up placement relative to the associated story was the same on both pages (although pop-ups were not all associated with the same story). When the time of exposure to the Web page had elapsed, participants were automatically redirected towards an online questionnaire containing free recall and recognition items, along with their perceptions of the amount of time available to read the stories featured on the page. During participant exposure to the Web page, skin conductance responses and heart-rate measures were collected to assess pop-ups’ likelihood to elicit reflexive orientation given their location on the screen.

**Participants**

Thirty-five (N=35) students enrolled in Communication classes at a large Northeastern University participated in the pretest experiment in exchange for class credit. The project announcement indicated that class credit would be given in exchange for participation in a short study involving the examination of psychological and
physiological responses to online news pages.

**Stimulus Material**

Two fictitious web pages were created; both web pages were divided into four different frames, with each frame containing a news story. On each of the two web pages, all four stories shared the same topic. One topic concerned Pandas and their behavior in captivity, while the other concerned the oil crisis that was unfolding in spring 2006, at the time of the experiment. They were displayed respectively under the Smithsonian National Zoological Park and New York Times Business sections. Although all four stories within a page shared the same topic, they were altered so that the content overlap was minimal and all story titles, leads, and bodies were distinct (Appendix A, p. 168). Unlike a usual news page, each quadrant had a light colored, transparent background.

Each Web page was associated with a pop-up window displaying either advertorial or informational content. Four pop-up windows were used, containing either factoid-type information about Pandas or oil, or advertisement-type information about National Geographic or BP Oil Company (Appendix A, p. 168). The content of the pop-ups was chosen so that it was relevant to the news stories’ topics, in an effort to balance the impact of pop-up factoids and pop-up ads on the Web page (and news stories) credibility. The pop-ups’ placement relative to the stories was varied with the condition of the participant, as follows:

1) For some participants, the pop-up windows were displayed on the side of the page without covering any of the story text.

2) For other participants, the pop-ups were displayed so that they covered half of one story, including title, lead, and body of the respective story.
3) For a third group, the pop-up windows were displayed so that they covered half of one story (lead and body) while leaving the story title fully visible (Appendix A, p. 168).

**Independent Variables**

Time of exposure to the web page and pop-up placement on the screen were the main independent variables, and they were manipulated as follows: to control the time of exposure to a Web page, a java script was inserted into the Web page code so that participants were redirected to an online questionnaire either after 70 (time 1) or after 120 seconds (time 2). The pop-up placement was manipulated so that the pop-up windows would be on the side of a story while leaving the entire story visible (location 1), covering half of the entire story (location 2) or covering half of the lead and body of a story while leaving the title visible (location 3).

**Dependent Variables**

Three categories of dependent variables were used in the pretest, including the number of stories a participant recognized and recalled freely, participants’ assessment of the amount of time available for reading the stories, and physiological indicators of reflexive orientation including skin conductance responses and beats-per-minute (i.e., a measure derived from heart rate). Free recall was measured by asking participants to write as much information they could possibly recall from the Web page, and list each idea on a separate line. Each line/idea was then matched to a story, and the number of stories listed on at least one line was then counted. Thus, the number of stories recalled freely varied between 1 and 4. Pop-up recall was also counted separately, and had a value of either 0 or 1. Story recognition was measured via multiple-choice questions. Five questions were
asked about each story, with one question asked for which of the following: story title, story lead, story body, story background, and general topic of the story. Similarly, four questions were asked about a pop-up window, with one question asked for which of the following: pop-up lead, pop-up body, pop-up text color, and general topic of the pop-up. The first three recognition items were combined so that a story recognition score was obtained. The story recognition score was given the value 1 if any of the three questions mentioned above were answered correctly. Finally, the number of stories was calculated by counted the number of story recognition scores with the value 1. General recognition scores were obtained by similarly combining the answers to the general topic and story background questions. Two open-ended questions were used to measure participants’ assessment of the amount of time available for reading the stories, with one asking participants to report whether there was enough time to read the stories and a second one asking them to approximate the percentage of information they read from the entire Web page (Appendix B, p. 171). The amplitude of skin conductance responses at pop-up onset and beats-per-minute (BPM) change scores during the 10 seconds following the pop-up onset were also used to assess whether the appearance of pop-up windows in various locations was associated with orienting responses or not. More detailed information about how SCR amplitude and BPM change scores were computed can be found in the description of dependent variables measured in the main experiment (pp. 66-67), as well as under the Index Construction section (pp. 76-77).

 Procedures

Participants were scheduled to come, one by one, to a research laboratory equipped with a computer connected to the Internet, and BIOPAC instruments set up for physiological recordings. Upon arrival, the participant was greeted by the investigator and
informed of the topic of the study; the participant was then asked to read and sign an informed consent form. After the participant has given written consent to participate in the experiment, she was led to a room that housed the computer and was seated in a comfortable chair while the experimental procedures were introduced. The participant was instructed that she would look at two different news pages. Approximately half of the participants were also instructed that they would have a limited amount of time to find specific information. This information was not available directly in any of the featured news stories. Asking part of the participant sample to find specific information ensured that at least some participants were motivated to read the stories, while also allowing for testing differences in behavior between participants who were task-oriented compared to those who were not. After giving the first verbal experimental instruction regarding general procedure for the experiment, the investigator placed the electrodes on participant’s skin in order to collect physiological data. Once the electrodes were properly placed and the experimental procedure explained in more detail, the participant was instructed to turn on the computer monitor and proceed as directed. The first screen contained a general instructions page briefly reminding the participant about the procedures. This page also contained a javascript programming code meant to randomly assign participants to one of the six conditions. Upon clicking the “start” link, the participant was redirected to the first Web page containing information about Pandas. According to the participant’s condition, exposure to the news page was limited to either 70 or 120 seconds. During this period, the participant was also exposed to one pop-up window. The pop-up window was manipulated so that the content was either an advertisement for National Geographic or a factoid about Pandas. The pop-up was associated either one of the four stories, and the relative distance from the story depended on participant’s condition (see the description of location 1, 2, and 3 in the Pretest’s
Stimulus Material section on p. 49). The participant could either close the pop-up or ignore it. If it had been ignored, the pop-up would have automatically closed after 10 seconds from onset. The time for which each pop-up stayed on the screen was recorded and controlled for in all analyses. At the same time, heart rate (BPM) and skin conductance responses (SCR) were recorded throughout participant’s exposure to the Web page (for a description, see the Experimental Procedures section on p. 71). After the time period elapsed, the participant was automatically directed towards the first online questionnaire, which contained measures of free recall and recognition, as well as participant’s own assessment of the amount of time available for reading the Web page. After successfully submitting the questionnaire, the participant was redirected to the second Web page and repeated the same procedural steps. This page contained information about the ongoing oil crisis, and the pop-ups displayed either oil facts or an advertisement for the BP oil company. The news pages and pop-up locations were counterbalanced for order. At the end, the participant was thanked for participating and answered any additional questions regarding the experiment.

Results

Three analyses of covariance were first performed, with the time of exposure to a Web page as the independent variable, number of stories recalled, number of stories recognized, and general recognition scores as dependent variables, and incentive level (i.e., motivated to find information or not), pop-up content (ad vs. factoid), and page number as covariates. No significant effects of exposure time on number of stories recalled or general recognition scores were found. However, there was a significant effect of exposure time on number of stories recognized \( F(1, 27) = 9.88, p < .01 \), such that more stories were recognized on average when the time of exposure was 120 seconds (\( M \)
= 2.15, SE =0.19) as opposed to 70 seconds (M = 2.92, SE =0.24). Similar analyses of covariance were conducted with the estimated percentage of read stories as the dependent variables. A significant effect of exposure time on estimated percentage of read stories was found [F (1, 28) = 4.62, p < .05], such that a higher percentage of information was reported as read when the time of exposure was 120 seconds (M = 61.43, SE =8.03) as opposed to 70 seconds (M = 37.90, SE =6.50). It thus seems that 70 seconds are enough for people to read at least a story completely, with participants reporting having read an average of approximately two stories and 37.90% (i.e., above the 25% for one story) of information on the Web page. Therefore, 70 seconds was selected as the appropriate time of exposure to a Web page.

Next, two analyses of covariance were performed, with the pop-up placement relative to an associated story as the independent variable, pop-up recall and pop-up recognition, as dependent variables, and incentive level (i.e., motivated to find information or not), pop-up content (ad vs. factoid), and page number as covariates. No effect of pop-up location was found on pop-up recognition. However, a significant effect of pop-up placement on pop-up recall [F (2, 55) = 4.71, p < .05], such that a pop-up positioned in location 2 (M = 0, SE =0.77) were recalled less often than pop-ups positioned in location 1 (M = 0.33, SE =1.29) or 3 (M = 0.29, SE =0.25). Thus, contrary to expectations, pop-ups that covered half of an entire story (including title, lead, and body) were recalled less than pop-ups positioned on the side or pop-ups that were leaving the title visible. It is possible that pop-ups covering all elements of a story have an increased intrusive and interruptive effect, and therefore there is an increased need for the participant to focus intensely on the content of the page. Similar analyses of covariance were performed to check whether pop-up placement affected recall or recognition of the story associated with the location of the pop-up. No effect of pop-up placement was found on either recall or recognition of the
A series of analyses were also run to test whether pop-ups in different placements relative to a story elicit orienting responses. First, an analysis of covariance was performed with pop-up placement as the independent variable, SCR amplitude as the dependent variable, and pop-up content and page number as the covariates. No significant effect of pop-up placement on SCR amplitude was found. Next, BPM change scores during the 10 seconds following the pop-up onset were run against time (one second at a time), a quadratic component of time, and pop-up placement, while controlling for the same covariates. There was no significant effect of time or the quadratic component of time on BPM change scores. However, a significant interaction effect between pop-up placement and the quadratic component of time on BPM change scores was found, $F(2, 446) = 21.44, p < 0.001$ (Figure 4). Subsequently, similar analyses were run to test the effect of the quadratic component of time on BPM change scores for each pop-up placement separately. A significant effect of the quadratic component of time on BPM change scores was found only for location 3, $F(1, 198) = 8.23, p < 0.01$.

Figure 4. Heart-rate changes following the onset of a pop-up when the pop-up placement relative to a news story was varied.
In the end, location 3 (covering half of the story but leaving the entire title visible) was selected as the appropriate placement of a pop-up relative to a story. This placement ensured that reflexive orientation will occur at the onset of a pop-up, and that some recollection of the pop-up content will take place. Thus, both H2 and H4 hypotheses could be tested concurrently.

**Experiment**

A 2 (same location pop-up, different location pop-up) x 2 (one pop-up window, three pop-up windows) x 2 (advertisement, factoid) between-subjects factorial design was employed to test the five hypotheses mentioned above. Participants were randomly assigned to one of nine conditions, with a ‘no pop-ups’ group being an additional (control) group. All participants saw two web pages for a brief period of time. The pop-up windows started appearing a short time after the webpage was completely loaded on the screen. All other navigational behavior within the Web page was restricted. The amount of content that participants were exposed to in any condition was maintained constant and the content displayed in each pop-up window – be it advertisement or factoid – was relevant to the respective Web page. During participants’ exposure to the two Web pages, physiological responses were recorded (EEG, facial EMG, GSR). Self-reported frustration levels were also assessed after each page via an online questionnaire, along with participants’ perceptions of the web page and the web page content, their perceptions of the pop-up windows, and their recall and recognition of the web page content.

**Participants**

One hundred and thirty-three \((N=133)\) undergraduate students were recruited from Communication classes at a large Northeastern University, and participated in the
experiment in exchange for extra-credit. The project announcement indicated that class
credit would be given in exchange for participation in a short study involving the
examination of psychological and physiological responses to online news pages. Students
were also informed that they could earn the same amount of credit by completing an
alternative assignment. Upon agreeing to participate in the study, students were asked to
schedule a time and come to a lab located on campus. Prior to entering the lab, each
participant was thoroughly informed about the purpose and procedures of the study, given
the opportunity to ask any additional questions regarding the study, and asked to sign an
informed consent form. The sample consisted of 41.73% males and 58.27% females, with
ages ranging from 18 to 26 years ($M = 20.08$, $SD = 1.66$). 82.82% of participants were 21
years of age or younger.

Stimulus materials

Two fictitious web pages were created, similar to some existent news sites or news
portals; both web pages were divided into four different frames, with each frame
containing a news story. Any given story displayed big titles and headlines, which
revealed general (i.e., global) information about the respective story. They also contained
leads and bodies, which constituted the local information about the story. On each of the
two web pages, all four stories shared the same topic. The topics reflected current world
and business events and were chosen so that they were likely to be moderately involving
and relatively unknown to a student population. The stories were adapted from actual Web
news stories that appeared on nytimes.com, cnn.com, bbc.com, and mcnews.com, and
dealt with the Italian election crisis unfolding during spring 2006 and the oil crisis that
took place during the same period. They were displayed under the New York Times
World and New York Times Business sections to ensure their credibility. Although all
four stories within a page shared the same topic, they were altered so that the content overlap was minimal and all story titles, leads, and bodies were distinct (Appendix C, p. 203). Unlike a usual news page, each quadrant had a light colored, transparent background. At the helpful suggestion of a reviewer, this was done to ensure that at least one characteristic of a story would be encoded and retrieved from memory by most participants who attended to the respective story.

Four pop-up windows were also created, containing either factoid-type information about Italy or oil, or advertisement-type information about CNN International or BP Oil Company. The content of the pop-ups was chosen so that it was relevant to the news stories’ topics, in an effort to balance the impact of pop-up factoids and pop-up ads on the Web page (and news stories) credibility. It is unlikely for the factoids to affect Website credibility, and previous research has showed that relevant pop-up advertisements are less likely to undermine Website credibility compared with irrelevant pop-ups (Stavrositu & Sundar, 2004). The pop-up text was structured such that it contained both global (headlines, slogans, etc.) and local (detailed copy) information (Appendix C, p. 203). The pop-ups’ position relative to the stories was chosen based on a pretest (see above). Within each page, the pop-ups’ appeared in only one of the four quadrants and covered part of the story lead and body while leaving the entire title visible. Thus, the pop-up windows were spatially linked to one of the four stories while leaving enough information visible for the respective story.

**Independent variables**

The main independent variables in this study were pop-up location similarity (same vs. different), number of pop-ups featured within a page (one vs. three), and pop-up content (advertisement vs. factoid); they were all manipulated using html and CGI scripts.
The first independent variable, location similarity, was used to discriminate between location-specific processing evoked by the appearance of pop-ups and users’ predisposition to orient towards a specific portion of the screen (more details appear in the Experimental Procedure section, p. 71). The second independent variable, number of pop-ups per page, was used to vary the amount of attentional/cognitive load, as well as the intensity of negative affect evoked by pop-up windows. The third independent variable, pop-up content, was introduced so that the effect of the pop-up modality and the effect of the pop-up content could be distinguished.

Affect Manipulation Check

An affect manipulation check was performed after each Webpage using items derived from the Multiple Affect Adjective Check List (Zuckerman & Lubin, 1965), the Positive Affect Negative Affect Scale (Watson, Clark, & Tellegen, 1988), and the Activation-Deactivation Adjective Check List (Thayer, 1986). The items included were irritated, frustrated, angry, annoyed, excited, energetic, drowsy, wide-awake, tense, clutched-up, happy, pleased, and calm. These adjectives were selected so that both emotional valence (positive vs. negative) and intensity (low vs. high) could be assessed. Items were measured on a 10-point Likert-type scale anchored between 1 (“Describes very poorly how I feel now”) and 10 (“Describes very well how I feel now”). All items are listed at the beginning of each questionnaire located in Appendix D at page 206.

Dependent Variables

Four different categories of dependent variables were employed, as follows: perceptions of Web page, Web page content, and pop-up windows, recall and recognition for the website information, orienting responses, and emotional valence and intensity.
*Perception Scales.* Three scales were developed to measure participants’ perceptions of the Web page, perceptions of the news stories, and perceptions of the pop-up windows. Participants’ perceptions of the Web page were measured by asking participants to respond to each Web page as follows: “For each word below, please choose one option to indicate how well the word describes the Web site you just browsed,” followed by a series of 10 Web site attributes (*organized, interactive, useful, coherent, confusing, enjoyable, appealing, informative, interesting, clear, likely to visit for daily news needs, likely to recommend to friends or relatives of returning to the website, layout affected ability to read stories*), each placed next to a 10-point Likert-type scale anchored between “Describes Very Poorly” and “Describes Very Well.” Some items were negatively coded to ensure thoughtful answers. The adjectives were derived from Sundar and Kalyanaraman’s Website Perceptions Scale (Sundar & Kalyanaraman, 2004) and Zaichkowsky’s Personal Involvement Inventory (1985). Additionally, four other questions were added, as follows:

1) “Thinking about the news site you have just browsed as a whole, how well would you say it utilized the capabilities of the WWW medium?” followed by a 10-point Likert-type scale anchored between “Not Well At All” and “Extremely Well.”

2) “How likely are you to visit the website for your daily news needs?” followed by a 10-point Likert-type scale anchored between “Not At All Likely” and “Extremely Likely.”

3) “How likely are you to recommend this site to friends/relatives for their daily news?” followed by a 10-point Likert-type scale anchored between “Not At All Likely” and “Extremely Likely.”
4) “How much do you think the layout of the website affected your ability to read the stories?” followed by a 10-point Likert-type scale anchored between “Did Not Affect” and “Affected Very Much.”

These additional questions were adapted from Sundar’s (2000) Website Evaluations Scale.

Perceptions of Web page content were measured by asking participants to respond to all news segments featured on a page as follows: “For each word or phrase below, please choose one option to indicate how well the word describes in general the news stories you have just read”, followed by a series of 14 adjectives (accurate, believable, biased, captivating, comprehensive, clear, involving, factual, fair, informative, important, objective, persuasive, and well-written), each placed next to a 10-point Likert-type scale anchored between “Describes Very Poorly” and “Describes Very Well.” The adjectives were derived from Sundar (1999), Sundar (2000), Liu and Shrum (2002), and Sundar and Constantin (2004).

Perceptions of pop-up windows were measured by asking participants to respond to additional windows as follows: “You may or may have not seen additional windows, other than the Web page. If you did, please take a moment to answer a few questions regarding these additional windows. For each word or phrase below, please choose one option to indicate how well the word describes the additional windows”, followed by a series of 14 semantic-differential adjective pairs (pleasant/unpleasant, irritating/not irritating, entertaining/not entertaining, enjoyable/not enjoyable, important/not important, helpful/not helpful, informative/not informative, useful/not useful, made me curious/did not make me curious, boring/not boring, interesting/not interesting, factual/persuasive, distracting/not distracting, and annoying/not annoying), each placed next to a 10-point
scale. The adjectives were derived from Raman & Leckenby’s (1998) scale measuring Web advertisement characteristics.

**Free recall and recognition.** Free recall and recognition were assessed for both news stories and pop-up content. Free recall was measured by asking participants to recall as much information as possible from their experience on the Web page they had just seen, and list each idea on a separate line. No restrictions were imposed on the number of lines or number of characters per line that participants were able to write. Subsequently, free recall was coded separately for main and pop-up windows, and also for local/global and focal/peripheral information (see the *Index Construction* section on p. 77 for more information). Twenty-four recognition items (e.g., “What emerging economies put pressure on oil supplies?”), each with five multiple-choice, closed-ended response options (e.g., “a. China and India,” “b. Iraq and Saudi Arabia,” “c. Nigeria and Iran,” “d. China and Niger,” and “e. I do not remember”) measured participants’ recognition of the four news stories and the pop-up window content. Three multiple-choice questions were asked for each news story: one question measured recognition of information drawn from the story title, another one measured story lead recognition, and a third measured body recognition. Two additional questions per story were also asked, one testing participants’ recognition of its general topic, while the other was testing recognition of its background color. Participants were also asked to answer four multiple-choice questions regarding the pop-up content. One question measured the lead recognition, a second one measured body recognition, a third measured recognition of pop-up’s general content, and a fourth measured recognition of its text color. Pop-up advertisements did not display explicit titles, and therefore no question assessing title recognition was asked (all questionnaire items are listed in Appendix D, p. 206). Recognition items were further combined to assess recognition of focal vs. peripheral and local vs. global information for both Web
Orienting responses. The involuntary attention elicited by a novel, sudden, or animated stimulus has been labeled orienting response (OR). Pavlov (1927) was the first one to identify an “orienting reflex,” when a previously conditioned response failed to occur in a dog while the animal was attending to an unusual stimulus. Although the antecedents of ORs are often thought of in terms of stimulus “novelty,” Pavlov’s observations suggest that mere changes in one’s environment are responsible for ORs (Siddle, Stephenson, & Spinks, 1983).

Following Pavlov, several researchers have focused on physiological indicators of orienting responses (ORs). A variety of behaviors follow a sudden event, such as postural adjustments, skin conductance changes, pupil dilation, decrease in heart rate, a pause in breathing, and constriction of the peripheral blood vessels (Rohrbaugh, 1984). Lynn (1966), for example, had identified some of these physiological changes occurring in humans when presented with novel stimuli. They include increased skin conductance responses (SCR), increased muscle activity (EMG) and pupil dilation, activation of the EEG pattern, a decrease in heart rate, peripheral (limbic) vasoconstriction, and cephalic vasodilation. Among these, cortical arousal as reflected in brain waves and brain potential has been suggested as an important physiological indicator of ORs (Sokolov, 1963). According to Sokolov, generalized or localized brain activation when encountering a particular stimulus indicates on orienting reflex (Sokolov, 1963). For visual stimuli, for example, ORs would be reflected in a depression of the occipital alpha rhythm (Sokolov, 1963). Orienting responses have been also linked to another form of brain activation, namely the event-related brain potentials (ERPs), which are derived from EEG recordings; unlike EEG which represents spontaneous brain activity, however, ERPs are generated as
a response to specific stimuli (Andreassi, 2000). Evidence from neuropsychological studies suggests that long latency potentials (i.e., components of ERPs that occur 250 to 750 msec after an event) reflect subjective responses to expected or unexpected stimuli, including orienting responses. Orienting responses have been especially associated with a positive component that occurs approximately 300 msec after stimulus onset, named P300 (Ritter, Vaughan, & Costa, 1968).

Along with cortical arousal or activation, eletrodermal activity has also been used as an indicator of orienting responses. Numerous studies have showed that a physiological consequence of arousing involuntary attention is the elicitation of a phasic skin conductance response (Ben-Shakhar et al., 1995; Ben-Shakhar & Gati, 1987; for a review of media studies linking EDs to ORs, also see Fletcher, 1985). Consequently, stimulus characteristics that were previously linked to orienting responses, such as motion, novelty or change, have been also associated with skin conductance responses. Thus, Detenber, Simons, and Bennett, Jr. (1998) found that participants exposed to moving pictures exhibited significantly greater skin conductance response than those exposed to static versions of the same picture. Animated ads have been found to elicit stronger orienting responses (Borse & A. Lang, 2000) and greater skin conductance responses (Heo & Sundar, 2000; Sundar & Kalyanaraman, 2004) as well. At the same time, stimulus novelty, defined as changes in object characteristics compared with previously seen objects, was also linked to greater electrodermal responses (Gati et al., 1996; Ben-Shakhar, 1994).

Another type of physiological indication of orientation towards an environmental stimulus is given by short-term changes in heart rate (A. Lang, 1994; Sokolov & Caccioppo, 1997). Thus, Graham and Clifton (1966) have proven phasic heart rate response (i.e., heart rate deceleration and recovery) to be a reliable and discriminating
index of ORs. At the same time, they showed that not only the stimulus onset, but also the stimulus offset elicits the same type of reaction (Graham & Clifton, 1966; Sokolov & Caccioppo, 1997). A growing body of evidence was gathered over time, demonstrating that the occurrence of an orienting response is associated with a decrease in heart rate starting immediately after the onset of the OR-eliciting stimulus and continuing for about 4-6 seconds (Borse & A. Lang, 2000; A. Lang, 2000).

Along with cortical activation, electrodermal activity, and heart rate responses, ocular behavior has also been used in some contexts as an indicator of attention (Rayner, 1998; Viviani, 1990). More specifically, fixations and saccades have been studied extensively in association with visual attention (Buswell, 1935; Fitts, Jones, & Milton, 1950; Nakayama, Takahashi, & Shimizu, 2002; Rayner, 1998; Viviani, 1990). Fixations, for example, are considered relatively motionless gazes that last approximately 200-300 milliseconds and indicate that visual attention is directed towards a specific location within the visual scene (Rayner, 1998) and that intense cognitive processing is taking place (Viviani, 1990). Saccades, on the other hand, are rapid eye movements that indicate eyes’ shift towards a visual target. Unlike eye fixations, saccades are said to reflect a suppression of information processing (Rayner, 1998). Although generally associated with intentional, goal-directed choices concerning best locations to attend (Buswell, 1935; Peltz, Canosa, & Babcock, 2000; Yarbus, 1967), eye movements could also be indicative of orienting reflexes. The distinction between overt and covert orienting reflexes becomes very important in this context (Coren, et al., 1994; Johnson & Proctor, 2004). Thus, whereas overt orienting reflects changes in the positioning of the senses to improve perception (e.g., head or eye movements), covert orienting allows attention to be directed to a location other than the focus of the eyes (Johnson & Proctor, 2004). It is therefore suggested, following this distinction, that eye movements could only reflect overt
orientation, whereas cortical activation, electrodermal arousal, and heart rate changes could also capture covert orienting responses.

This ability to capture covert orientation even when overt shifts in attentional focus are absent is essential, especially given the empirical evidence suggesting that covert orienting affects early perceptual processing (Heinze et al., 1990) and that shifts in visual attention may not be as fast as one might assume (Ward, Duncan, & Shapiro, 1996). Neuropsychological studies provide some evidence in this sense, showing that activation in the superior colliculus reflects a shift of attention toward a stimulus and begins 50 msec after stimulus onset, while the eye movement follows approximately 200 msec later (Coren, et al., 1994).

Although pop-up windows are likely to trigger overt orientation, two physiological measures that could also capture covert orientation were chosen as OR indicators to err on the side of caution: skin conductance responses and phasic heart rate deceleration.

**Skin conductance.** Skin conductance estimates the amount of secretion of active sweat glands by measuring the level of electrical conductance through the skin, and is commonly measured in either micromhos or microsiemenens (Dawson, Schell, & Fillion, 2000). Depending on the type of stimuli being used, experimental paradigms recommend different aspects of skin conductance measurement. Experiments using discrete stimuli advocate using skin conductance responses (SCR), which measure a response to a specific part of the stimulus, phasic activity, as the effects of discrete stimuli are fairly brief. As such, the phasic aspect of skin conductance responses is commonly used as an index of orienting responses (Sokolov, 1963; Siddle, 1983). In the present study, the amplitude of skin conductance responses as showed in an 8-second interval following the onset and offset of a pop-up window was used to indicate respectively ORs at onset and ORs at
offset. The 8-second period has been indicated as sufficient to show skin conductance responses in previous studies (Dawson et al., 2000).

**Heart rate.** A physiological measure of heart activity (Electrocardiograph-ECG) was also employed to show reflexive orientation. ECG is a method of recording the electrical impulses that pass through the heart during contraction and spread to the surface of the body (Andreassi, 2000). ECG duration is measured in milliseconds, and amplitude is measured in Volts, and usually averaged over fixed periods. The time between beats, called the inter-beat interval, is recorded and then converted into heart rate (HR). Such Beats-per-Minute (BPM) scores have been widely used in previous research to document orienting responses (Borse & A. Lang, 2000; Campbell, Wood, & McBride, 1997; A. Lang, 2000).

**Emotional valence and intensity.** Many researchers organize emotion theories into two primary theoretical frameworks (see Barrett, 1998; Christie & Friedman, 2004; Detenber & Reeves, 1998; Detenber, Simons, & Reiss, 2000; Detenber & Winch, 2000). One is said to conceptualize emotions discretely or categorically (Izard, 1977; Ortony, Clore, & Collins, 1988; Plutchik, 1980), whereas the other to regard emotion as a dimensional construct (P. J. Lang, 1995, 1999; Larsen & Diener, 1992; Osgood, Suci, & Tannenbaum, 1957; Russell & Mehrabian, 1977). In general, dimensional approaches posit two or three dimensions as underlying all emotions. The two most commonly used are autonomic arousal and hedonic valence. A third, less frequently used dimension is dominance or control. Researchers typically describe the dimension of autonomic arousal as a continuous range of affective responses that vary in intensity from high to low. That is, at one end of the spectrum people feel excited, energized, or aroused and at the other they feel calm, peaceful, or unaroused. The arousal or intensity dimension of emotion has also been characterized as the sleep-tension dimension (Engen, Levy, & Schlosberg, 1958).
or as the organismic arousal reflected in an energy mobilization (Duffy, 1962). Another dimension proposed by Schlosberg (1941) is that of pleasantness-unpleasantness of emotion. Later referred to as emotional valence, this dimension is commonly characterized as ranging from pleasant or positive feelings at one end, to unpleasant or negative feelings at the other. Although other dimensions have been proposed, such as deliberative-impulsive (Osgood, 1966) or self-assured-insecure (Frijda & Phillipszoon, 1963), valence and arousal, are thought to account for most of the variance in emotional responses (Greenwald, Cook, & P. J. Lang, 1989) and can be used to effectively discriminate between emotional responses.

One of the benefits of the dimensional view of emotions is that specific physiological measures have been devised to indicate two of the primary dimensions. Thus, skin conductance responses (SCR) have been traditionally associated with the arousal dimension, whereas facial muscle movement (i.e., electromyographic, or EMG, activity) and heart rate are said to reveal differences in valence. Previous research has showed, for example, that in the context of watching moving images zygomatic activity and heart-rate acceleration occur in response to pleasant stimuli, whereas unpleasant stimuli are accompanied by corrugator activity and heart-rate slowing (Detenber et al., 1998; A. Lang, 1994; Simons et al., 1999). Similar effects have been observed in response to radio advertisements, where negatively valenced messages were accompanied by increased corrugator activity (i.e., frowning) and positively valenced messages were associated with higher zygomatic activity (i.e., smiling; Bolls, A. Lang, & Potter, 2001). Likewise, as people experience arousal, their sweat glands become active and skin conductance responses (SCR) become larger and more frequent (Dawson et al., 2000; Hopkins & Fletcher, 1994).
Along with muscular and heart activity, some have proposed that brain activation can also show emotional responses to pleasant and unpleasant stimuli. Thus, on the basis of studies of resting EEG (Davidson, 1998b; Fox & Davidson, 1991; Tomarken, Davidson, & Henriques, 1990; Wheeler, Davidson, & Tomarken, 1993), studies of facial expression (Ekman, Davidson, & Friesen, 1989; Fox & Davidson, 1988), and studies using .Im clips and slides (Davidson et al., 1990), Davidson has proposed a framework relating individual differences in emotion processing to prefrontal activation asymmetries that are primarily associated with emotional valence. Heller and her colleagues have argued for an augmented model, positing that anterior brain regions process emotional valence whereas posterior regions, especially parietal areas, may be more involved in modulating emotional arousal (Heller, 1993; Heller, Etienne, & Miller, 1995; Heller, Nitschke, Etienne, & Miller, 1997; Nitschke, Heller, Palmieri, & Miller, 1999).

The present study used two of the physiological responses mentioned above to document the irritating effect of pop-ups; thus, skin conductance levels were used to indicate arousal, whereas corrugator activity was used to indicate the negative emotional valence associated with exposure to pop-up windows.

*Skin conductance level.* Generally, the effects of chronic stimuli have been measured via skin conductance levels (SCL); unlike SCR, SCL is a measure of tonic activity, indicating responses to stimuli over a relatively longer period of time (Dawson et al., 2000). As a physiological correlate of emotion, skin conductance level has been previously used in different contexts to indicate affect intensity, or in other words, arousal (Oliver, 1994; Zillmann, 1971). Similarly, skin conductance levels were used here to document changes in average levels of negative affect experienced, as well as excitation transferred from one web page to another (i.e., accumulated over multiple exposures to pop-ups).
Modeling SCL after measures used in previous research (e.g., Oliver, 1994), SCL change scores were obtained by subtracting the average SCR per second for the duration of exposure to a webpage (prior and after exposure to pop-ups) from the average SCR during the second immediately preceding the exposure to a pop-up window (see the Index Construction section on page 76 for detailed information).

Facial electromyography. Corrugator activity was monitored via EMG (electromyography) recordings. Facial EMG is considered a good quantitative index of both overt expressive behavior and subjective emotional state (Fridlund & Izards, 1983), and has been used extensively by psychophysologists to measure the valence of emotional response to environmental stimuli (Bolls et al., 2001). This physiological method measures the electrical signal generated by the occurrence of action potentials across a group of muscles dedicated to moving specific parts of the face (Cacioppo, Tassinary, & Fridlund, 1990). Contraction of the corrugator muscle moves the brow downward and inward, associating the corrugator muscle with frowning (Fridlund & Izard, 1983). Thus, increased corrugator activity has been considered a good indicator of unpleasant experiences or negative emotions (Bolls et al., 2001; Fridlund & Izards, 1983). Generally, the duration and amplitude (i.e., strength) of muscular contractions are measured and averaged over fixed periods, giving the amount of frowning or smiling of a participant. In this study, EMG change scores for corrugator activity were computed by subtracting the mean EMG per half second during the half second immediately prior to the onset of a pop-up window from the half-second time periods during user’s exposure to the respective pop-up. The 500 ms period was used for the EMG averages as physiological research indicated that changes in muscular tension are likely to occur during the respective period of time (see Andreassi, 2000).
Control Measures

Navigational behavior within the web page was completely restricted so that the level of interaction with the page, as well as the amount of content to which participants were exposed, were kept constant across all conditions.

Experimental Procedures

Participants were scheduled to come, one by one, to a research laboratory equipped with a computer connected to the Internet, and BIOPAC instruments set up for physiological recordings. Upon arrival, the participant was greeted by the investigator and informed of the topic of the study; the participant was then asked to read and sign an informed consent form. After the participant has given written consent to participate in the experiment, she was led to a room that housed the computer. At that point, the participant was seated in a comfortable chair while the experimental procedures were introduced. After giving the first verbal experimental instruction regarding general procedure for the experiment, the investigator placed the electrodes on participant’s skin in order to collect physiological data. Once the electrodes were properly placed and the experimental procedure explained in more detail, the participant was instructed to turn on the computer monitor and proceed as directed. The first screen contained a general instructions page briefly reminding the participant about the procedures, and read as follows: “You will be looking at two different news pages for a brief period of time. After each news page, you will be automatically redirected towards an online questionnaire. When you are finished with the second questionnaire, please notify the investigator.” This page also contained a javascript programming code meant to randomly assign participants to one of the nine conditions.

Upon clicking the “start” link, the participant was redirected to a page containing
more explicit instructions for the first web page: “The upcoming page is a news page containing information about the recent general elections in Italy [about the oil crisis]. Please learn as much as you can about this topic, and also evaluate the quality of the news writing for all news stories featured on the page. You will only have a very limited amount of time on the page. At the end of that time period, you will be automatically redirected towards an online questionnaire.” Once she read the instructions, the participant accessed the first Web page. As described in the Stimulus Material section, the Web page contained four stories on the same topic. The time of exposure to the news page was limited to 70 seconds; this time interval was previously determined to be necessary for completely reading at least one story, but not enough to read all four. During this period, the participant was exposed to either none, one or three pop-up windows. The pop-up windows were manipulated so that the content was either an advertisement or a factoid, and the location was chosen so that the pop-up was partly covering either the top-left, top-right, bottom-left, or bottom-right story. All four story titles were visible at all times. In the three pop-up conditions, all three pop-ups had the same content and appeared in the same location in order to control for the amount of information to which participants were exposed and to correctly assess the effect of pop-ups on location-specific memory. The first pop-up appeared two seconds after the complete loading of the news page (so that the participant would not have time to start reading and focus on a particular story). Two reasons were important in selecting such a short period: on the one hand, a pop-up appearing shortly after the complete page upload would prevent participants from being already fixated on a story; on the other hand, the effects of pop-ups might have been greater when the interruption occurred earlier during the task (Hodgetts & Jones, 2005). Once the pop-up was on the screen, he participant could either close the pop-up or ignore it. If it had been ignored, the pop-up would automatically close after 10 seconds from
onset. In previous visual cognition research, most of the discrete stimuli triggering orienting responses were shown for 5 seconds or less (Ben-Shakhar & Gati, 1987; Gati & Ben-Shakhar, 1990; Keane, Hayward, & Burke, 2003; Neumann et al., 1992). In the present study, however, the pop-up windows contained verbal rather than graphic information, and therefore the exposure time was extended to ensure that some information processing occurred if the participant attended to the pop-up window. Given the ratio of amount of pop-up information to amount of story information, 10 seconds were deemed necessary for reading the pop-up content. Maintaining the pop-up presence on the screen for a period longer than 5 seconds had also the purpose of ensuring appropriate conditions for testing the three mechanisms hypothesized in H2, H4, and H6. If attentional spotlight offered a valid explanation for pop-ups’ effects on cognitive processes, then the longer the pop-up would be on the screen, the longer the users’ attentional focus may be directed towards the location of the pop-up, even after its offset. Previous research has shown that the longer attention is maintained to a particular source of stimulation, there is an increasing tendency to further maintain attention to that source. This phenomenon, labeled attentional inertia, seems to go beyond involvement with a particular content (Anderson & Burns, 1991). At the same time, the longer the pop-up will be on the screen, the more it will interfere with the processing of main webpage information, and also the more likely it is to increase users’ experienced frustration.

In the three pop-up conditions, the second pop-up appeared after 14 seconds and the third after 26 seconds from the complete page upload. Similarly to the first pop-up, the participant had the option to close them. If the participant ignored them, the pop-ups were programmed to auto-close after 10 seconds from their appearance on the screen. The time for which each pop-up stayed on the screen was recorded and controlled for in all analyses.
At the same time, ECG, SCR, and corrugator activity (EMG) were recorded throughout participant’s exposure to the Web page. Physiological data were recorded using a BIOPAC MP150 data acquisition system equipped with two TEL100 amplifying units. The BIOPAC system was connected to a Power Mac with a G4 processor, and the recorded data were stored locally on the Mac computer. To record skin conductance responses, two Ag-AgCl electrodes with 6 mm contact area were attached to the ring and middle fingers of the participant’s non-dominant hand (i.e., the hand not used to control the mouse). The electrodes were mounted in individual, ergonomically designed, molded polyurethane housings for improved contact, complete with a stretchable VelcroTM strap that ensured a snug fit. These electrodes were part of a single assembly and shielded to minimize noise interference and improve recordings. The 1.6mm electrode cavities were also filled with an isotonic gel to improve the quality of the signal. The signal was captured at a rate of 200 samples per second, initially recorded in Volts, and subsequently transformed into micromhos by BIOPAC’s Acqknowledge software that was also used to record all physiological responses. For ECG measurement, a transducer was used to detect the physiological signal from the surface of the skin and transmit the heart rate signal to the recording computer. Three disposable pre-gelled electrodes with a 1 cm contact area were placed on participant’s inner part of the left wrist, and right and left ankles right above the ankle bone (lead III); a three-way shielded lead cable was connected to all three electrodes as follows: the negative white lead was connected to the electrode placed on the left wrist, the positive read lead was connected to the electrode placed above the left ankle, ad the negative black lead was connected to the electrode placed above the right ankle. ECG was captured at a rate of 200 samples per second; its duration was measured in milliseconds and its amplitude was measured and recorded in Volts. For EMG recordings, muscular contractions provoked by facial expressions were detected as biopotentials
measured at the surface of the skin. These signals were captured via reusable 4 mm Ag-AgCl electrodes and transmitted to the recording computer through a shielded three-way transducer. The electrodes and corresponding leads were placed on the left side of participant’s face, as follows: the negative lead was placed slightly above the left eyebrow, close to the nose. The positive lead was placed 1 cm away from the negative lead, approximately above the middle of the eyebrow, along the same muscle (i.e., corrugator supercilii). The ground lead was placed approximately in the middle of the forehead. The EMG signals were captured at a rate of 1000 samples per second and averaged across every 25 samples to eliminate noise; they were measured and recorded in minivolts. For more information about physiological recording using MP150, please visit BIOPAC at www.biopac.com.

Throughout participant’s exposure to the Web page, the onset and offset of each pop-up was signaled within the same file containing physiological measurements. During this time, the experimenter was able to monitor a participant’s online behavior via a control monitor connected to her computer. This procedure allowed the experimenter to flag when a pop-up disappeared from the screen if a participant closed it prior to the 10-second auto-close limit. The flagging procedure involved pressing a switch attached to the same hardware unit that captured participants’ physiological responses.

After the 70-second period elapsed, the participant was automatically directed towards the first online questionnaire, which contained measures for self-assessed emotional state, perceptions of the Web page, Web page content, and pop-up windows, as well as measures of free recall and recognition for each story title, story lead, story body, and pop-up window. After successfully submitting the questionnaire, the participant was redirected to the second Web page and repeated the same procedural steps. The pop-up windows associated with the second page appeared either in the same location as
previously, or in a different location; the news pages and pop-up locations were also counterbalanced for order. At the end, the participant was thanked for participating and answered any additional questions regarding the experiment.

Scale and Index Construction

Skin conductance responses. The largest amplitude of skin conductance responses during the 8-second period following (the onset or offset of) a pop-up window was used to indicate orienting responses at respectively onset and offset. The amplitude was determined by subtracting the SCR value at the bottom of an ascending SCR curve from the peak value (Figure 5). The 8-second period has been indicated as sufficient to show skin conductance responses following exposure to a discrete stimulus (Dawson et al., 2000).

![Figure 5. Main components of skin conductance responses.](http://instruct1.cit.cornell.edu/courses/ee476/FinalProjects/s2006/hmm32_pjw32/index.html)

The distribution of the SCR amplitude was not normal, and therefore the SCR scores were transformed using the log function of the initial SCR amplitudes. All subsequent analyses were performed using the log function. The means and standard errors reported further pertain to the initial SCR scores.

Skin conductance levels. SCL change scores were computed by subtracting the average SCL during the second immediately preceding the onset of a pop-up from the average SCL per second during the exposure to the respective pop-up window. Similar
procedures have been previously used in media studies involving excitation transfer (e.g., Oliver, 1994).

**Heart rate.** The time between beats, called the inter-beat interval, was recorded and then converted into heart rate (HR). The BPM change scores were then computed by subtracting the average BPM per second during the second immediately prior to pop-up onset from the average BPM per second during the following 10 seconds. Similar BPM change scores were computed for pop-up offset, with the average BPM per second during the second immediately prior to pop-up offset being subtracted from the average BPM per second during the following 15 seconds. A growing body of evidence has demonstrated that phasic attention is most likely accompanied by a decrease in heart rate beginning immediately after the onset of the stimulus and continuing for about 4-6 seconds (Borse & A. Lang, 2000; Campbell et al., 1997). A 15-second period is thus deemed sufficient to observe both the heart rate deceleration and its quick recovery (Diao, 2001; Diao & Sundar, 2004; A. Lang, 2000; Reeves & Nass, 1996; Thorson & A. Lang, 1992). This period was reduced to only 10 seconds for the pop-up onset so as not to confound reactions to stimulus onset with those to stimulus offset.

**Facial EMG.** EMG change scores for corrugator activity were computed similarly. As EMG changes were showed to occur within a 500 ms period (Andreassi, 2000), EMG change scores were obtained by subtracting the average EMG during the 1/2 second immediately prior to the onset of a pop-up window from the half-second time periods during user’s exposure to the respective pop-up.

**Free recall and recognition.** To measure free recall, participants were asked to write as much as they could recall about the page they have previously seen while listing each idea on a separate line. Each line written was then given the value 1 and matched with the title, lead, or body of a story, or with the lead or body of a pop-up window. The
total recall for the title, lead, and body of each story, as well as the total recall for the lead and body of each pop-up were then computed by adding the number of lines or separate ideas that corresponded to each of those. Finally, recall scores were additively combined to determine the total recall for each story, the total recall for the news page, the total recall for the pop-up window, and the location-specific recall (i.e., total recall for the story associated with the pop-up location). The location-nonspecific recall was obtained by averaging across the other three stories. Recognition was measured using multiple-choice questions regarding the title, leads, and bodies of each story and pop-up window. All correct answers were given the value 1 and all incorrect or “do not know” answers were given the value 0. Subsequently, recognition scores were similarly combined to obtain total recognition, location-specific and location-nonspecific recognition for a story, a Web page, or a pop-up window.

*Self-reported frustration.* An exploratory factor analysis was conducted upon the 13 items related to self-reported emotional state. A matrix of Pearson's product-moment correlations was first generated from participants’ ratings of the 13 items. Unities in the diagonal were maintained and a principal components analysis with varimax rotation was performed. The number of common factors was determined by counting the number of principal components with eigenvalues greater than or equal to one. The resulting factors were then examined for common, rather than specific, variance by applying the items-on-factor criterion (i.e., at least two items with their highest loading on a given factor). An item was said to load on a given factor provided its loading on that factor was 0.6 or higher, with secondary loadings on other factors being no greater than 0.4 (McCroskey & Young, 1979). The same rules were applied for all factor analyses that follow. This analysis yielded 4 principal components with eigenvalues greater than one, together accounting for 74.26 percent of the variance. Upon rotation, all measures were clearly
differentiated, with their primary loading exceeding 0.6 and all other loadings below 0.4.

The items loading on the 4 factors were additively combined (after reverse-coding negatively valenced items) to form the four indices. Table 1 shows the items loading on each of the four composite indices, along with their reliabilities.

Table 1
Factor Loadings and Reliabilities for Self-reported Emotional States

<table>
<thead>
<tr>
<th>Factor</th>
<th>Items</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frustration</td>
<td>irritated, frustrated, angry, annoyed</td>
<td>Cronbach’s $\alpha$ = .89</td>
</tr>
<tr>
<td>Happiness</td>
<td>excited, energetic, happy, pleased</td>
<td>Cronbach’s $\alpha$ = .78</td>
</tr>
<tr>
<td>Tension</td>
<td>tense, clutched-up, calm (reverse coded)</td>
<td>Cronbach’s $\alpha$ = .79</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>wide-awake, drowsy (reverse coded)</td>
<td>Pearsons’ $r = .59$</td>
</tr>
</tbody>
</table>

Perceptions of the Web page. An exploratory factor analysis was conducted upon the 14 items related to perceptions of the Web page. The analysis yielded 3 principal components with eigenvalues greater than one, together accounting for 63.23 percent of the variance. Upon rotation, all measures were clearly differentiated, with their primary loading exceeding 0.6 and all other loadings below 0.4. Only one item (i.e., page layout influenced reading ability) loaded significantly on the third factor, and was thus used separately in further analyses. The items loading on the remaining two factors were additively combined (after reverse-coding negatively valenced items) to form the two composite indices. Table 2 shows the items loading on each of the indices, along with their reliabilities.
Table 2

Factor Loadings and Reliabilities for Perceptions of the Web Page

<table>
<thead>
<tr>
<th>Factor Attractiveness</th>
<th>Cronbach’s α = .88</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>reflective of WWW capabilities, interactive, appealing, interesting, could be used for daily news, could be recommended to friends</td>
</tr>
<tr>
<td>Page Quality</td>
<td>Cronbach’s α = .82</td>
</tr>
<tr>
<td></td>
<td>organized, useful, coherent, confusing (reverse coded), informative, clear</td>
</tr>
</tbody>
</table>

Perceptions of the Web page content. An exploratory factor analysis was conducted upon the 14 items related to perceptions of the Web page content. The analysis yielded 3 principal components with eigenvalues greater than one, together accounting for 64.33 percent of the variance. Upon rotation, all measures were clearly differentiated, with their primary loading exceeding 0.6 and all other loadings below 0.4. Only one item (i.e., biased) loaded significantly on the third factor, and was thus used separately in further analyses. The items loading on the remaining two factors were additively combined (after reverse-coding negatively valenced items) to form the two composite indices. Table 3 shows the items loading on each of the indices, along with their reliabilities.

Table 3

Factor Loadings and Reliabilities for Perceptions of the Web Page Content

<table>
<thead>
<tr>
<th>News Quality</th>
<th>Cronbach’s α = .91</th>
</tr>
</thead>
<tbody>
<tr>
<td>accurate, believable, factual, fair, informative, important, objective, comprehensive, clear, well-written</td>
<td></td>
</tr>
<tr>
<td>News Appeal</td>
<td>Cronbach’s α = .75</td>
</tr>
<tr>
<td>captivating, involving, persuasive</td>
<td></td>
</tr>
</tbody>
</table>
Perceptions of the pop-up windows. An exploratory factor analysis was conducted upon the 14 items related to perceptions of the Web page. The analysis yielded 2 principal components with eigenvalues greater than one, together accounting for 63.37 percent of the variance. Upon rotation, 13 measures were clearly differentiated, with their primary loading exceeding 0.6 and all other loadings below 0.4. Only one item (i.e., boring) did not load significantly on any of the two factors, and was thus used separately in further analyses. The items loading on the two factors were additively combined (after reverse-coding negatively valenced items) to form the two composite indices. Table 4 shows the items loading on each of the indices, along with their reliabilities.

Table 4
Factor Loadings and Reliabilities for Perceptions of Pop-Up Windows

<table>
<thead>
<tr>
<th>Pop-Up Annoyance</th>
<th>irritating, distracting, annoying, pleasant (reverse coded), entertaining (reverse coded), enjoyable (reverse coded)</th>
<th>Cronbach’s α = .87</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pop-Up Informational Value</td>
<td>important, helpful, informative, useful, made me curious, interesting, factual</td>
<td>Cronbach’s α = .90</td>
</tr>
</tbody>
</table>

Data Analysis

First, a series of overtime mixed-model analyses were performed to understand the extent of physiological reactions to pop-up windows. Thus, BPM change scores at the onset and offset of pop-ups, as well as SCL and EMG change scores during exposure to pop-ups were run against quadratic components of time. Similar analyses were further replicated while including the page number, pop-up number, or pop-up type as independent variables. These analyses tested whether pop-up windows elicit orienting
responses (BPM) or negative emotions such as frustration and annoyance (SCL and EMG). All the analyses included order of Web page presentation as a control variable. Other control variables such as pop-up type, pop-up number, and page number were also included in those analyses that did not feature them as independent variables. Two additional single-sample t-tests were used to check whether the amplitude of skin conductance responses at the onset and offset of pop-up windows were significantly different from zero; these tests along with analyses of BPM changes following stimulus onset and offset provided a clear picture of the extent and nature of ORs as a response to pop-ups. As SCR amplitude scores were not normally distributed, log functions of the scores were used in further analyses.

To test the attentional spotlight hypotheses, simple independent-sample t-tests were first performed to check existent differences between location-specific and location non-specific recall and recognition. In order to be able to eliminate natural tendencies to focus on particular screen locations, as well as to control for order of Web page presentation, or pop-up type, subsequent tests used mixed-model analyses of covariance, with pop-up location nested within similarity of pop-up location as the between-participants factor, story position as the within-participants factor, and recall and recognition as dependent variables. Similar analyses were run for total recall score per story, title recall, lead and body recall, recognition score per story, and title, lead and body recognition.

The relationship between recall/recognition for Web page and recall/recognition for pop-ups was tested using simple and multiple (including pop-up and page number as predictors) linear regressions. Additional analyses of covariance were used to test the relationships between the presence of pop-up windows and the degradation in one’s recall and recognition of page information. These analyses included pop-up presence as
independent variable, recall and recognition as dependent variables, and order of page presentation, pop-up number, and page number as control variables.

The impact of presence and number of pop-up windows on negative affect was then tested using both analyses of variance (when negative affect was measured via self-reports) and overtime mixed-model analyses (when negative affect was indicated by EMG changes). Subsequently, the relationships between the presence and the number of pop-ups, on the one hand, and the locus of attention, on the other, were tested via mixed-model analyses, where the presence-absence of pop-ups and the number of pop-ups were included as between-participants factors, the locus of attention (titles, lead, body) was the within-participants factor, and overall recall and recognition, as well as the recall and recognition of each story, were dependent variables.

When presence or absence of pop-ups was included in the analysis as an independent variable, the comparison group was the control, no pop-up group. In all other cases, two or more treatment groups were compared against each other (e.g., one-ad group versus three-ad group, etc.).
Chapter 4

Results

Hypotheses 1a-1b predicted that the onset and offset of pop-up windows would elicit orienting responses. To test these hypotheses, the BPM change during the 10 seconds following the pop-ups’ onset and the 15 seconds following the pop-ups’ offset was run against time and a quadratic component of time. A significant effect of the quadratic component of time on BPM change at pop-up onset was found, $F(1, 3547) = 21.44, p < .001$, such that the heart rate decelerated immediately after the pop-up onset, followed by a quick recovery (Figure 6).

![Figure 6. BPM change following the onset of a pop-up window](image)

A significant effect of the quadratic component of time on BPM change at pop-up offset was also found, $F(1, 4225) = 6.77, p < .01$ (Figure 7). As the pattern was not clear, a follow-up analysis was performed, with a quadratic component of time and user action (whether the participant closed or not the pop-up window) as predictors and BPM change following pop-up offset as the response. An almost significant interaction between the quadratic component of time and user action on BPM change following the pop-up offset was discovered, showing $F(3, 4222) = 2.29, p = 0.07$, showing OR (i.e., heart rate
deceleration and recovery) only for those participants who did not close the pop-up (Figure 8).

![BPM Change at Pop Up Offset](image1)

*Figure 7. BPM change following the offset of a pop-up window*

![BPM Change at Pop-Up Offset as a Function of User Action](image2)

*Figure 8. BPM change following the offset of user-closed vs. auto-closed pop-up windows*

As additional tests for hypotheses 1a-1b, two one-sample t-tests were run to check whether the amplitude of skin conductance responses following the onset and offset of pop-ups was significantly different from zero. The analyses showed that the amplitude of both SCR at onset [for the log function of SCR at pop-up onset, \( t(435) = -19.44, p < .001 \)] and SCR at offset [for the log function of SCR at pop-up offset, \( t(429) = -23.32, p < .001 \)]
was significantly greater than zero. Moreover, a paired-sample t-test showed that SCR at onset was significantly greater than the SCR at offset [for the log functions of SCR at pop-up onset and offset, \( t(421) = 4.68, p < .001; \] Figure 9].

![Amplitude of SCR Following the Pop-Up Onset and the Pop-Up Offset](image)

*Figure 9. Amplitude of skin conductance responses following the onset and offset of pop-ups*

Overall, these findings suggest that the onset of pop-ups do elicit orienting responses, lending full support to hypothesis 1a. At the same time, they show that the offset of pop-up elicit orienting responses only for those users who do not close the pop-up windows, lending only partial support to hypothesis 1b.

Hypothesis 2 predicted, following the spotlight model of attention that stories associated with the location of the pop-ups would be recalled and recognized better than stories not associated with the location of the pop-ups. To test these predictions, two paired-samples t-tests were performed initially to test possible differences between recall and recognition scores for stories associated with the pop-ups and the recall and recognition scores averaged across the other three stories. The results show that the recall scores for stories associated with the pop-ups (\( M = .72, SE = .08 \)) were significantly higher
than the average recall for the other three stories ($M = .50$, $SE = .08$), $t (232) = 2.82$, $p < .01$. However, recognition scores were not different.

Two mixed-model analyses of variance were also performed, with the pop-up location nested within similarity of pop-up location as the between-participants factor, story position as the within-participants factor, and free recall and recognition as responses. These and all additional mixed-model analyses reported here employed a multivariate approach using Wilks’ criterion. The first analysis showed a significant main effect of story location on total recall [$F (2.71, 690.85) = 19.20$, $p < .001$, partial $\eta^2 = .075$], with the top left story having the highest recall scores and the bottom right story having the lowest scores (Table 5).

Table 5

<table>
<thead>
<tr>
<th>Effect of Story Location on Free Recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Left Story</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Free Recall</td>
</tr>
</tbody>
</table>

Wilks’ $\Lambda = .83$, $F (3, 242) = 10.41$, $p < .001$, partial $\eta^2 = .172$

*Note: Means not sharing a subscript in common differ at $p < .05$ based on LSD post-hoc tests.*

More importantly, it also showed an almost significant interaction between pop-up location and story location on free recall [$F (10.84, 690.85) = 1.78$, $p = .05$, partial $\eta^2 = .03$; Figure 10]. Thus, whenever the pop-ups were associated with the top left story, the total recall for the top left story was significantly greater than the total recall for any of the other three stories. Similarly, whenever the pop-ups were associated with the top right story, the total recall for the top right story was significantly greater than the total recall of any other story with the exception of the top left story. A similar pattern was also found
for the bottom left story, with the total recall being slightly greater for the bottom left story compared to the top right story, and significantly greater for the bottom left story rather than the bottom right story whenever the pop-ups were associated with the bottom left story. Although not statistically significant, the total recall for the bottom right story tended to be higher whenever the pop-ups were associated with the bottom right story rather than being associated with any of the other stories (Table 6).

Thus, with the exception of top-left stories, news stories seemed to be better recalled when they were associated with pop-up windows as opposed to when they were not.

The second analysis showed only a significant main effect for story location on total recognition \([F(2.91, 663.75) = 87.62, p < .001, \text{partial } \eta^2 = .28]\), with the top left story having the highest recognition scores and the bottom stories having the lowest scores.
Table 6

Post-Hoc Tests for the Interaction Effect between Story Location and Pop-Up Location on Total Recall

<table>
<thead>
<tr>
<th></th>
<th>Pop-Up on Bottom Left Story</th>
<th>Pop-Up on Bottom Right Story</th>
<th>No Pop-Up</th>
<th>Pop-Up on Top Left Story</th>
<th>Pop-Up on Top Right Story</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Recall for Top Left Story</td>
<td>0.667&lt;sub&gt;<em>Aa</em>&lt;/sub&gt;</td>
<td>1.033&lt;sup&gt;<em>B</em>&lt;/sup&gt;</td>
<td>0.769&lt;sub&gt;<em>ABa</em>&lt;/sub&gt;</td>
<td>0.968&lt;sub&gt;<em>ABa</em>&lt;/sub&gt;</td>
<td>0.955&lt;sub&gt;<em>ABa</em>&lt;/sub&gt;</td>
</tr>
<tr>
<td>Total Recall for Bottom Left Story</td>
<td>0.600&lt;sub&gt;<em>Aa</em>&lt;/sub&gt;</td>
<td>0.533&lt;sub&gt;<em>Ab</em>&lt;/sub&gt;</td>
<td>0.423&lt;sub&gt;<em>Aa</em>&lt;/sub&gt;</td>
<td>0.460&lt;sub&gt;<em>Aa</em>&lt;/sub&gt;</td>
<td>0.379&lt;sub&gt;<em>Aa</em>&lt;/sub&gt;</td>
</tr>
<tr>
<td>Total Recall for Top Right Story</td>
<td>0.422&lt;sub&gt;<em>Ab</em>&lt;/sub&gt;</td>
<td>0.600&lt;sup&gt;<em>A</em>&lt;/sup&gt;</td>
<td>0.654&lt;sub&gt;<em>ABCa</em>&lt;/sub&gt;</td>
<td>0.333&lt;sub&gt;<em>Bb</em>&lt;/sub&gt;</td>
<td>0.894&lt;sub&gt;<em>Ca</em>&lt;/sub&gt;</td>
</tr>
<tr>
<td>Total Recall for Bottom Right Story</td>
<td>0.200&lt;sub&gt;<em>Ab</em>&lt;/sub&gt;</td>
<td>0.383&lt;sub&gt;<em>Ab</em>&lt;/sub&gt;</td>
<td>0.385&lt;sub&gt;<em>Aa</em>&lt;/sub&gt;</td>
<td>0.302&lt;sub&gt;<em>Ab</em>&lt;/sub&gt;</td>
<td>0.212&lt;sub&gt;<em>Ab</em>&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

Wilks’ Λ = .83, \( F (3, 242) = 10.41, p < .001 \), partial \( \eta^2 = .172 \)

*Note:* Within rows, means not sharing an upper case subscript are significantly different at \( p < .05 \) based on LSD post-hoc tests. Within columns, means not sharing lower case subscript are significantly different at \( p < .05 \) based on LSD post-hoc tests.
Similar analyses were also conducted separately for story titles, story leads, and story bodies. A significant main effect of story location on free recall of story titles was found \[ F(2.37, 604.5) = 16.18, p < .001, \text{ partial } \eta^2 = .06 \], with titles for the top left story being recalled most often, and the titles of the bottom stories being recalled the least (Table 8).

Table 7

<table>
<thead>
<tr>
<th></th>
<th>Top Left Story</th>
<th>Bottom Left Story</th>
<th>Top Right Story</th>
<th>Bottom Right Story</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Recognition</td>
<td>2.904\textsubscript{a}</td>
<td>1.480\textsubscript{b}</td>
<td>1.871\textsubscript{c}</td>
<td>1.534\textsubscript{b}</td>
</tr>
</tbody>
</table>

Wilks’ \( \Lambda = .5, F(3, 226) = 75.35, p < .001, \text{ partial } \eta^2 = .5 \)

Note: Means not sharing a subscript in common differ at \( p < .05 \) based on LSD post-hoc tests.

Similarly, significant main effects of story location on free recall of story leads \[ F(2.78, 708.46) = 3.45, p < .05, \text{ partial } \eta^2 = .014 \], free recall of story bodies \[ F(2.74, 699.52) = 10.70, p < .001, \text{ partial } \eta^2 = .04 \], recognition of story titles \[ F(2.99, 749.59) = 79.55, p < .001, \text{ partial } \eta^2 = .24 \], recognition of story leads \[ F(2.86, 715.01) = 10.72, p < .001, \text{ partial } \eta^2 = .04 \], and recognition of story bodies \[ F(2.58, 625.77) = 23.54, p < .001, \text{ partial } \eta^2 = .09 \] were found, with the top left story having the highest scores and the bottom stories generally having the lowest scores (Table 8). Thus, free recall of a story was significantly influenced by the location of the pop-up (i.e., whether the pop-up was located near the story or was located elsewhere on the screen), whereas story recognition was not affected by pop-up location. Given these findings, hypothesis 2 was partially supported.
Table 8

Effect of Story Location on Recall and Recognition of Story Title, Lead, and Body

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<td>Story</td>
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<tr>
<td>Title Recall</td>
<td>.199&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.055&lt;sub&gt;b&lt;/sub&gt;</td>
<td>.135&lt;sub&gt;c&lt;/sub&gt;</td>
<td>.032&lt;sub&gt;b&lt;/sub&gt;</td>
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<td></td>
<td>Wilks’ Λ = .86, F (3, 253) = 13.27, &lt;i&gt;p&lt;/i&gt; &lt; .001, partial η&lt;sup&gt;2&lt;/sup&gt; = .14</td>
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<td>Lead Recall</td>
<td>.170&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.157&lt;sub&gt;ab&lt;/sub&gt;</td>
<td>.103&lt;sub&gt;bc&lt;/sub&gt;</td>
<td>.086&lt;sub&gt;c&lt;/sub&gt;</td>
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<td>Wilks’ Λ = .97, F (3, 253) = 3.07, &lt;i&gt;p&lt;/i&gt; &lt; .05, partial η&lt;sup&gt;2&lt;/sup&gt; = .04</td>
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<td>Body Recall</td>
<td>.496&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.251&lt;sub&gt;bc&lt;/sub&gt;</td>
<td>.318&lt;sub&gt;b&lt;/sub&gt;</td>
<td>.160&lt;sub&gt;c&lt;/sub&gt;</td>
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<td></td>
<td>Wilks’ Λ = .90, F (3, 253) = 8.93, &lt;i&gt;p&lt;/i&gt; &lt; .001, partial η&lt;sup&gt;2&lt;/sup&gt; = .10</td>
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<td>Title Recognition</td>
<td>.752&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.275&lt;sub&gt;c&lt;/sub&gt;</td>
<td>.580&lt;sub&gt;b&lt;/sub&gt;</td>
<td>.222&lt;sub&gt;c&lt;/sub&gt;</td>
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<td>Wilks’ Λ = .51, F (3, 249) = 78.6, &lt;i&gt;p&lt;/i&gt; &lt; .001, partial η&lt;sup&gt;2&lt;/sup&gt; = .49</td>
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<td>Lead Recognition</td>
<td>.507&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.286&lt;sub&gt;b&lt;/sub&gt;</td>
<td>.314&lt;sub&gt;b&lt;/sub&gt;</td>
<td>.304&lt;sub&gt;b&lt;/sub&gt;</td>
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<tr>
<td></td>
<td>Wilks’ Λ = .91, F (3, 248) = 8.66, &lt;i&gt;p&lt;/i&gt; &lt; .001, partial η&lt;sup&gt;2&lt;/sup&gt; = .10</td>
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<tr>
<td>Body Recognition</td>
<td>.387&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.118&lt;sub&gt;c&lt;/sub&gt;</td>
<td>.125&lt;sub&gt;bc&lt;/sub&gt;</td>
<td>.193&lt;sub&gt;b&lt;/sub&gt;</td>
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<td>Wilks’ Λ = .80, F (3, 241) = 20.02, &lt;i&gt;p&lt;/i&gt; &lt; .001, partial η&lt;sup&gt;2&lt;/sup&gt; = .2</td>
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Note: Means not sharing a subscript in common differ at <i>p</i> < .05 based on LSD post-hoc tests.
Hypothesis 3a predicted that the amount of location-specific recall and recognition would decrease with repeated exposure to pop-ups. In contrast, hypothesis 3b predicted that the amount of location-specific recall and recognition would remain constant over multiple exposures to pop-up windows. Similar mixed-model analyses of variance were employed to test these alternative hypotheses, with the pop-up location and number of pop-ups featured on a page as the between-participants factors, story position as the within-participants factor, and free recall and recognition as responses. The analyses for both free recall \( \text{Wilks’ } \Lambda = .95, F(18, 667.99) = 0.68, p = .84 \) and recognition \( \text{Wilks’ } \Lambda = .92, F(18, 594.45) = 1.05, p = .41 \) were not significant. Additionally, two analyses of covariance were used to test H3a and H3b, with page number as the independent variable, location-specific recall and location-specific recognition as dependent variables, and order of Webpage presentation, number of pop-ups, and type of pop-ups as covariates. No significant effect of page number was found for either location-specific recall or location-specific recognition. Therefore, location-specific recall and recognition were not diminishing with multiple exposures to pop-ups, lending support to hypothesis H3b.

Hypothesis 4a predicted degradation in one’s recall and recognition for web page information when exposed to pop-up windows. This hypothesis was tested using analyses of covariance, with presence or absence of pop-ups as the predictor, total recall and recognition for web page information as the response, and order of page presentation, number of pop-ups per page, and type of pop-ups as covariates. No analysis was statistically significant, although the recognition of web page information tended to be slightly higher in the absence of pop-ups \( (M = 8.59, SE = .65) \) than in the presence of pop-ups \( (M = 7.63, SE = .21) \), \( F(1, 231) = 1.98, p < .09 \). Thus, hypothesis 4a was not supported.
Hypothesis 4b predicted that greater recognition for pop-up information would be associated with lower recall for the web page information. A bivariate regression was conducted to test this prediction, with pop-up recognition as the predictor and web page recall as the response. An almost significant effect of pop-up recognition on web page recall was found \( F(1, 216) = 3.76, p = .05, \beta = .18, R^2 = .02 \). However, this effect was in the opposite direction from the one predicted, and thus hypothesis 4b failed to receive support.

Hypothesis 4c predicted that the degradation in recall for web page information would be more severe when the user would face multiple as opposed to one pop-up per news page. Neither the number of pop-ups per page nor the interaction between the number of pop-ups per page and the amount of recognition for pop-up information significantly predicted the amount of recall for news page information; hence hypothesis 4c failed to receive support.

Hypothesis 5a predicted that the occurrence of pop-up windows would be associated with negative emotions. This hypothesis was tested using both physiological and psychological responses. First, the EMG change scores were tested against a linear and a quadratic component of time. No significant effect was found for either time or the quadratic component of time on EMG change scores. However, the sample size for this analysis was fairly low due to the equipment failure mentioned in the previous section. Subsequently, a t-test was used to check whether the presence or absence of pop-ups predicted the level of self-reported frustration. A significant effect of presence or absence of pop-ups was found, \( t(258) = 2.08, p < .05 \), with the absence of pop-ups eliciting increased level of self-reported frustration \( (M = 20.38, SE = 1.67) \) compared to the presence of pop-up windows \( (M = 16.72, SE = 0.56) \). However, when performing analyses of covariance by adding order of page presentation, pop-up type, and number of pop-ups
per page, the pop-up presence or absence did not significantly impact self-reported frustration. Hence, hypothesis 5a did not receive support.

Hypothesis 5b predicted that skin conductance levels would increase with multiple exposures to pop-up windows. To test this, SCL change scores were tested against a linear component of time, a quadratic component of time, news page number, and pop-up number within a page. An almost significant interaction between the quadratic component of time and pop-up number on SCL change was found, $F(3, 3936) = 2.28, p < .05$; the pattern, however, went opposite of the direction suggested by the hypothesis, with SCL decreasing rather than increasing with multiple exposures to pop-up windows (Figure 11). Instead of excitation transfer, a process of habituation seems to take place in terms of skin conductance levels.

![Effect of Pop-Up Number on SCL Change Scores](image)

*Figure 11. Interaction effect between pop-up number and a quadratic component of time on SCL change during exposure to pop-ups*

Hypothesis 5c predicted that perceptions of the Web page and perceptions of the news stories would become more negative following exposure to multiple sets of pop-up windows. A series of analyses of covariance were performed, with page number and pop-
up number as independent variables, perceptions of the Web page, perceptions of the Web page content, and perceptions of pop-up windows as dependent variables, and order of page presentation and pop-up type as covariates. No impact of either page number or pop-up number was found on perceptions of the Web page, perceptions of the Web page content, or perceptions of the pop-up windows. Thus, H5c failed to receive support.

Hypothesis 6a predicted, according to the affect-as-information paradigm, that recall and recognition for details (story body) would be greater than the recall and recognition for global information (titles). To test this hypothesis, a within-participants analysis of variance was performed, checking whether the total recall for titles, leads and story bodies (which operationalized global and local information respectively) were significantly different according to the presence or absence of pop-ups. A significant effect of locus (global vs. local) of attention on free recall was found, $F(1.68, 387.22) = 44.78, p < .001$, partial $\eta^2 = .163$, such that the amount of recall for story body ($M = 1.25, SE = 1.08$) was greater than the amount of recall for titles ($M = .45, SE = .05$) or leads ($M = .46, SE = .06$). A significant effect of locus of attention on recognition was also found, $F(1.98, 464.22) = 37.24, p < .001$, partial $\eta^2 = .203$, such that the amount of recognition for story titles ($M = 1.84, SE = .08$) was greater than the amount of recognition for leads ($M = 1.42, SE = .08$) and bodies ($M = .84, SE = .06$). No interaction effects between locus of attention and pop-up presence was found on either recall or recognition,

Similar analyses were also conducted while including pop-up and story location, along with the locus (global vs. local) of attention as predictors of free recall and recognition. A significant main effect of story location on free recall of story titles was found [$F(2.37, 604.5) = 16.18, p < .001$, partial $\eta^2 = .06$], with titles for the top left story being recalled most often, and the titles of the bottom stories being recalled the least (Table 8). Similarly, significant main effects of story location on free recall of story leads
\[ F (2.78, 708.46) = 3.45, p < .05, \text{partial } \eta^2 = .014 \], free recall of story bodies \[ F (2.74, 699.52) = 10.70, p < .001, \text{partial } \eta^2 = .04 \], recognition of story titles \[ F (2.99, 749.59) = 79.55, p < .001, \text{partial } \eta^2 = .24 \], recognition of story leads \[ F (2.86, 715.01) = 10.72, p < .001, \text{partial } \eta^2 = .04 \], and recognition of story bodies \[ F (2.58, 625.77) = 23.54, p < .001, \text{partial } \eta^2 = .09 \] were found, with the top left story having the highest scores and the bottom stories generally having the lowest scores (Table 8).

However, no combined effects of number of pop-ups and locus of attention were found on either recall \[ F (2, 229) = .43, p = .65 \] or recognition \[ F (2, 470) = .02, p = .99 \]. Thus, the increased recall for story bodies compared to titles and leads and the increased recognition of the titles compared to the bodies and leads cannot be explained through the frustration induced by the presence of pop-ups or increased number of pop-ups. Hypothesis 6a was not supported.

Hypothesis 6b predicted that the recall and recognition of detailed information (i.e., story bodies) would increase with repeated exposure to pop-up windows. Two mixed-model analyses of variance were performed, with the page number and pop-up number as the between-participants predictors, the locus of attention as the within-participants predictor, and recall and recognition as responses. A significant locus of attention x page number interaction effect on recognition was found \[ \text{Wilks’ } \Lambda = .89, F (2, 234) = 44.78, p < .001, \text{partial } \eta^2 = .11 \], such that title recognition was greater in the second page compared to the first page (Figure 12). While this finding was significant, it went in the opposite direction compared with the one predicted by the hypothesis and thus H6b was not supported.

Additional analyses were performed to test whether physiological and psychological frustration habituates over time rather than increase with multiple exposures to pop-up windows. Thus, the interaction between a quadratic component of time and page number
Figure 12. Interaction effect between locus of attention and page number on recognition of page information was tested against EMG change scores. The interaction effect was significant, $F (1, 1715) = 4.30, p < .05$, and suggested that indeed corrugator activity abates rather than increases with multiple exposures to pop-up windows (Figure 13). On the other hand, the analysis of variance performed with the page number as the predictor and self-reported frustration levels as the response was also significant [$F (1, 258) = 22.78, p < .001$] but going in the opposite direction so that self reported frustration was greater after the second page ($M = 19.52, SE = .72$) than it was after the first page ($M = 14.65, SE = .72$).

Figure 13. Interaction effect between page number and a quadratic component of time on EMG change scores.
A series of exploratory analyses were also performed to determine the role of pop-up content compared to the role of the structural function (popping up). All the above analyses were replicated after introducing pop-up type as an additional independent variable. A significant interaction between a quadratic component of time and pop-up type on BPM change scores following the pop-up onset was found, $F(1, 3546) = 6.86, p < .01$, suggesting that whereas both ads and factoid elicit orienting responses, the ORs tend to recover faster after a pop-up ad rather than after a pop-up factoid (Figure 14).

![BPM Change at Pop-Up Onset as a Function of Pop-Up Type](image)

*Figure 14. Interaction effect between pop-up type and a quadratic component of time on BPM change score following the pop-up onset*

A significant main effect of pop-up type on SCR following the pop-up offset was also found, $F(1, 425) = 6.39, p < .05$, with ads eliciting greater skin conductance responses at offset ($M = .50, SE = .04$) than factoids did ($M = .47, SE = .04$).

Also, a significant interaction between the quadratic component of time and pop-up type on EMG change scores was discovered, $F(1, 1715) = 9.62, p < .01$, suggesting that during most of the exposure to a pop-up window, factoids attracted increased corrugator activity compared to pop-up ads (Figure 15).
There were no significant effects of pop-up type on local versus global recall and recognition or location-specific versus location-nonspecific recall and recognition.

![EMG Change During Exposure to Different Pop-Up Types](image)

*Figure 15. Interaction effect between pop-up type and a quadratic component of time on EMG change scores*

In summary, these results show that pop-up windows attract orienting responses regardless of their content, although Web users tend to spend more time reading pop-up factoids compared to pop-up advertisements. Pop-up offsets also attract involuntary attention, but only when they close automatically and not when closed by the user. In terms of pop-ups’ impact on news processing, it was found that news was better recalled when pop-ups were placed in the same quadrant rather than elsewhere on the screen. The number of pop-ups did not significantly affect news recall and recognition. The level of pop-up recognition was positively associated with the amount of news recall (contrary to our expectations). Also, the presence or absence of pop-ups did not significantly affect the locus of attention (i.e., global vs. local). Therefore, the hypotheses derived from attentional spotlight models have received support, whereas those derived from cognitive load or affect-as-information theories did not.
Chapter 5
Discussion

The present study implied that pop-up windows would attract user’s attention, elicit frustration, and interfere with ongoing tasks. Consequently, three mechanisms have been proposed as responsible for pop-ups’ impact on online information processing. The following section explains the results in light of the proposed mechanisms and discusses the theoretical implications for their supporting theories. Additionally, practical implications and study limitations are reviewed, and directions for future research are suggested.

Findings

It has been suggested here that pop-up windows could impact processing of online information via one or more of three different mechanisms. One possibility is that pop-up windows redirect one’s attentional spotlight to the location of the pop-up so that information located in and around the pop-up is processed more efficiently. Another possibility is that pop-ups attract one’s attention toward themselves and away from other computing activities. Yet a third possibility is that pop-up-induced negative affect induces a shift of attention from general to local information. A detailed account of the current findings is given next in light of the three proposed mechanisms.

Attentional Spotlight Mechanisms. The present results suggest that pop-up windows only affect what users learn from online news and not how much they learn. We found, for example, that a story was better recalled when associated with a pop-up rather than not being associated with a pop-up. The only exception was the top left story, which was equally recalled regardless of the pop-up presence or absence. As opposed to other stories,
top left ones benefit from natural voluntary orientation given the western reading style. This benefit was greatly emphasized by other similar results. Thus, not only overall recall of a story, but also overall recognition, recall of the titles, of the leads, and of the bodies of a story, and recognition of the titles, the leads, and the bodies were greater for the top left story than they were for any other stories regardless of the presence or absence of pop-ups. For all other stories however, pop-up location was a significant factor in overall story recall.

Of course, the attentional spotlight mechanisms could explain the nature of news processing only if pop-up windows orient Web users’ attention to a specific location on the screen. The current study confirms previous empirical evidence in this sense, suggesting that pop-up windows do attract involuntary attention. As seen in previous research (Diao & Sundar, 2004), the onset of a pop-up window was associated with heart-rate deceleration and recovery, indicating that orienting responses do occur in such circumstances (Graham & Clifton, 1966). Interestingly, the offset of a pop-up window was also associated with heart rate deceleration and recovery but only when the pop-up window was closed by the system, and not by the user. This is consistent with previous findings suggesting that the presence of pop-up windows serves to bias visual attention for certain parts of the computer screen. If such mechanisms are activated, the spatial gradient that surrounds the attended location (i.e., the pop-up location in this case) would make stories closer to the pop-up to be processed more efficiently compared to stories located further away from the pop-up (Yantis, 2000), thus explaining the higher recall for stories associated with pop-ups. At the same time, spotlight mechanisms would predict that stimuli placed in the focal visual field are less likely to attract involuntary attention, given that stimuli located in the attentional spotlight are already attended to or perceived (Klein & Shore, 2000; Johnson & Proctor, 2004). Pop-ups that are not closed by the user,
however, might trigger a sudden change in the visual field similar to the unexpected onset of the pop-up (Diao & Sundar, 2004; Theeuwes, 1991). In this context, it seems that the differential impact of system- versus user-controlled offsets has more to do with the surprise element of pop-up closure rather than the issue of user control or agency. As a corollary to these findings, one could also argue that users who are heavily pursuing certain goals in a Web environment are more likely to close pop-ups themselves in order to minimize the impact of stimulus offsets on task performance. Certainly, more research needs to be done in order to determine whether user exercised control stems from a need to minimize the impact of stimulus offset or purely from a desire to eliminate task-irrelevant stimuli.

It is also remarkable that the effects of attentional spotlight on memory did not habituate over time. Analyses using both the pop-up number and the page number, for example, showed that the effect of attentional spotlight did not depend on the level of previous experience with pop-ups. This can be taken as an indication that pop-ups do not attract involuntary attention as much through their relative novelty (A. Lang, 2000) as they do through their sudden onsets and offsets, since novel stimuli seem to be subject to habituation in an overwhelming number of cases (Balkenius, 2000; Ben-Shakhar & Lieblich, 1982; Coren et al., 1994; Gati & Ben-Shakhar, 1990; Siddle et al., 1983; Wang, 1995).

Although recall seems to be influenced by attentional spotlight, recognition was not. As recognition is taken to indicate the extent of encoding, whereas recall is thought to reflect the efficiency of storage and retrieval (A. Lang, 2000), this finding might indicate that selectivity occurs at a later stage, after the visual scene has been already surveyed (Norman, 1968). On the other hand, it might simply mean that individuals have the tendency to first scan the visual scene and take in general information, and only later, if at
all, focus on details. Thus, whereas participants might have skimmed all stories at the beginning and hence encoded information about all, they only focused on one to read more attentively. This interpretation is strengthened by an additional finding, that story titles were recognized more than story leads and those even more than story bodies. Taken together, these findings support the argument that an initial scanning of the entire page occurs first and it is followed by a more focused reading of a particular story in a second stage. Such precedence of general over local information has long been documented theoretically. Navon (1977), for example, showed that when participants observed larger letters comprised of several smaller ones and were asked to identify either the smaller or the larger letters, they identified larger letters much faster than they identified smaller ones. Moreover, response latencies for identification of small letters were affected by the larger letters (in particular, the identification of the small letter was facilitated when the large and small letters were the same, and was inhibited when they were mismatched). The opposite was not supported, so that response latencies for large letter identification were not affected by the identity of small letters. Based on this evidence, Navon advanced the *global precedence hypothesis*, which stipulated that the processing of global form precedes that of local form.

Both the late-stage selectivity and the global precedence arguments, however, suggest that attentional spotlight operations do not constrain one’s attention completely, but rather redirect the focus of attention toward a certain location in the visual field.

*Attentional and Cognitive Load.* Contrary to expectations, attentional and/or cognitive load did not seem to affect the extent to which news stories were processed. Exposing participants to pop-ups did not appear to interfere with their news processing. More specifically, neither the presence nor the number of pop-ups had an impact on story
recall or story recognition. Additionally, the hypothesized impact of pop-up recognition on story recall was not found. Furthermore, the recognition for pop-up information was positively (as opposed to negatively) associated with news recall. This finding simply suggests that greater encoding and storage of both pop-ups and news took place, which would be expected in the absence of cognitive overload. Thus, it seems that neither the presence nor an increased number of pop-ups resulted in cognitive overload to the point of impairing news processing. Another explanation for these findings may also rely on the experimental context. On the one hand, one might argue that the pop-ups to which participants were exposed may have not interfered with news processing. We believe this explanation to be improbable, given that news pages were only shown for 70 seconds each and therefore three pop-ups, even when closed immediately, would take a significant amount of time relative to the time spent reading the news stories. On the other hand, participants might have felt compelled to focus more on the news, although the task instructions did not require them to disregard the pop-ups. Some of our findings do suggest that, comparatively, the recall and recognition for pop-up information were significantly lower than the recall and recognition for news stories \( t (179) = 27.23, p < .001 \), \( M_{\text{pop-up recognition}} = 1.65, SE_{\text{pop-up recognition}} = .22 \), \( M_{\text{news recognition}} = 7.57, SE_{\text{news recognition}} = .22 \); \( t (233) = 17.35, p < .01 \), \( M_{\text{pop-up recall}} = .23, SE_{\text{pop-up recall}} = .11 \), \( M_{\text{news recall}} = 2.22, SE_{\text{news recall}} = .11 \). These findings show that the banner blindness phenomenon observed earlier for banner ads may extend to pop-up ads as well. Noticed first in a text-based Web advertising setting, banner blindness indicates that Web users are very likely to overlook salient items such as banners when searching for specific items (Benway & Lane, 1998). Recent research suggests that the banner blindness phenomenon can be more prevalent than initially thought. Nielsen and Loranger argue that Web users are extremely goal oriented and they can train themselves to ignore information that is pushed on them.
More than just passively ignoring unwanted information, Web users can and will develop a self-defensive system for dealing with it. That is not to say that pop-ups or any other sudden stimuli do not attract involuntary attention, but rather that Web users can avoid longer gazes (i.e., reading or paying more attention) to what they suspect to be unwanted information (Nielsen & Loranger, 2006).

Several theoretical accounts can explain the “pop-up blindness” phenomenon in this context. The perceptual load theory (Lavie, 1995; Lavie & Tsal, 1994), for example, suggests that participants cannot engage in focused attention unless their attentional resources are depleted. According to this theory, high-load displays force individuals to focus more attentively in order to process the available information, whereas low-load displays do not engage one’s focused attention. Consequently, an ignored or unwanted distractor can interfere with the processing of information only when occurring in low-load displays. In this sense, one can argue that online news pages provide an overload of information that in turn helps focus readers’ attention to the stories while ignoring unwanted information. It is unclear, however, whether the ignoring of unwanted information occurs at the perceptual or at the cognitive level. Thus, this account does not indicate whether pop-ups are ignored perceptually (that is, do not attract attention) or cognitively (that is, do not impact memory processes).

Another theoretical account proposes that it is not the perceptual load but rather the salience of the distractor which dictates whether the distractor will interfere with processing of target information or not (Eltiti, Wallace, & Fox, 2005). And if the salience of the distractor is operationalized in terms of its dissimilarity with the target information, the salience hypothesis might explain partly why pop-up windows did not interfere with the processing of news stories. Incongruency, for example, might increase the salience of a distractor and thus its memorability, as suggested by previous research (Heckler &
Childers, 1992). When defined as both expectancy and relevance, incongruency has been shown to affect both the amount and the accuracy of memory. When a stimulus was expected, relevant ones were better remembered compared to irrelevant ones, whereas the opposite was true for unexpected stimuli (Heckler & Childers, 1992). Hence, assuming that the arrival of a pop-up was an unexpected occurrence, the fact that the pop-up content was relevant to the topic of the news stories could have contributed to its lower recall and recognition relative to the recall and recognition of news stories. This claim has some additional support from Web advertising research, which shows that ad content is better retained when ads are incongruent as opposed to congruent with the site (McCoy et al., 2004). Previous research, however, has also indicated that expectancy and relevance would impact image processing, but not word processing (Heckler & Childers, 1992). Further research should therefore consider the influence of verbal versus graphic pop-ups not only on the memorability of the pop-up and Web site itself, but also on the level of processing (that is, global or local). Along with main effects, the combination of verbal and graphic information within the same pop-up would offer additional knowledge about pop-up and Web page processing, as prior studies have proposed that integrating text and images in pop-up windows can positively impact learning (Betrancourt & Bisseret, 1998).

**Affect-as-Information.** Even though Web users experienced less frustration when exposed to pop-up windows, repeated exposure to pop-ups led to increased self-reported frustration. However, self-reported frustration did not successfully predict recall and recognition of global or local information. Corrugator activity did not appear to vary with the presence of pop-ups or with the number of pop-ups seen, raising the question of whether the pop-ups in the present experiment induced frustration in the first place. There are, however, alternative interpretations for these findings besides the lack of induced
frustration. While the sample size was fairly small for facial EMG analyses due to equipment failure, two other findings seem to indicate that the corrugator activity noticed in our experiment may reflect overall mental effort rather than negative affect. Not only did corrugator activity decrease with repeated exposure to pop-ups (contrary to self-reported measures which suggested increased frustration in a similar situation), but it was also higher during exposure to pop-up factoids compared to pop-up advertisements. At the same time, although both pop-up factoids and pop-up ads elicited a similar drop in heart-rate, the recovery time was longer for factoids than it was for ads. Taken together, this set of findings suggests that Web users orient towards both types of pop-ups, but spend more time reading the information displayed in a pop-up factoid rather than the one displayed in a pop-up ad. It is therefore probable for the corrugator activity to indicate mental effort rather than negative affect in this case. Previous research has provided some support for this possibility, showing that mental effort is often accompanied by increased muscle tension in different parts of the body, especially for muscle groups located on the forehead (MacNeilage, 1966). Among those, the tonic activity of the lateral frontalis muscle, the orbicularis oris inferior, and corrugator supercillii appears to index the mobilization of general, non-specific resources and generally considered to reflect mental effort during information processing tasks (Van Boxtel & Jessurun, 1993; Waterink & Van Boxtel, 1994).

Since corrugator activity does not seem to be a good physiological indicator of frustration in this experimental context, further research is necessary to determine whether frustration plays a significant role in processing of online information. Subjective reports provide some indication that frustration may be negatively correlated with the recall of global information (i.e., story titles, $r = -0.11$, $p < .05$), which in turn is negatively correlated with the recall of local information (i.e., story bodies, $r = -0.15$, $p < .01$).
However, there is no indication that pop-up presence or pop-up number has any direct
effect on the locus of attention (global vs. local). It is worth noting here that pop-up
presence appeared to decrease self-reported frustration, whereas a larger number of pop-
ups seemed to increase it. It may be that pop-ups elicit a cognitive rather than an
emotional reaction in Web users, contrary to previous assumptions. Web users may have
already become accustomed to seeing a variety of modalities on the Web. Exposure to a
plain Web page filled with information could be overwhelming for (at least) the new
generation of media users who are used to and maybe even like being highly stimulated
during their media experiences. As such, the absence of new modalities from
informational Websites or the mere presence of a text-heavy site may increase frustration,
and a relatively low number of pop-ups can perhaps serve to provide a release. Additional
research that considers previous experience with computers and Internet along with other
media experiences as contributing factors can provide a deeper understanding of this
proposition.

At the same time, one cannot dismiss the possibility that not all negative emotions
have the same impact on the locus of attention. Previous research suggested that a variety
of affective states and dispositions influence the way an individual elects to focus his/her
attention at either a local or a global level. Various positive emotions such as amusement
and contentment (Fredrickson & Branigan, 2005), personality traits such as subjective
well-being and optimism (Basso et al., 1996), and happy moods (Gasper, 2004) were
shown to induce a broader scope of attention and a global locus of processing. On the flip
side, personality traits associated with negative affect such as anxiety and depression
(Basso et al., 1996) and sad moods (Gasper, 2004; Gasper & Clore, 2002) were
accompanied by a narrowing of the locus of processing. Consequently, researchers felt
compelled to generalize across a broad range of affective states and traits and suggested
that positive affect in general tends to broaden the scope of attention and the range of thought-action repertoire, whereas negative affect has the opposite effect of narrowing the scope of attention (Fredrickson, 2001; Fredrickson & Branigan, 2005). Nonetheless, these effects might not generalize across the entire range of affective states, and this might be the case especially with discrete emotions such as fear, frustration, or anger. Previous research, for example, failed to observe a significant effect of anger, anxiety, disgust, or fear on the locus of attention (Fredrickson & Branigan, 2005). While the researchers indicated that their stimulus might have simply been insensitive to the narrowing of attention (hence, the inability to discriminate the impact of negative affect on locus of processing), it might as well be possible that not all negative emotions have the same effect. Further research can look into this possibility by using a wider range of emotions and maybe also include additional dimensions of affect such as dominance or control (see Osgood, 1996).

Another aspect that deserves consideration is the question of whether the impact of negative affect on visual processing is limited to visual graphic information without extending to visual verbal information. Research concerning mood-biased visual processing has mainly used graphic stimuli similar to those used by Navon (1977) in his Object Identification Tasks (Fredrickson & Branigan; 2005; Gasper & Clore, 2002; Kimchi & Palmer, 1982); to the best of our knowledge, this is the first attempt to understand mood biases in the context of visual verbal rather than visual graphic processing, with both the Web pages and the pop-ups displaying text rather than images.

A series of studies have shown that stimulus complexity significantly impacts visual information processing such that more complex stimuli take longer to process than simpler ones (Loftus & Hannah, 1989). Words are obviously complex stimuli (Boden & Brodeur, 1999) that require increased perceptual and cognitive resources, so that both
letters and meaning can be identified. The differential processing of visual verbal and visual graphic information significantly affects learning (Boden & Brodeur, 1999) not only given individual differences in the ability to process verbal or graphic information, but also given individual differences in processing preferences (Childers, Houston, & Heckler, 1985). Moreover, it has been proposed that visual graphic information is processed automatically, whereas verbal information is processed in a more controlled manner (A. Lang, Potter, & Bolls, 2000). Thus, some argue that unattended verbal stimuli remain unprocessed as no controlled processing resources are allocated to such stimuli (Treisman & Gelade, 1980); on the other hand, visual graphic information is processed rapidly and in a parallel process as the early stage of image processing is considered relatively cost free in terms of processing resources (Treisman, 1988). Although previous studies utilized auditory verbal information (see A. Lang, Potter, & Bolls, 2000), it may be possible for visual verbal information to require similar controlled processing. In which case, not only that mood biases would not extend from graphic processing to verbal processing, but processing of verbal information displayed in pop-ups would be very limited if at all. Since controlled processing would be required for both Web page and pop-up information, Web users would likely focus on task-related information (i.e., Web page) and disregard unwanted information (i.e., pop-up window). This argument is consistent with the previous conclusion that a “banner blindness” phenomenon may also apply to pop-up windows.

Other findings

Physiological Indicators. Surprisingly, quite a few of the physiological responses did not conform to the initial predictions. It was expected, for example, that the attentional spotlight mechanism would equally affect orienting responses and memory for content,
and that the direction of the impact would be the same. However, memory effects did not indicate that habituation processes took place, whereas BPM change scores showed evidence of habituation. Thus, over time analyses showed a significant effect of pop-up number on BPM change scores, $F(2, 3512) = 26.26, p < .001$, such that the second and third pop-ups featured on a page elicited a weaker orienting response compared with the first one (Figure 16).

![BPM Change at Pop-Up Onset as a Function of Pop-up Number Within a Page](image)

**Figure 16.** Interaction effect between time and pop-up number on BPM change scores

The dissonance between the physiological and the psychological response to pop-ups could indicate, on the one hand, that the habituation to form or structural features comes sooner than the habituation to content. Previous research provides some evidence in this sense, showing that reflexive orientation degrades over time in response to feature changes but not in response to content changes (Sundar & Constantin, 2004).

On the other hand, the differential impact of pop-up number on orienting responses compared with the memory for page content could signal that the attentional/perceptual demands and the cognitive demands made by pop-up windows need to be distinguished. Although pop-ups behave perceptually as novel stimuli by showing a degradation of
orienting responses with repeated exposure to pop-ups, this effect is not transferred to the cognitive level and thus the impact of attentional spotlight on memory is not subject to habituation processes. This distinction between attentional and cognitive effects of pop-up windows might explain not only the lack of habituation to pop-ups at the cognitive level, but also the lack of a cognitive load effect on recall and recognition of news stories. The limited capacity model (A. Lang, 2000), for example, predicts that the onset of a non-target stimulus during the encoding stage of target information might impose a strain on the available cognitive resources (i.e., cognitive load) that can negatively impact task performance. Even though the model acknowledges the role of attention by assuming that sudden, unexpected, or novel stimuli might attract involuntary attention and ultimately impede processing of target information (A. Lang, 2000), it may well be that, everything else being equal, the attentional load needs to be fairly high in order to constrain cognitive functioning. As reflexive orientation is shown to decrease over multiple exposures to pop-up stimuli, one could argue that the attentional load imposed by successive pop-ups does not reach the level required for cognitive impairment.

The argument of distinguishing between attentional and cognitive loads is also supported by skin conductance levels. Additional analyses revealed not only that the second and third pop-ups on a page elicited lower SCL responses compared with the first one (Figure 8), but there was also a significantly lower average SCL response to pop-ups featured on a second page compared with the ones featured on the previous page \[ F (1, 3935) = 13.21, p < .001; \text{Figure 17} \].

As shown in figure 17, the onset of pop-ups led to an increased skin conductance level regardless of the page where they were featured. Prolonged exposure to pop-ups, however, led to a decrease in SCL only for pop-ups featured on the second page. These results indicate that, contrary to initial hypotheses, SCL did not increase with repeated
Figure 17. Interaction effect between page number and time on SCL change during exposure to pop-ups

exposure to pop-up windows. One of the implications of this finding is that excitation transfer might not occur in the case of pop-up windows. This possibility is also buttressed by the fact that attitudes towards Web pages and news stories did not become more unfavorable with increased exposure to pop-ups. However, it is more likely that SCL indexes mental effort in this study rather than emotional intensity as initially thought, not unlike the presumed physiological indicator of emotional valence (that is, corrugator activity) which appears to have indexed mental effort rather than emotional states.

While skin conductance levels (SCLs) mirror the cardiac responses to pop-ups, skin conductance responses (SCRs) do not. It was found, for example, that heart rate decelerations followed pop-up offsets only when pop-up windows were closed by the system and not by the user. Contrary to these findings, skin conductance responses following pop-up offsets were significantly higher [$F (1, 391) = 31.04, p < .001$] when pop-ups were closed by the user ($M = .70, SE = .05$) rather than being closed by the system ($M = .40, SE = .03$). Also, instead of decreasing with repeated exposure to pop-ups, SCR following pop-up onsets was significantly higher [$F (1, 433) = 40.79, p < .001$] for the pop-ups featured on the second page ($M = .77, SE = .05$) compared with those
featured on the first page ($M = .42, SE = .05$). These two findings suggest that the autonomic arousal indexed by SCR is associated with emotional responsiveness rather than reflexive orientation toward newly appearing stimuli.

*Pop-up Ads vs. Pop-up Factoids.* A series of additional findings indicate that pop-up advertisements and pop-up factoids are both similar and dissimilar. There was no difference, for example, between ads and factoids in terms of memory measures, and they both attracted involuntary attention, although factoids managed to maintain it slightly longer than advertisements did (Figure 14). Consistent with previous research concerning online (Diao & Sundar, 2004) and offline pop-up windows (Bailey et al., 2000a, 2000b, 2001), this finding indicates that pop-up effects on cognitive functioning are due to its structural features rather than its content.

The similarity of memory effects between pop-up ads and pop-up factoids might indicate that they are perceived similarly as informational windows, especially given that both ads and factoids were rather text-heavy. They were, however, rated differently on a number of other dimensions. For example, factoids were perceived as significantly more factual ($M = 3.80, SE = .26$), whereas advertisements were perceived as more persuasive [$M = 5.51, SE = .27; F (1, 227) = 30.27, p < .001$]. There was also a significant difference between ads and factoids in terms of perceived importance [$F (1, 227) = 36.93, p < .001$], so that factoids ($M = 26.24, SE = 1.11$) were perceived as more important than ads ($M = 34.71, SE = 1.12$). Similarly, factoids were perceived as more enjoyable ($M = 22.71, SE = .51$) than ads [$M = 24.95, SE = .53; F (1, 228) = 9.56, p < .01$]. Factoids were also perceived as more interesting ($M = 17.41, SE = .66$) than ads [$M = 22.02, SE = .69; F (1, 229) = 30.34, p < .001$]. However, ads and factoids scored similarly in terms of perceived frustration. Overall, Web users are accurate in distinguishing the content of pop-up ads.
from the content of pop-up factoids, although their effects on memory are no different.
This finding strengthens the previous argument that the impact of pop-up windows on
cognitive functions is due to their structural features and not their content.

Theoretical Implications

Attentional Spotlight Model. The space-based models of attention, also called
spotlight models of attention (Posner, 1980), propose that an attentional spotlight exists
based on the location of the stimulus, and a spatial gradient surrounds the attended
locations such that stimuli closer to the focus of attention are processed more efficiently
than those farther away (Yantis, 2000). The current study found support to a claim derived
from such attentional spotlight models, namely that news content located in the vicinity of
attention-grabbing pop-ups is processed more efficiently and thus recollected better. The
spotlight effect, however, was observed for free news recall, and not for news recognition.
This raises the question of the level of processing affected by the attentional spotlight. If
recognition indeed reflects the extent of information encoding as suggested by the limited
capacity model (A. Lang, 2000), it seems that encoding of information may not be subject
to attentional spotlight effects. On the other hand, the location of focal attention
significantly influences the efficiency of information storage, as reflected in measures of
free recall. The differential impact of the attentional spotlight on various stages of
information processing (encoding, storage, retrieval) can then be taken as evidence for a
multi-stage processing of visual information. Thus, it may be that there are two stages in
visual information processing that act sequentially (Broadbent, 1971; Kahneman, 1973;
Neisser, 1967), and that the entire information is processed partly in the first phase while
part of the information is processed entirely in the second phase (Broadbent, 1971;
Kahneman, 1973; Treisman, 1988; Treisman & Gelade, 1980). Moreover, if the spotlight
of attention functions as a filter, it follows that selective processes take place during the second processing phase, giving credit to late-stage selection theories (Norman, 1968). At the same time, the difference between the impact of attentional spotlight on recall and recognition can be taken as an indication of individuals’ tendency to survey the visual scene before focusing on particular stimuli, giving credit to the global precedence hypothesis (Navon, 1977). The second interpretation brings into question the role of the attentional spotlight as an automatic filtering mechanism and proposes that the attentional spotlight functions more as a means of redirecting voluntary attention toward a location in the visual field. In this context, pop-up windows function more as a trigger for moving the focus of attention to a particular space, and their most notable impact on visual processing of online news consists not as much in attracting involuntary attention as in forcing voluntary attention to follow it. The idea that pop-ups influence voluntary rather than involuntary attention is also supported by another finding, namely that news stories are generally remembered better than actual pop-up content. Thus, pop-up windows might have a more durable impact on information processing than initially thought by manipulating not only involuntary responses such as OR, but also voluntary attention. As previously suggested, exogenous cues such as pop-ups can produce rapid performance benefits that dissipate quickly, whereas the benefits of endogenous cues such as user goals develop slower but are sustained for a longer period of time (Johnson & Proctor, 2004). If pop-up windows do manage to shift both voluntary and involuntary attention, the performance benefits could be exponentially increased by ensuring that target information is processed not only thoroughly but also faster, especially if the pop-ups do not interfere with such processing (as was the case in the current study).
Attentional and Cognitive Load. As mentioned previously, neither pop-up presence nor the number of pop-ups produced cognitive load, so that processing of news stories was not diminished in either case. If anything, pop-up processing increased processing of news stories instead of decreasing it. It is thus possible that cognitive resources were not depleted by merely increasing the number of pop-up windows to three pop-ups per Web page. The inability to reach cognitive load with number of pop-ups utilized in this study, however, can explain the lack of a negative relationship between pop-up recognition and news recall, but it does not explain the evidence of a positive relationship between the two. The latter can be understood in light of the autonomic arousal elicited by pop-ups. Both previous research and the current study show that novel or unexpected stimuli are accompanied by increases in autonomic arousal (Gati & Ben-Shakhar, 1990; A. Lang, 2000) indicating that a substantial amount of cognitive resources have been allocated to stimulus processing (Ohman, 1992). It is argued that the level of arousal elicited by novel stimuli affects attention and processing performance (A. Lang, 2000; Ohman, 1992). However, the relationship between arousal level (described as one’s general level of stimulation or readiness to act) and performance is not a linear one. Nearly a century ago, Yerkes and Dodson (1908) proposed the Yerkes-Dodson Law which stated that performance is an inverted U-shaped function of arousal, with the optimal arousal level (i.e., the level at which the inverted U peaks) being lower for more difficult tasks. If the Yorkes-Dodson Law holds for pop-up windows as well and if attending to such windows might be an automatic and relatively simple ‘task’, the threshold for optimal arousal could be relatively high. Consequently, not only that task performance indicated by news recognition is not diminished relative to pop-up recall, but it is also magnified prior to reaching the respective threshold. Future studies could research the number of pop-ups needed to reach optimal performance levels. Another aspect that such
studies should consider is the distinction between attentional and cognitive load. As previously argued, although sudden, unexpected, or novel stimuli might attract involuntary attention and thus impede processing of target information (Lang, 2000), the attentional load ought to be fairly high in order to impede cognitive functioning. In the current study, for example, the number of pop-up windows per page was manipulated such that Web pages were associated with none, one, or three pop-ups. However, the content of the pop-ups was maintained constant for any given Web page, suggesting that a greater number of pop-ups per page was indicative of higher attentional, but not cognitive, demand.

*Affect-as-Information.* The current study failed to observe a change in the locus of attention attributable to pop-up windows. Thus, neither the presence of pop-up windows nor an increased number of pop-ups determined whether individuals processed information more at a local than at a global level. This is by no means proof that the level of focus hypothesis (Clore & Gasper, 2001) does not apply to processing of Web information in the presence of pop-up windows. Mostly, it is unclear whether the pop-up windows succeeded in eliciting user frustration. On the one hand, physiological responses used as indicators of emotional intensity (SCL) and emotional valence (corrugator activity / EMG) appeared to index mental effort rather than emotional states. On the other hand, psychological responses were also inconclusive, as the lack of pop-ups seemed more frustrating than the presence of pop-ups, although self-reported frustration was, as predicted, higher after the second Web page compared with the first page. Thus, the lack of a shift in attentional focus from general to local information can be simply due to an inability to generate negative affect through the use of pop-up windows, be those advertisements or factoids. It is possible, as previously suggested, that the pop-up windows failed to generate negative affect given that most Internet users already have
extensive experience with pop-ups and thus have become habituated to these new modalities. Unless used exaggeratedly, pop-up windows seem to be subject to similar “banner blindness” phenomena as other online advertising formats (Nielsen & Loranger, 2006). It is also possible that pop-ups’ failure to induce negative affect is an artifact of the experimental setting, with participants trying to maintain the focus of attention on news stories based on an implicit assumption that the news stories are more important in the experimental task than pop-up windows.

Worth noting here is also the fact that both pop-up advertisements and pop-up factoids were more textual than graphic. This could explain at least partly why pop-up windows in general and pop-up ads in particular did not affect the nature of information processing by shifting the focus to local from general information. Previous studies testing the effect of positive and negative affect on processing style (Fredrickson, 2005; Gasper, 2002, 2004) used graphic rather than verbal information. At the same time, research has shown that verbal and graphic information are processed differently and have different effects on learning (Boden & Brodeur, 1999). More specifically, some have proposed that graphic information is processed automatically, whereas verbal information is processed in a more controlled manner (A. Lang, Potter, & Bolls, 2000). It then follows that unattended verbal stimuli could remain unprocessed as no controlled processing resources are allocated to such stimuli (Treisman & Gelade, 1980); on the other hand, visual graphic information is processed rapidly and in a parallel process as the early stage of image processing poses very few demands on processing resources (Treisman, 1988).

**Summary.** Overall, previous research suggested that pop-up windows attract users’ attention, elicit frustration, and interfere with ongoing tasks. Therefore, different mechanisms might be in place and explain not only the extent to which users learn from
an online news site, but also what they learn from the information that is available to them. On the one hand, pop-up windows can move users’ attention away from the task and lead to decreased recall and recognition of online news stories. Limited capacity theories support this point of view, arguing that novel or unexpected stimuli (such as pop-ups) would trigger involuntary attention and cause distraction, especially when they are presented during the encoding stage of information processing (A. Lang, 2000). Following this line of reasoning, one would expect Web users to show lower recall for news stories with increased recognition of information displayed in the pop-up window, especially when they are exposed to a greater number of pop-ups within a short time period. On the other hand, the nature of the information processed by Web users can also be affected by the occurrence of pop-ups. Pop-ups may not only orient users’ attention to a specific location on the screen and thus influence which stories will be processed and which will not (Klein & Shore, 2000; Johnson & Proctor, 2004; Yantis, 2000), but they may also elicit frustration and therefore induce a shift in the locus of attention from a global towards a local type of processing (Clore & Gasper, 2001; Clore, Gasper, & Garvin, 2001; Fredrickson, 1998, 2001). The current study shows that pop-up windows affect only the nature, and not the extent of processing. Therefore, present findings indicate that the information surrounding a pop-up benefits from the presence of the pop-up windows, thus lending support to an attentional spotlight mechanism. Neither the cognitive load nor the affective bias mechanisms were supported; however, these results should be understood in light of several limitations that are later discussed.

Practical Implications

Along with theoretical implications for visual processing models, these findings have several practical implications. The implications for Information Technologies and
User Interface designers, as well as for site owners, for example, are multifold. First and foremost, staying away from pop-ups as a general rule of thumb does not seem to be a requirement. There appears to be an industry-wide belief that pop-ups are completely detrimental to a Web site. Thus, although quite effective in grabbing users’ attention (Kynnin, n.d.), pop-ups were thought to elicit a great deal of frustration, annoyance, and irritation in users (Robinson, 2000; BBC News, 2001; Best, 2004). It has been suggested that this user frustration comes from the perceived interruption potential of pop-ups (Li et al., 2002; Wegert, 2002); at the same time, the negative attitudes derived from such perceived intrusiveness of pop-ups are considered to affect brand perceptions (MacKenzie & Lutz, 1989) and lead to avoidance (Abernethy, 1991) of not only the pop-ups themselves, but also the Website that carries them (McCoy et al., 2004). Consequently, the intensified user reactance to pop-ups has raised the concerns of Web designers and providers, so much so that ISPs such as Earthlink and search engines such as Google have completely banned pop-up ads (Olsen, 2002; Parker, 2003), and browser developers such as Microsoft, Netscape, or Mozilla designed pop-up blockers (Cassavoy, n.d.). The current study brings into question the tendency of some industry leaders to overstate the effects of pop-up windows as being overwhelmingly detrimental to Websites and users. More specifically, it was discovered that a limited number of pop-up windows does not impair processing of Website information and might not elicit user frustration especially if they are more informational in nature and relevant to the site content. Moreover, the appearance of a pop-up window might help by focusing user attention to a part of the screen, which therefore gains visual precedence over others. Thus, pop-ups can be quite effective in emphasizing some Website information over others by bringing it within the user’s attentional spotlight.
This would be a benefit for Web users as well, as pop-up windows could potentially assist in search tasks when placed appropriately. Web users engage in a variety of actions online – they could have the intent of immediately reaching a site (i.e., navigational goal), of acquiring certain information (i.e., informational goal), or of performing some web-mediated activity (i.e., transactional goal; Broder, 2002). Among these, the information motivation seems particularly important in understanding what drives users online (Ko, Cho, & Roberts, 2005; Schneiderman, Byrd, & Croft, 1997), explaining in part why more than three quarters of Internet users make search engine queries every month (comScore, 2004). The extremely large amount of information deposited online, however, and the unstructured nature of the Internet make information retrieval difficult. In this context, pop-up windows might assist users in search tasks by orienting their attention toward certain Web information. Moreover, clustering the information with the help of pop-up windows might improve Web organization and efficiency of information retrieval (Crestani & Wu, 2006).

Thus, the value-added functionality that pop-up windows bring to a Website might benefit users in a variety of Web contexts by enhancing the salience of certain information. Within social networking sites, for example, when multiple profiles are featured on the same page, some could be made more salient than others by simply associating them with pop-ups. And the benefits to the user could be even greater if the pop-up window itself delivers additional information about the given profile. Similarly, products or brands can be made more salient in an e-commerce context if they are associated with informational or promotional pop-ups related to the product, while possibly easing the transactional process for the online buyer.

In addition to implications for Web designers and Web users, the current study also provides some suggestions to policy makers. Instead of providing venues for Internet
regulation, however, this study supports an argument for some degree of deregulation. It was found that most of pop-ups’ impact on information processing stems from structural features. Content differences, while perceivable, had very little impact on how users processed Web information. As such, any attempt to regulate pop-up windows should be based on form rather than content, and therefore informational and ad pop-ups should be treated equally from a legislative perspective. It should be emphasized again, however, that while possibly intrusive and annoying, pop-ups are quite effective in increasing information awareness in users (Bailey et al., 2000a, 2000b, 2001) and thus they could provide an effective means of delivering information to users.

Of course, this is not to say that content does not matter at all and that sensitive content (e.g., adult content) should not be regulated differently from other types of content; however, in the case of non-sensitive content it should be noted that form seems to precede content, so that the act of popping up impacts Web activity more than the informational or factual nature of the content.

Limitations

The current study provides evidence that while attentional spotlight mechanisms can modify the nature of information processing, negative affect and cognitive load do not impact either the nature or the extent of processing. This evidence, however, should be viewed with several caveats in mind. First, it is unclear whether affective and cognitive mechanisms do not apply in the present context or the manipulation of affective and cognitive reactions simply did not work. It is quite possible, for example, that three pop-up windows were not enough to induce cognitive load, especially given that the content of all three was the same. While trying to control the amount of content available to participants in all conditions, displaying the same information in all pop-ups might have inhibited a
cumulative impact on cognitive resources. One can argue, then, that although pop-ups attract attention, they did not keep it long enough to impair cognitive functioning. Moreover, orienting responses habituated with repeated exposure to pop-ups (Figure 16). Thus, if orienting responses reflect the amount of cognitive resources allocated to stimulus processing (Ohman, 1992), the cognitive demands imposed by subsequent pop-ups tend to be progressively lower. The degradation in responses to pop-up features could be instead supplemented by new content, especially since habituation to content occurs, if at all, at a much slower rate than habituation to structural features (Sundar & Constantin, 2004). Not only the absence of new content, but also the relatively extended period of time (maximum 10 seconds) that pop-ups stayed on the screen may have contributed to the pop-ups’ failure to induce cognitive load. Appearing in the same position and staying there for a while might have allowed users to negotiate the presence of pop-ups on a Web page. Thus, not only was the threshold of cognitive load not met, the attentional demands might have been lower than intended since pop-ups did not appear and disappear fast enough to constantly distract the users.

Not only eliciting cognitive load, but also increasing frustration seems a difficult task, and there is little supportive evidence for negative responses to pop-ups in the current study. Both physiological and psychological responses were inconclusive in this sense: on the one hand, physiological reactions measured here appeared to index mental effort rather than experienced frustration, and on the other hand, psychological reactions went in a different direction than expected, suggesting that the absence rather than the presence of pop-ups could be a more frustrating experience, at least when visiting a text-heavy site.

Therefore, it is possible that the means used to manipulate cognitive load and negative affect did not work in the current study. More importantly, it is also possible that the study procedures themselves are biasing in favor of the attentional spotlight and
against the cognitive load and affective bias mechanisms. Several procedural aspects might have contributed to such biases.

First, it is unclear whether pop-up windows appeared over the text that participants were actively reading at the point of interruption. The first pop-ups were loaded almost immediately on the screen so that participants were not already engaged with the story at the arrival of the pop-up. If they were engaged with a story, it would be likely for the goal-directed attention (reading the self-chosen story) to override stimulus-directed attention (reading the story associated with the pop-up). Thus, testing the attentional spotlight mechanism would have proven difficult. A rapid loading on the screen is nevertheless ecologically valid, as most pop-ups appear when entering or exiting a site (Edwards et al., 2002). However, (almost) immediate loading on the screen could have also diminished the interruptive potential of pop-ups. Alternatively, a pop-up appearing on top of text that Web users are currently reading might be more interruptive, increasing both the potential for cognitive load and the likelihood of experiencing frustration. Human-computer interaction literature, for example, suggests that secondary stimuli presented during a task sequence are more interruptive than ones presented before a task sequence begins, when it ends, or in between task sequences (Adamczyk & Bailey, 2004).

Therefore, given that the first pop-up appeared soon after the page was loaded on the screen could have significantly dimished its interruptive potential. Moreover, the study design makes it difficult to test whether the second or the third pop-ups appeared on top of the text that participants were reading at that moment, thus limiting the generalizability of the study. A possible alternative would be to feature only one story on the page or design a pop-up window that covers all stories featured on the page. Such a design, however, would make it difficult to test whether pop-up windows can bias Web users’ attention by directing it to a particular location on the screen.
Second, previous research has also showed that an interruption has a disruptive effect on both task performance and emotional states (Bailey et al., 2001), and that the level of disruption is determined by the cognitive load at the interruption moment (Bailey et al., 2000b, 2001). Several stimulus characteristics assumed in this study to increase cognitive load (frequency and length of interruption) do not appear to enhance one’s mental load (Gillie & Broadbent, 1989; Monk, 2004), whereas irrelevant messages (Cutrell, Czerwinski, & Horvitz, 2000) and complex primary tasks (Gillie & Broadbent, 1989) do. Moreover, previous studies have indicated that reading is not an activity as complex as adding or counting, for example, and that a reading task is easier to resume after an interruption compared to other tasks (Bailey et al., 2000b).

It is thus possible for pop-ups to have different effects on Web behaviors other than reading. While online news reading is a legitimate form of online information seeking and not merely casual browsing, it is nonetheless less structured and less goal-directed than active searching or navigational behavior. Information retrieval researchers, for example, have categorized online information seeking based on the degree of formality or focus. Thus, some Web users are said to engage in undirected viewing by scanning broadly diverse information easily available. Others engage in a more structured, conditioned viewing when topics of interest are determined a priori. Other Web users perform informal searches within a narrow topic of interest but no specific targets, while others develop very structured, formal searches with well-specified targets (Choo, Detlor, & Turnbull, 1998; Morrison, Pirolli, & Card, 2001). While online news reading is certainly motivated by an information seeking behavior, it is arguably less structured and less goal-directed than active searching behaviors such as navigational, transactional, or highly purposive information searching (Broder, 2002).

More of an exploratory information seeking behavior than a directed search, news
reading might be less investing and less cognitively taxing than other online behaviors, especially for college students. Consequently, the distracting and frustrating potential of pop-up windows may be more severe when online tasks are highly goal-directed than it is currently found with online news reading. It should be noted, however, that goal-directed tasks might be biased against the attentional spotlight mechanism, as attention would be more likely to be driven by endogenous factors (i.e., user goals) than exogenous factors (pop-up location on the screen), especially when the task at hand is cognitively taxing (Lavie, 1995; Lavie & Tsal, 1994). An alternative to goal-directed tasks would be to inform participants that they would not see any pop-up windows, but to expose them to pop-ups during their Web activity. While very likely to increase frustration even in the absence of a cognitively taxing or goal-directed task, this alternative lacks sufficient discriminant validity, as not only the pop-up functionality but also expectancy violation might contribute to enhancing annoyance, anxiety, and frustration.

Another shortcoming of the current study comes from relying on physiological measurements to indicate user reactions to pop-ups. Contrary to expectations, very few of the physiological indices followed the predicted directions. Thus, BPM changes supported the view that heart rate decelerations and recoveries reliably index orienting responses (Graham & Clifton, 1966; Lang, 1994). However, skin conductance levels and corrugator activity appeared to indicate cognitive effort rather than intensity and valence of affective states respectively. Similarly, skin conductance responses reflected autonomic arousal associated with emotional states rather than being indicative of reflexive orientation. While finding appropriate physiological correlates for psychological processes is important in itself, the mismatch between physiological indicators and psychological reactions made theory-testing difficult in the present context.

Of course, ecological validity should also be considered here. As with most
experimental studies, the current one made use of student samples and laboratory settings. Although we took great care in including random effects especially to eliminate the role of individual differences in our findings, it is possible that such settings undermined the generalizability of our results. More importantly, the laboratory setting might be partly responsible for the apparent “banner blindness” phenomenon, with participants making inferences about the relative importance of news stories and pop-ups based on experimental instructions.

**Suggestions for further research**

One possible direction for further research would consist in testing the differential impact of pop-ups that deliver pictorial versus verbal content. In an effort to maintain the same processing style across pop-up windows, both pop-up ads and pop-up factoids were more textual than pictorial. Employing text-heavy content for both ads and factoids could have obscured the differences between pop-up ads and other pop-up windows, while also reducing the intrusive aspect of pop-ups. Adding a graphic component to both informational pop-ups and pop-up ads might change the nature of information processing since visual verbal and visual graphic information are processed differently (Boden & Brodeur, 1999). According to previous research, for example, visual graphic information is processed automatically, whereas verbal information is processed in a more controlled manner (A. Lang, Potter, & Bolls, 2000). Consequently, not only the structural features but also the content type could interfere with the nature and extent of information processing.

A second direction for further research would be to look at differences between attentional and cognitive load. The current study found that increasing the number of pop-up windows does not necessarily increase the cognitive demand to the point of impairing
cognitive processing. Moreover, an increase in the number of pop-ups has different effects on reflexive orientation compared with cognitive activity. While orienting responses habituated with repeated exposure to pop-ups, memory for Web page information was unaffected by the number of pop-up windows. This differential impact of the number of pop-ups on orienting responses compared with memory for page content signals that the attentional and the cognitive demands made by pop-up windows should be distinguished. Moreover, the current study suggests that it may be possible for an increase in attentional load not to impede processing of target information in the absence of a cognitive load. Increasing the number of pop-ups per page, for example, could increase attentional demands by constantly attracting involuntary attention; the lack of new content, however, might keep the cognitive demands low and thus avoid the effects of cognitive load.

A third direction for further research would to better understand the role of user control on pop-up and site processing. Pop-up windows could be not only initiated by the system, but they could also be hyperlink-based and thus user-initiated (Betancourt & Bisseret, 1998). Some of the findings here suggest that user control eliminates the orienting potential of pop-up windows by placing them in the attentional spotlight. Of course, these findings refer to stimulus offsets. Control over stimulus onsets could have quite different implications. While previous research shows that user control over stimulus onset also attenuates reflexive orientation, it also proposes that awareness of imminent changes in the visual environment lessens the likelihood of cognitive load as Web users can predict the arrival of new information and thus prepare by making some cognitive resources available for additional processing (Wise & Reeves, 2007).

Conclusion

Overall, the present study questions the implicit assumption that pop-up windows
are completely detrimental to news sites, showing that pop-ups can help focus Web users’
attention towards relevant information while not impeding the extent to which they
process this information. Thus, it appears that information can be made “more visible”
simply by associating it with a pop-up window. While it is true that the nature of the pop-
up content does not affect these processes, online news might benefit even more when
showed both on a Webpage and in a pop-up window given that informational pop-ups
seem to maintain users’ tonic attention (that is, interest) longer than pop-up ads.

To date, the scientific research on pop-up windows, however, has revolved around
pop-up advertisements and Internet users’ psychological reactance to this new modality.
The public and scholarly discourse focused on pop-up ads to such a degree that the mere
mention of “pop-up” became synonymous with the (persuasive) content they delivered. It
is important to emphasize that pop-up windows are more prevalent than previously
suggested and encompass more than just pop-up ads – they are available both online and
offline, they deliver various types of content, and they can be initiated equally by the
system or by the user. Understanding how this modality affects user’s performance in an
ongoing task is therefore essential in computing environments. More research should be
done in this area in the future, exploring for example how the function performed by a
pop-up window (i.e., to advertise, warn, inform, etc.) or the nature of the initiation (system
vs. user) affect information processing.
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Appendix A

Pretest Stimulus Material

New Panda Breeding and Research Center has opened in Sichuan, China

The giant pandas are found in the wild only in Sichuan, Shaanxi, and Gansu provinces in China. There are very few exemplars left, of which 80% are distributed within the Sichuan province.

In China, 10% of the giant pandas are held in zoos, and the remaining 90% are held in breeding centers. Most giant pandas are in zoos in China. They are mostly in zoos in China.

Research conducted in Japanese breeding centers show why Pandas are scarce

One of the main reasons for which the captive population of giant pandas is still not self-sustaining, specialists say, is that there are few young animals that will breed normally.

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The giant pandas are found in the wild only in Sichuan, Shaanxi and Gansu provinces in China. There are very few exceptions left, of which 80% are distributed within the Sichuan province.

The giant pandas are threatened by habitat loss and fragmentation due to human activities such as farming, logging, and infrastructure development. This has led to a decline in their habitat, which is critical for their survival. The center is one of the most important conservation efforts for the species.

Research conducted in Japanese breeding centers show why Pandas are scarce

One of the main reasons for which the captive population of giant pandas is still not self-sustaining, specialists say, is that there are very few animals that still breed naturally.

Specialists from several centers conducted surveys to establish the practice and breeding program protocol in their facilities to determine which factors affect the survival and reproduction of giant pandas.

Breeding Problems Have Brought Giant Pandas on The Endangered Species List

The panda breeding season takes place only from March to May. Along with the usual difficulties encountered when breeding in captivity, this makes it harder to increase the panda population.

Although the species is threatened, the center has been successful in raising captive giant pandas. However, the center faces several challenges, including breeding difficulties and the need for a larger population to ensure genetic diversity.
The New York Times

North Sea oil hits record price

Oil Facts

North Sea oil has surged, setting a new record for the world's oil markets, with a price of $73.70 per barrel.

Oil prices fell on Wednesday after producers' cartel Opec left output levels unchanged and the US reported a rise in American crude stocks.

UK Brent crude settled at $73.77 higher at $66.88, after hitting a peak of $65.85, while US West Texas crude rose $1.14 to close at $65.71. Prices have risen 17% so far in 2015, and they will continue to grow throughout the summer. Geopolitical tensions concerning Iran have kept up prices high recently. Although Washington has reported a sudden report that it is preparing forolla, US crude stocks fell, and reached the new high of $73.70 on Thursday afternoon. Prices were also pulled up on US producer cutbacks.

Oil hits new peaks on Iran fears

Crude oil prices have climbed to a record high in the UK, amid reports that the US is considering military options in the war with Iran.

UK Brent crude settled at $73.77 higher at $66.88, after hitting a peak of $65.85, while US West Texas crude rose $1.14 to close at $65.71. Prices have risen 17% so far in 2015, and they will continue to grow throughout the summer. Geopolitical tensions concerning Iran have kept up prices high recently. Although Washington has reported a sudden report that it is preparing forolla, US crude stocks fell, and reached the new high of $73.70 on Thursday afternoon. Prices were also pulled up on US producer cutbacks.

Price fear keeps oil flowing

Speaking ahead of an Opec meeting in Vienna on Tuesday, members of oil groups said they would increase output levels to ease prices.

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The New York Times

Oil prices dip on Opec decision

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Appendix B
Pretest Measurement Instrument
Version A
Questionnaire

Before you start, please type in your participant code: ______________

What is your age? __________________________

What is your gender? Male Female

*Please take a moment to describe how you feel at the moment*

1. For each word below, please choose one option to indicate how well the word describes THE WAY YOU FEEL NOW:

<table>
<thead>
<tr>
<th></th>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irritated</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Frustrated</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Angry</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Annoyed</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Excited</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Energetic</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Drowsy</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Wide-Awake</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Tense</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Clutched-Up</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Happy</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Pleased</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Calm</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
</tbody>
</table>

*We understand that the time was limited and you may not have read all the stories. We would appreciate if you could take a moment to answer the following questions, to the best of your abilities.*

2. Please try to recall as much information as possible from your experience on the webpage you have just seen. Please list each idea on a separate line.
3. Please answer the following questions, to the best of your knowledge:

**What has been recently opened in Sichuan, China?**
Please choose one of the following
- A breeding and research center
- A zoo and visitor center
- A bear center
- A new wild habitat for Pandas
- I do not remember

**What percentage of pandas are found in the Sichuan province?**
Please choose one of the following
- 50%
- 60%
- 70%
- 80%
- I do not remember

**How many people are expected to visit the Chengdu Center per year?**
Please choose one of the following
- 1,000,000
- 100,000
- 2,000,000
- 200,000
- I do not remember

**When was a record number of panda births attained?**
Please choose one of the following
- 2000
- 1994
- 2005
- 2003
- I do not remember

**How many cubs were born in Chinese centers the year a record number of births were attained?**
Please choose one of the following
- 20
- 21
- 25
- 30
- I do not remember

**When did artificial insemination practices for breeding pandas started?**
Please choose one of the following
- 1960s
- 1970s
- 1980s
- 1990s
- I do not remember
Where was the research showing why Pandas are scarce conducted?
Please choose one of the following
China
Japan
US
Europe
I do not remember

Giant Pandas are not self-sustaining in captivity because …
Please choose one of the following
They are genetically dysfunctional
They do not like captivity
There are not enough males
They do not breed naturally
I do not remember

One of the research findings was that ...
Please choose one of the following
Males showed no interest in females in heat
Males showed no interest in eating
Males showed no interest in returning to wilderness
Males showed no interest in other males
I do not remember

What is the list Pandas are on?
Please choose one of the following
The protected family list
The protected species list
The endangered species list
The endangered family list
I do not remember

The Pandas' breeding season takes place from …
Please choose one of the following
March to May
March to April
May to June
March to June
I do not remember

What are the reasons for which Pandas are in low numbers?
Please choose one of the following
Mating habits
Eating habits and short breeding season
Being in captivity
Genetic deficiency
I do not remember
How many Pandas are left in the wild?
  Please choose one of the following
  About 5,000
  About 500
  About 1,000
  About 10,000
  I do not remember

Zoo Pandas can be as old as …
  Please choose one of the following
  15
  25
  35
  45
  I do not remember

How much does a National Geographic subscription cost?
  Please choose one of the following
  $15.99 per month
  $15.99 per year
  $5.99 per month
  $5.99 per year
  I do not remember

What can you find in this month’s National Geographic?
  Please choose one of the following
  Bears
  Japan
  Artificial insemination
  China
  I do not remember

The top left story was about ...
  Please choose one of the following
  The opening of a breeding and research center in China
  Research about Panda breeding conducted in Japan
  Record number of Panda births in a recent year
  Why Pandas are on the endangered species list
  I do not remember

The bottom left story was about ...
  Please choose one of the following
  The opening of a breeding and research center in China
  Research about Panda breeding conducted in Japan
  Record number of Panda births in a recent year
  Why Pandas are on the endangered species list
  I do not remember
The top right story was about ...
Please choose one of the following
- The opening of a breeding and research center in China
- Research about Panda breeding conducted in Japan
- Record number of Panda births in a recent year
- Why Pandas are on the endangered species list
- I do not remember

The bottom right story was about ...
Please choose one of the following
- The opening of a breeding and research center in China
- Research about Panda breeding conducted in Japan
- Record number of Panda births in a recent year
- Why Pandas are on the endangered species list
- I do not remember

The background of the top left story was...
Please choose one of the following
- Light blue
- Light green
- Light purple
- Light yellow
- I do not remember

The background of the bottom left story was...
Please choose one of the following
- Light blue
- Light green
- Light purple
- Light yellow
- I do not remember

The background of the top right story was...
Please choose one of the following
- Light blue
- Light green
- Light purple
- Light yellow
- I do not remember

The background of the bottom right story was...
Please choose one of the following
- Light blue
- Light green
- Light purple
- Light yellow
- I do not remember
Again, we understand that the time was limited and you may not have read all the stories. We would appreciate if you could take a moment to answer the following questions, to the best of your abilities.

4. Approximately what percentage of the content you saw on the screen were you able to read? ______________________

5. How many stories have you read entirely? ______________________

6. Besides the stories you read entirely, how many additional ones have you 'browsed' through or skimmed?____________________

Now, please take a moment to answer a few questions about the website you just browsed

7. Thinking about the news website you have just browsed as a whole, how well would you say it utilized the capabilities of the WWW medium?

<table>
<thead>
<tr>
<th>Not Well At All</th>
<th>Extremely Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○</td>
</tr>
</tbody>
</table>

8. For each word below, please choose one option to indicate how well the word describes THE WEB SITE YOU JUST BROWSED:

<table>
<thead>
<tr>
<th></th>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organized</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Interactive</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Useful</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Coherent</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Confusing</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Enjoyable</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Appealing</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Informative</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Interesting</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Clear</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
</tbody>
</table>

9. How likely are you to visit this site for your daily news needs?

<table>
<thead>
<tr>
<th>Not At All Likely</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○</td>
</tr>
</tbody>
</table>
10. How likely are you to recommend this site to friends/relatives for their daily news?

<table>
<thead>
<tr>
<th>Not At All Likely</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○</td>
</tr>
</tbody>
</table>

11. How much do you think the layout of the website affected your ability to read the stories?

<table>
<thead>
<tr>
<th>Did not affect</th>
<th>Affected Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○</td>
</tr>
</tbody>
</table>

**Please take a moment now to answer a few questions regarding the news stories you just read**

12. For each word below, please choose one option to indicate how well the word describes in general THE NEWS STORIES YOU JUST READ:

<table>
<thead>
<tr>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Believable</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Biased</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Captivating</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Comprehensive</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Clear</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Involving</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Factual</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Fair</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Informative</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Important</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Objective</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Persuasive</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Well-written</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
</tbody>
</table>

**You may or may have not seen additional windows, other than the webpage. If you did, please take a moment now to answer a few questions regarding these additional windows**

13. For each word below, please choose one option to indicate how well the word describes THE ADDITIONAL WINDOWS:

<table>
<thead>
<tr>
<th>pleasant</th>
<th>unpleasant</th>
</tr>
</thead>
<tbody>
<tr>
<td>irritating</td>
<td>not irritating</td>
</tr>
<tr>
<td>entertaining</td>
<td>not entertaining</td>
</tr>
<tr>
<td>enjoyable</td>
<td>not enjoyable</td>
</tr>
<tr>
<td>important</td>
<td>not important</td>
</tr>
</tbody>
</table>
You may or may have not seen additional windows, other than the webpage. If you did, please take a moment now to answer a few questions regarding these additional windows.

The additional window was about ...
Please choose one of the following
- Panda facts
- Breeding and research centers
- National Geographic
- There was no additional window
- I have seen an additional window, but I do not remember the content
- I do not remember whether I saw a window or not

The text in the additional window was ...
Please choose one of the following
- Black
- Green
- Blue
- Brown
- I have seen an additional window, but I do not remember the content
- I do not remember whether I saw a window or not

Please click on the button below to submit the questionnaire.
Submit
Questionnaire

Before you start, please type in your participant code: ______________

*Please take a moment to describe how you feel at the moment*

1. For each word below, please choose one option to indicate how well the word describes THE WAY YOU FEEL NOW:

<table>
<thead>
<tr>
<th></th>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irritated</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Frustrated</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Angry</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Annoyed</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Excited</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Energetic</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Drowsy</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Wide-Awake</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Tense</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Clutched-Up</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Happy</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Pleased</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Calm</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
</tbody>
</table>

*We understand that the time was limited and you may not have read all the stories. We would appreciate if you could take a moment to answer the following questions, to the best of your abilities.*

2. Please try to recall as much information as possible from your experience on the webpage you have just seen. Please list each idea on a separate line.
3. Please answer the following questions, to the best of your knowledge:

What region has oil hitting record prices?
Please choose one of the following
North Sea
Black Sea
Red Sea
North Pole
I do not remember

What country is causing oil prices to be high given its tensions with the international community?
Please choose one of the following
Nigeria
UK
US
Saudi Arabia
I do not remember

In US, the prices are within $3 from record prices that hit during a harsh period. What period was it?
Please choose one of the following
Last winter, when the consumption went up
Last August, when hurricanes disrupt production
Immediately after the war in Iraq started
15 year ago after the first Persian Gulf War
I do not remember

On account of whose fear does the oil hit new peaks?
Please choose one of the following
Iraq
Iran
US
China
I do not remember

Crude oil prices climbed in UK, amid reports that US considers taking action. What is the action that US is accused of considering?
Please choose one of the following
Increasing oil stocks
Increasing oil consumption
Military option against Iraq
Military option against Iran
I do not remember
How did Washington react to media reports about its intentions?

- Rejected the reports
- Did not comment
- Confirmed the reports
- There is no clear indication of how it reacted
- I do not remember

On account of whose decision do oil prices dip?

- UN
- US
- OPEC
- Saudi Arabia
- I do not remember

What recent rise was taking place prior to the current fall in oil prices?

- Rise of tension between US and Saudi Arabia
- Rise in oil consumption
- Rise in American crude stock
- Rise in American taxes
- I do not remember

What emerging economies put pressure on oil supplies?

- China and India
- Iraq and Saudi Arabia
- Nigeria and Iran
- China and Niger
- I do not remember

How does price fear keep the oil?

- At premium
- Highly priced
- Flowing
- Cheap
- I do not remember

Where did oil groups meet?

- Vienna
- Geneva
- Zurich
- London
- I do not remember
How much of the world's oil supply do the oil groups provide?
  Please choose one of the following
  One half
  One third
  One sixth
  One fifth
  I do not remember

How much oil does Saudi Arabia own?
  Please choose one of the following
  A half of the world reserves
  A third of the world reserves
  A fourth of the world reserves
  A sixth of the world reserves
  I do not remember

What country is the second largest oil consumer?
  Please choose one of the following
  UK
  US
  Japan
  Saudi Arabia
  I do not remember

What would you learn from alternativenergy.com?
  Please choose one of the following
  About solar cells
  About oil prices
  About clean fuels
  About oil production
  I do not remember

How can we switch off carbon emissions?
  Please choose one of the following
  With ethanol
  With low energy prices
  With sun power
  With low oil consumption
  I do not remember

The top left story was about ...
  Please choose one of the following
  North sea oil high prices
  Opec decision
  Oil prices spike on Iran fears
  Oil producers meeting
  I do not remember
The bottom left story was about ...
Please choose one of the following
North sea oil high prices
Opec decision
Oil prices spike on Iran fears
Oil producers meeting
I do not remember

The top right story was about ...
Please choose one of the following
North sea oil high prices
Opec decision
Oil prices spike on Iran fears
Oil producers meeting
I do not remember

The bottom right story was about ...
Please choose one of the following
North sea oil high prices
Opec decision
Oil prices spike on Iran fears
Oil producers meeting
I do not remember

The background of the top left story was...
Please choose one of the following
Light blue
Light green
Light pink
Light yellow
I do not remember

The background of the bottom left story was ...
Please choose one of the following
Light blue
Light green
Light pink
Light yellow
I do not remember

The background of the top right story was ...
Please choose one of the following
Light blue
Light green
Light pink
Light yellow
I do not remember
The background of the bottom right story was ...

Please choose one of the following
Light blue
Light green
Light pink
Light yellow
I do not remember

Again, we understand that the time was limited and you may not have read all the stories. We would appreciate if you could take a moment to answer the following questions, to the best of your abilities.

4. Approximately what percentage of the content you saw on the screen were you able to read? _______________________

5. How many stories have you read entirely? _______________________

6. Besides the stories you read entirely, how many additional ones have you 'browsed' through or skimmed?____________________

Now, please take a moment to answer a few questions about the website you just browsed

7. Thinking about the news website you have just browsed as a whole, how well would you say it utilized the capabilities of the WWW medium?

<table>
<thead>
<tr>
<th>Not Well At All</th>
<th>Extremely Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
</tbody>
</table>

8. For each word below, please choose one option to indicate how well the word describes THE WEB SITE YOU JUST BROWSED:

<table>
<thead>
<tr>
<th></th>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organized</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Interactive</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Useful</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Coherent</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Confusing</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Enjoyable</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Appealing</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Informative</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Interesting</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Clear</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
</tbody>
</table>
9. How likely are you to visit this site for your daily news needs?

<table>
<thead>
<tr>
<th>Not At All Likely</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
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<tr>
<td>○</td>
<td>○</td>
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<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

10. How likely are you to recommend this site to friends/relatives for their daily news?

<table>
<thead>
<tr>
<th>Not At All Likely</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
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<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

11. How much do you think the layout of the website affected your ability to read the stories?

<table>
<thead>
<tr>
<th>Did not affect</th>
<th>Affected Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
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<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Please take a moment now to answer a few questions regarding the news stories you just read.

12. For each word below, please choose one option to indicate how well the word describes in general THE NEWS STORIES YOU JUST READ:

<table>
<thead>
<tr>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Believable</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Biased</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Captivating</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Comprehensive</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Clear</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Involving</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Factual</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Fair</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Informative</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Important</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Objective</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Persuasive</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Well-written</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
</tbody>
</table>

You may or may have not seen additional windows, other than the webpage. If you did, please take a moment now to answer a few questions regarding these additional windows.
13. For each word below, please choose one option to indicate how well the word describes THE ADDITIONAL WINDOWS:

<table>
<thead>
<tr>
<th>Word</th>
<th>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</th>
<th>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</th>
<th>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</th>
<th>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</th>
<th>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</th>
<th>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</th>
</tr>
</thead>
<tbody>
<tr>
<td>pleasant</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>irritating</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>entertaining</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>enjoyable</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
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You may or may have not seen additional windows, other than the webpage. If you did, please take a moment now to answer a few questions regarding these additional windows.

The additional window was about ...
  Please choose one of the following
  Oil facts
  High oil prices
  BP
  There was no additional window
I have seen an additional window, but I do not remember the content
I do not remember whether I saw a window or not

The text in the additional window was ...
  Please choose one of the following
  Black
  Green
  Blue
  There was no additional window
I have seen an additional window, but I do not remember the content
I do not remember whether I saw a window or not

Please click on the button below to submit the questionnaire.

Submit
Before you start, please type in your participant code: ______________

What is your age? _______________________

What is your gender? Please choose one of the following
Male
Female

*Please take a moment to describe how you feel at the moment*

1. For each word below, please choose one option to indicate how well the word describes THE WAY YOU FEEL NOW:

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<th>Describes Very Well</th>
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*We understand that the time was limited and you may not have read all the stories. We would appreciate if you could take a moment to answer the following questions, to the best of your abilities.*

2. Please try to recall as much information as possible from your experience on the webpage you have just seen. Please list each idea on a separate line.
3. Please answer the following questions, to the best of your knowledge:

**What has been recently opened in Sichuan, China?**
- Please choose one of the following
  - A breeding and research center
  - A zoo and visitor center
  - A bear center
  - A new wild habitat for Pandas
  - I do not remember

**What percentage of pandas are found in the Sichuan province?**
- Please choose one of the following
  - 50%
  - 60%
  - 70%
  - 80%
  - I do not remember

**How many people are expected to visit the Chengdu Center per year?**
- Please choose one of the following
  - 1,000,000
  - 100,000
  - 2,000,000
  - 200,000
  - I do not remember

**When was a record number of panda births attained?**
- Please choose one of the following
  - 2000
  - 1994
  - 2005
  - 2003
  - I do not remember

**How many cubs were born in Chinese centers the year a record number of births were attained?**
- Please choose one of the following
  - 20
  - 21
  - 25
  - 30
  - I do not remember

**When did artificial insemination practices for breeding pandas started?**
- Please choose one of the following
  - 1960s
  - 1970s
  - 1980s
  - 1990s
  - I do not remember
Where was the research showing why Pandas are scarce conducted?
Please choose one of the following
China
Japan
US
Europe
I do not remember

Giant Pandas are not self-sustaining in captivity because …
Please choose one of the following
They are genetically dysfunctional
They do not like captivity
There are not enough males
They do not breed naturally
I do not remember

One of the research findings was that …
Please choose one of the following
Males showed no interest in females in heat
Males showed no interest in eating
Males showed no interest in returning to wilderness
Males showed no interest in other males
I do not remember

What is the list Pandas are on?
Please choose one of the following
The protected family list
The protected species list
The endagered species list
The endagered family list
I do not remember

The Pandas' breeding season takes place from …
Please choose one of the following
March to May
March to April
May to June
March to June
I do not remember

What are the reasons for which Pandas are in low numbers?
Please choose one of the following
Mating habits
Eating habits and short breeding season
Being in captivity
Genetic deficiency
I do not remember
How many Pandas are left in the wild?
Please choose one of the following
About 5,000
About 500
About 1,000
About 10,000
I do not remember

Zoo Pandas can be as old as …
Please choose one of the following
15
25
35
45
I do not remember

How much does a National Geographic subscription cost?
Please choose one of the following
$15.99 per month
$15.99 per year
$5.99 per month
$5.99 per year
I do not remember

What can you find in this month’s National Geographic?
Please choose one of the following
Bears
Japan
Artificial insemination
China
I do not remember

The top left story was about ...
Please choose one of the following
The opening of a breeding and research center in China
Research about Panda breeding conducted in Japan
Record number of Panda births in a recent year
Why Pandas are on the endangered species list
I do not remember

The bottom left story was about ...
Please choose one of the following
The opening of a breeding and research center in China
Research about Panda breeding conducted in Japan
Record number of Panda births in a recent year
Why Pandas are on the endangered species list
I do not remember
The top right story was about ...
Please choose one of the following
The opening of a breeding and research center in China
Research about Panda breeding conducted in Japan
Record number of Panda births in a recent year
Why Pandas are on the endangered species list
I do not remember

The bottom right story was about ...
Please choose one of the following
The opening of a breeding and research center in China
Research about Panda breeding conducted in Japan
Record number of Panda births in a recent year
Why Pandas are on the endangered species list
I do not remember

The background of the top left story was...
Please choose one of the following
Light blue
Light green
Light purple
Light yellow
I do not remember

The background of the bottom left story was...
Please choose one of the following
Light blue
Light green
Light purple
Light yellow
I do not remember

The background of the top right story was...
Please choose one of the following
Light blue
Light green
Light purple
Light yellow
I do not remember

The background of the bottom right story was...
Please choose one of the following
Light blue
Light green
Light purple
Light yellow
I do not remember
Again, we understand that the time was limited and you may not have read all the stories. We would appreciate if you could take a moment to answer the following questions, to the best of your abilities.

4. Approximately what percentage of the content you saw on the screen were you able to read? ______________________

5. How many stories have you read entirely? ______________________

6. Besides the stories you read entirely, how many additional ones have you 'browsed' through or skimmed?____________________

Now, please take a moment to answer a few questions about the website you just browsed

7. Thinking about the news website you have just browsed as a whole, how well would you say it utilized the capabilities of the WWW medium?

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<th>Extremely Well</th>
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<td>○</td>
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<td>○</td>
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<td>○</td>
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<tr>
<td>○</td>
<td>○</td>
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<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

8. For each word below, please choose one option to indicate how well the word describes THE WEB SITE YOU JUST BROWSED:

<table>
<thead>
<tr>
<th></th>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organized</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Interactive</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Useful</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Coherent</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Confusing</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Enjoyable</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Appealing</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Informative</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Interesting</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Clear</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
</tbody>
</table>

9. How likely are you to visit this site for your daily news needs?

<table>
<thead>
<tr>
<th>Not At All Likely</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
</tbody>
</table>

10. How likely are you to recommend this site to friends/relatives for their daily news?

<table>
<thead>
<tr>
<th>Not At All Likely</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
</tbody>
</table>
11. How much do you think the layout of the website affected your ability to read the stories?

<table>
<thead>
<tr>
<th>Did not affect</th>
<th>Affected Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
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<td>○</td>
<td>○</td>
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<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Please take a moment now to answer a few questions regarding the news stories you just read.

12. For each word below, please choose one option to indicate how well the word describes in general THE NEWS STORIES YOU JUST READ:

<table>
<thead>
<tr>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate</td>
<td>○ ○ ○ ○ ○ ○ ○ ○○○</td>
</tr>
<tr>
<td>Believable</td>
<td>○ ○ ○ ○ ○ ○ ○ ○○○</td>
</tr>
<tr>
<td>Biased</td>
<td>○ ○ ○ ○ ○ ○ ○ ○○○</td>
</tr>
<tr>
<td>Captivating</td>
<td>○ ○ ○ ○ ○ ○ ○ ○○○</td>
</tr>
<tr>
<td>Comprehensive</td>
<td>○ ○ ○ ○ ○ ○ ○ ○○○</td>
</tr>
<tr>
<td>Clear</td>
<td>○ ○ ○ ○ ○ ○ ○ ○○○</td>
</tr>
<tr>
<td>Involving</td>
<td>○ ○ ○ ○ ○ ○ ○ ○○○</td>
</tr>
<tr>
<td>Factual</td>
<td>○ ○ ○ ○ ○ ○ ○ ○○○</td>
</tr>
<tr>
<td>Fair</td>
<td>○ ○ ○ ○ ○ ○ ○ ○○○</td>
</tr>
<tr>
<td>Informative</td>
<td>○ ○ ○ ○ ○ ○ ○ ○○○</td>
</tr>
<tr>
<td>Important</td>
<td>○ ○ ○ ○ ○ ○ ○ ○○○</td>
</tr>
<tr>
<td>Objective</td>
<td>○ ○ ○ ○ ○ ○ ○ ○○○</td>
</tr>
<tr>
<td>Persuasive</td>
<td>○ ○ ○ ○ ○ ○ ○ ○○○</td>
</tr>
<tr>
<td>Well-written</td>
<td>○ ○ ○ ○ ○ ○ ○ ○○○</td>
</tr>
</tbody>
</table>

You may or may have not seen additional windows, other than the webpage. If you did, please take a moment now to answer a few questions regarding these additional windows.

13. For each word below, please choose one option to indicate how well the word describes THE ADDITIONAL WINDOWS:

<p>| pleasant | ○ ○ ○ ○ ○ ○ ○ ○○○ | Unpleasant |
| irritating | ○ ○ ○ ○ ○ ○ ○ ○○○ | not irritating |
| entertaining | ○ ○ ○ ○ ○ ○ ○ ○○○ | not entertaining |
| enjoyable | ○ ○ ○ ○ ○ ○ ○ ○○○ | not enjoyable |
| important | ○ ○ ○ ○ ○ ○ ○ ○○○ | not important |
| helpful | ○ ○ ○ ○ ○ ○ ○ ○○○ | not helpful |
| informative | ○ ○ ○ ○ ○ ○ ○ ○○○ | not informative |
| useful | ○ ○ ○ ○ ○ ○ ○ ○○○ | not useful |
| made me | ○ ○ ○ ○ ○ ○ ○ ○○○ | did not make |</p>
<table>
<thead>
<tr>
<th>curious</th>
<th>me curious</th>
<th>not boring</th>
</tr>
</thead>
<tbody>
<tr>
<td>boring</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>interesting</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>factual</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>distracting</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>annoying</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
</tbody>
</table>

You may or may have not seen additional windows, other than the webpage. If you did, please take a moment now to answer a few questions regarding these additional windows.

The additional window was about ...
- Please choose one of the following
- Panda facts
- Breeding and research centers
- National Geographic
- There was no additional window
- I have seen an additional window, but I do not remember the content
- I do not remember whether I saw a window or not

The text in the additional window was ...
- Please choose one of the following
- Black
- Green
- Blue
- Brown
- I have seen an additional window, but I do not remember the content
- I do not remember whether I saw a window or not

Did you find the information you were asked to find?
- Please choose one of the following
- Yes
- No

What is the answer? ______________

Do you think you had enough time to look for it?
- Please choose one of the following
- Yes
- No

Approximately what percentage of all news stories were you able to read during the time the news page was on? ______________

Please click on the button below to submit the questionnaire.
Submit
Questionnaire

Before you start, please type in your participant code: ______________

Please take a moment to describe how you feel at the moment

1. For each word below, please choose one option to indicate how well the word describes THE WAY YOU FEEL NOW:

<table>
<thead>
<tr>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irritated</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Frustrated</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Angry</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Annoyed</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Excited</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Energetic</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Drowsy</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Wide-Awake</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Tense</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Clutched-Up</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Happy</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Pleased</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Calm</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
</tbody>
</table>

We understand that the time was limited and you may not have read all the stories. We would appreciate if you could take a moment to answer the following questions, to the best of your abilities.

2. Please try to recall as much information as possible from your experience on the webpage you have just seen. Please list each idea on a separate line.


3. Please answer the following questions, to the best of your knowledge:

What region has oil hitting record prices?
   Please choose one of the following
   North Sea
   Black Sea
   Red Sea
   North Pole
   I do not remember
What country is causing oil prices to be high given its tensions with the international community?

Please choose one of the following
- Nigeria
- UK
- US
- Saudi Arabia
- I do not remember

In US, the prices are within $3 from record prices that hit during a harsh period. What period was it?

Please choose one of the following
- Last winter, when the consumption went up
- Last August, when hurricanes disrupt production
- Immediately after the war in Iraq started
- 15 year ago after the first Persian Gulf War
- I do not remember

On account of whose fear does the oil hit new peaks?

Please choose one of the following
- Iraq
- Iran
- US
- China
- I do not remember

Crude oil prices climbed in UK, amid reports that US considers taking action. What is the action that US is accused of considering?

Please choose one of the following
- Increasing oil stocks
- Increasing oil consumption
- Military option against Iraq
- Military option against Iran
- I do not remember

How did Washington react to media reports about its intentions?

Please choose one of the following
- Rejected the reports
- Did not comment
- Confirmed the reports
- There is no clear indication of how it reacted
- I do not remember

On account of whose decision do oil prices dip?

Please choose one of the following
- UN
- US
- OPEC
- Saudi Arabia
- I do not remember
What recent rise was taking place prior to the current fall in oil prices?
Please choose one of the following
Rise of tension between US and Saudi Arabia
Rise in oil consumption
Rise in American crude stock
Rise in American taxes
I do not remember

What emerging economies put pressure on oil supplies?
Please choose one of the following
China and India
Iraq and Saudi Arabia
Nigeria and Iran
China and Niger
I do not remember

How does price fear keep the oil?
Please choose one of the following
At premium
Highly priced
Flowing
Cheap
I do not remember

Where did oil groups meet?
Please choose one of the following
Vienna
Geneva
Zurich
London
I do not remember

How much of the world's oil supply do the oil groups provide?
Please choose one of the following
One half
One third
One sixth
One fifth
I do not remember

How much oil does Saudi Arabia own?
Please choose one of the following
A half of the world reserves
A third of the world reserves
A fourth of the world reserves
A sixth of the world reserves
I do not remember
What country is the second largest oil consumer?
Please choose one of the following
UK
US
Japan
Saudi Arabia
I do not remember

What would you learn from alternativenergy.com?
Please choose one of the following
About solar cells
About oil prices
About clean fuels
About oil production
I do not remember

How can we switch off carbon emissions?
Please choose one of the following
With ethanol
With low energy prices
With sun power
With low oil consumption
I do not remember

The top left story was about ...
Please choose one of the following
North sea oil high prices
Opec decision
Oil prices spike on Iran fears
Oil producers meeting
I do not remember

The bottom left story was about ...
Please choose one of the following
North sea oil high prices
Opec decision
Oil prices spike on Iran fears
Oil producers meeting
I do not remember

The top right story was about ...
Please choose one of the following
North sea oil high prices
Opec decision
Oil prices spike on Iran fears
Oil producers meeting
I do not remember
The bottom right story was about ...
   Please choose one of the following
   North sea oil high prices
   Opec decision
   Oil prices spike on Iran fears
   Oil producers meeting
   I do not remember

The background of the top left story was...
   Please choose one of the following
   Light blue
   Light green
   Light pink
   Light yellow
   I do not remember

The background of the bottom left story was ...
   Please choose one of the following
   Light blue
   Light green
   Light pink
   Light yellow
   I do not remember

The background of the top right story was ... 
   Please choose one of the following
   Light blue
   Light green
   Light pink
   Light yellow
   I do not remember

The background of the bottom right story was ... 
   Please choose one of the following
   Light blue
   Light green
   Light pink
   Light yellow
   I do not remember

Again, we understand that the time was limited and you may not have read all the stories. We would appreciate if you could take a moment to answer the following questions, to the best of your abilities.

4. Approximately what percentage of the content you saw on the screen were you able to read? ________________________

5. How many stories have you read entirely? ________________________
6. Besides the stories you read entirely, how many additional ones have you 'browsed' through or skimmed?____________________

Now, please take a moment to answer a few questions about the website you just browsed

7. Thinking about the news website you have just browsed as a whole, how well would you say it utilized the capabilities of the WWW medium?

Not Well At All | Extremely Well
---|---
○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

8. For each word below, please choose one option to indicate how well the word describes THE WEB SITE YOU JUST BROWSED:

<table>
<thead>
<tr>
<th>Word</th>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organized</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Interactive</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Useful</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Coherent</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Confusing</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Enjoyable</td>
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<td></td>
</tr>
<tr>
<td>Appealing</td>
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<td></td>
</tr>
<tr>
<td>Informative</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Interesting</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Clear</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
</tbody>
</table>

9. How likely are you to visit this site for your daily news needs?

Not At All Likely | Very Likely
---|---
○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

10. How likely are you to recommend this site to friends/relatives for their daily news?

Not At All Likely | Very Likely
---|---
○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

11. How much do you think the layout of the website affected your ability to read the stories?

Did not affect | Affected Very Much
---|---
○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
Please take a moment now to answer a few questions regarding the news stories you just read.

12. For each word below, please choose one option to indicate how well the word describes in general THE NEWS STORIES YOU JUST READ:

<table>
<thead>
<tr>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Believable</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Biased</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Captivating</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Comprehensive</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Clear</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Involving</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Factual</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Fair</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Informative</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Important</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Objective</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Persuasive</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Well-written</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
</tbody>
</table>

You may or may have not seen additional windows, other than the webpage. If you did, please take a moment now to answer a few questions regarding these additional windows.

13. For each word below, please choose one option to indicate how well the word describes THE ADDITIONAL WINDOWS:

| pleasant | ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ unpleasant |
| irritating | ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ not irritating |
| entertaining | ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ not entertaining |
| enjoyable | ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ not enjoyable |
| important | ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ not important |
| helpful | ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ not helpful |
| informative | ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ not informative |
| useful | ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ not useful |
| made me curious | ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ did not make me curious |
| boring | ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ not boring |
| interesting | ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ not interesting |
| factual | ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ not factual |
| distracting | ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ not distracting |
| annoying | ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ not annoying |
You may or may have not seen additional windows, other than the webpage. If you did, please take a moment now to answer a few questions regarding these additional windows.

The additional window was about ...
Please choose one of the following
- Oil facts
- High oil prices
- BP
- There was no additional window
- I have seen an additional window, but I do not remember the content
- I do not remember whether I saw a window or not

The text in the additional window was ...
Please choose one of the following
- Black
- Green
- Blue
- There was no additional window
- I have seen an additional window, but I do not remember the content
- I do not remember whether I saw a window or not

Did you find the information you were asked to find?
Please choose one of the following
- Yes
- No

What is the answer? _______________________

Do you think you had enough time to look for it?
Please choose one of the following
- Yes
- No

Approximately what percentage of all news stories were you able to read during the time the news page was on? _________________

Please click on the button below to submit the questionnaire.

Submit
Appendix C

Experimental Stimulus Material

North Sea oil hits record price
Crude oil prices hit all-time high in London on fears of growing tensions between Saudi Arabia and international community

Brent North Sea crude oil scheduled for delivery in May jumped $3.20 per barrel on fears Saudi Arabia will delay oil exports to protest Iraq's decision to reduce oil prices. Brent crude oil was within $3 of the record price hit last August when hurricanes disrupted production. Oil prices surged 13% last year, driven mainly by concerns about supply. Brent's Middle East Brent crude prices have been hitting record highs this week and reached a new high of $56.20 per barrel on Thursday and fell 10% after the announcement.

Oil hits new peaks on Iran fears
UK crude oil prices climbed to a record high amid reports of US considering military options in the nuclear row with Iran

Oil prices dip on Opec decision
Oil prices fall following recent rise in American crude stocks and decision of petroleum cartel to leave output levels unchanged

Price scare keeps oil flowing
Right before the OPEC meeting in Vienna, oil producers promise an increase in output levels in hopes to ease prices

Italian PM refuses to concede defeat in elections
Italian Prime Minister Silvio Berlusconi denies defeat despite low number of disputed election ballots

Italian Prime Minister Silvio Berlusconi has formed a new government that is still provisional. The electoral authorities have yet to validate or count the ballots and to prove Berlusconi's victory.

Berlusconi Suffers Setback in Recount

Italy Faces Second Week of Political Stalemate
Italy heads into a second week of uncertainty with Prime Minister Silvio Berlusconi refusing to recognize rival's victory

Prodi Ponders Future Italian Government
Opposition leader working on future government while winner still unconfirmed after general elections

Overthrow threatens prime minister

Government leaders met twice at the weekend to try to form a new government. But the talks broke down when Berlusconi refused to allow a new prime minister to be chosen by the president. The coalition has been in power for two years and Berlusconi has been under pressure to resign.

Prime Minister Silvio Berlusconi has refused to resign and has made no comments on the future of the government.
Italian PM refuses to concede defeat in elections
Italian Prime Minister Silvio Berlusconi denies defeat despite low number of disputed election ballots

Italian Interior Ministry confirmed Prime Minister Silvio Berlusconi's victory in elections for parliament, with the centre-left coalition winning with 451 of the 630 seats in the lower house of parliament. The government now has enough seats to form a majority government. The election result was welcomed by government officials and was seen as a victory for Berlusconi's centre-right coalition.

Italy Faces Second Week of Political Stalemate
Italy heads into a second Prime Minister selection

The Supreme Court in Rome has ordered a new election for the lower house of parliament. The centre-left coalition has won a majority of seats in the election, but the government is still in a state of political uncertainty. The government has announced that it will submit a bill to the Italian Senate to dissolve the lower house, paving the way for a new election.

Prodi Ponders Future Italian Government
Opposition leader working on future government while winner still unconfirmed after general elections

After a bitter election campaign, the centre-left coalition has emerged victorious in the general election in Italy. However, the government still needs to be formed, and the opposition leader, Romano Prodi, has announced that he will continue to work on forming a government.

Berlusconi Suffers Setback Over Recount
Announcement of an unlikely ballot recount threatens Silvio Berlusconi's fight to remain prime minister

The government has announced that it will hold a recount in some areas, which could affect the outcome of the election. The government has been criticized for the way it handled the election, and the opposition is calling for a new election to be held.

Italy Political Facts

Italy has been a republic since 1946. After World War II, Italy was divided into two states: the Kingdom of Italy and the Socialist Republic of Italy. In 1946, a referendum was held on whether Italy should become a republic. Italy has a bicameral parliament, consisting of the Chamber of Deputies and the Senate. The Prime Minister is the head of government and is appointed by the President of the Republic.
Italian PM refuses to concede defeat in elections

Italian Prime Minister Silvio Berlusconi denies defeat despite low number of disputed election ballots.

Italian Prime Minister Silvio Berlusconi confirmed Friday that the number of disputed ballots was only around 5,000, far fewer than expected. Berlusconi said that he had not conceded defeat. Earlier in the day, Berlusconi’s center-right coalition announced that it would ask the court to consider the possibility of a recount. Italian Prime Minister Silvio Berlusconi said that the court had rejected the request for a nationwide recount. Berlusconi’s coalition hopes to gain a majority in the Chamber of Deputies and maintain a slim majority in the Senate. Meanwhile, the center-left coalition has gained a narrow victory in the election. The court has rejected the request for a nationwide recount. Berlusconi’s coalition hopes to gain a majority in the Chamber of Deputies and maintain a slim majority in the Senate.

Prodi Ponders Future Italian Government

Opposition leader working on future government while winner still unconfirmed after general elections.

After a tense election campaign, the Italian government’s failure to agree on a coalition government leaves the country facing a political uncertainty. Prime Minister Romano Prodi has announced that he will work with the center-left coalition to form a government. Prodi’s coalition includes the Democratic Party, the Italian Socialists, and the Green Party. The center-left coalition has won a narrow majority in the election. Prodi has announced that he will work with the center-left coalition to form a government. Prodi’s coalition includes the Democratic Party, the Italian Socialists, and the Green Party. The center-left coalition has won a narrow majority in the election. Prodi has announced that he will work with the center-left coalition to form a government. Prodi’s coalition includes the Democratic Party, the Italian Socialists, and the Green Party. The center-left coalition has won a narrow majority in the election.
Appendix D

Experimental Measurement Instruments

Questionnaire

Before you start, please type in your participant code: ______________

What is your age? _________________________

What is your gender? Please choose one of the following

Male
Female

*Please take a moment to describe how you feel at the moment*

1. For each word below, please choose one option to indicate how well the word describes THE WAY YOU FEEL NOW:

<table>
<thead>
<tr>
<th>Word</th>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irritated</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Frustrated</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Angry</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Annoyed</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Excited</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Energetic</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Drowsy</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Wide-Awake</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Tense</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Clutched-Up</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Happy</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Pleased</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Calm</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
</tbody>
</table>

*We understand that the time was limited and you may not have read all the stories. We would appreciate if you could take a moment to answer the following questions, to the best of your abilities.*

2. Please try to recall as much information as possible from your experience on the webpage you have just seen. Please list each idea on a separate line.
3. Please answer the following questions, to the best of your knowledge:

**What is the Italian PM refusing to do?**
- Please choose one of the following
- Concede defeat
- Announce withdrawal
- Run for reelection
- Meet with opposition leaders
- I do not remember

**In spite of what does Silvio Berlusconi deny defeat?**
- Please choose one of the following
- Low public support
- Low number of votes
- Low international support
- Low number of disputed ballots
- I do not remember

**Who congratulated Prodi?**
- Please choose one of the following
- Russian President Vladimir Putin
- British PM Tony Blair
- Italian PM Silvio Berlusconi
- US President George Bush
- I do not remember

**Over what does Berlusconi suffer setback?**
- Please choose one of the following
- Election results
- Internal affairs
- Recount
- Saudi Arabia
- I do not remember

**What is Berlusconi fighting for?**
- Please choose one of the following
- Fiscal responsibility
- Decreasing oil prices
- New government
- Remaining prime minister
- I do not remember

**On what did Interior Ministry blame initial incorrect numbers?**
- Please choose one of the following
- Material error
- Poorly trained personnel
- Political pressure
- There is no clear indication about what was blamed
- I do not remember
Italy is facing a second week of …
Please choose one of the following
Economic downs
Political stalemate
Political chaos
Political competition
I do not remember

What does the Italian Prime Minister refuse to recognize?
Please choose one of the following
Rising tension in Italy
Economic failure
Rival victory
Political failure
I do not remember

Who is calling for 45,000 votes cast in northern Italy to be ruled illegal?
Please choose one of the following
Former reforms minister
Former prime minister
Former president
Opposition leader
I do not remember

What does Prodi ponder?
Please choose one of the following
Political victory
Future election
Future government
Lost election
I do not remember

What happened to the winner of general election?
Please choose one of the following
Winner is still unconfirmed
Winner will be sworn in office at the end of May
Winner won by a large margin
Winner withdrew from race
I do not remember

Results showed the closest election campaigns since …
Please choose one of the following
World War I
World War II
1948
Last elections
I do not remember
What did Italy join in 1999?
Please choose one of the following
UNICEF
United Nations
The Economic and Monetary Union
NATO
I do not remember

Under whom did Italy become a nation-state?
Please choose one of the following
Borgia
Berlusconi
Victor Emmanuel II
Prodi
I do not remember

Where can you find more on the Italian political crisis?
Please choose one of the following
CNN Website
New York Times
CNN International
CNN News
I do not remember

What can you see at 10:00 EST?
Please choose one of the following
interview with Romano Prodi
interview with Silvio Berlusconi
complete coverage of Italian political crisis by CNN International
CNN News
I do not remember

The top left story was about…
Please choose one of the following
Italian PM refusing to concede despite low number of problematic ballots
Initial ballot count unlikely to be overturned
Italy facing a second week of political insecurity
Plans for future Italian Government
I do not remember

The bottom left story was about ...
Please choose one of the following
Italian PM refusing to concede despite low number of problematic ballots
Initial ballot count unlikely to be overturned
Italy facing a second week of political insecurity
Plans for future Italian Government
I do not remember
The top right story was about ...
Please choose one of the following
- Italian PM refusing to concede despite low number of problematic ballots
- Initial ballot count unlikely to be overturned
- Italy facing a second week of political insecurity
- Plans for future Italian Government
I do not remember

The bottom right story was about ...
Please choose one of the following
- Italian PM refusing to concede despite low number of problematic ballots
- Initial ballot count unlikely to be overturned
- Italy facing a second week of political insecurity
- Plans for future Italian Government
I do not remember

The background of the top left story was...
Please choose one of the following
- Light blue
- Light green
- Light pink
- Light yellow
I do not remember

The background of the bottom left story was ...
Please choose one of the following
- Light blue
- Light green
- Light pink
- Light yellow
I do not remember

The background of the top right story was ...
Please choose one of the following
- Light blue
- Light green
- Light pink
- Light yellow
I do not remember

The background of the bottom right story was ...
Please choose one of the following
- Light blue
- Light green
- Light pink
- Light yellow
I do not remember
Again, we understand that the time was limited and you may not have read all the stories. We would appreciate if you could take a moment to answer the following questions, to the best of your abilities.

4. Approximately what percentage of the content you saw on the screen were you able to read? ______________________

5. How many stories have you read entirely? ______________________

6. Besides the stories you read entirely, how many additional ones have you 'browsed' through or skimmed?____________________

Now, please take a moment to answer a few questions about the website you just browsed

7. Thinking about the news website you have just browsed as a whole, how well would you say it utilized the capabilities of the WWW medium?

<table>
<thead>
<tr>
<th>Not Well At All</th>
<th>Extremely Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
</tbody>
</table>

8. For each word below, please choose one option to indicate how well the word describes THE WEB SITE YOU JUST BROWSED:

<table>
<thead>
<tr>
<th></th>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organized</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Interactive</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Useful</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Coherent</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Confusing</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Enjoyable</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Appealing</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Informative</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Interesting</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
<tr>
<td>Clear</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
</tbody>
</table>

9. How likely are you to visit this site for your daily news needs?

<table>
<thead>
<tr>
<th>Not At All Likely</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○</td>
</tr>
</tbody>
</table>
10. How likely are you to recommend this site to friends/relatives for their daily news?

<table>
<thead>
<tr>
<th>Not At All Likely</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
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<tr>
<td>○</td>
<td>○</td>
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<td>○</td>
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<td>○</td>
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<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

11. How much do you think the layout of the website affected your ability to read the stories?

<table>
<thead>
<tr>
<th>Did not affect</th>
<th>Affected Very Much</th>
</tr>
</thead>
<tbody>
<tr>
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<td>○</td>
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<td>○</td>
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<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Please take a moment now to answer a few questions regarding the news stories you just read

12. For each word below, please choose one option to indicate how well the word describes in general THE NEWS STORIES YOU JUST READ:

<table>
<thead>
<tr>
<th></th>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate</td>
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<td></td>
</tr>
<tr>
<td>Believable</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Biased</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Captivating</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Comprehensive</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Clear</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Involving</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Factual</td>
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<td></td>
</tr>
<tr>
<td>Fair</td>
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<tr>
<td>Informative</td>
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<tr>
<td>Objective</td>
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<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>Well-written</td>
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<td></td>
</tr>
</tbody>
</table>

You may or may have not seen additional windows, other than the webpage. If you did, please take a moment now to answer a few questions regarding these additional windows

13. For each word below, please choose one option to indicate how well the word describes THE ADDITIONAL WINDOWS:

<table>
<thead>
<tr>
<th></th>
<th>Unpleasant</th>
<th>not irritating</th>
<th>not entertaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>pleasant</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
<td></td>
</tr>
<tr>
<td>irritating</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
<td></td>
</tr>
<tr>
<td>entertaining</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>-------</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>enjoyable</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>○</th>
<th>○</th>
<th>○</th>
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</table>

<table>
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<th>○</th>
<th>○</th>
<th>○</th>
<th>○</th>
<th>○</th>
<th>not annoying</th>
</tr>
</thead>
<tbody>
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<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
</tbody>
</table>

You may or may have not seen additional windows, other than the webpage. If you did, please take a moment now to answer a few questions regarding these additional windows.

The additional window was about ...
  Please choose one of the following
  Italy political facts
  Italy elections
  CNN International
  There was no additional window
  I have seen an additional window, but I do not remember the content
  I do not remember whether I saw a window or not

The text in the additional window was ...
  Please choose one of the following
  Black
  Green
  Blue
  There was no additional window
  I have seen an additional window, but I do not remember the content
  I do not remember whether I saw a window or not

Please click on the button below to submit the questionnaire.

Submit
Questionnaire

Before you start, please type in your participant code: ______________

*Please take a moment to describe how you feel at the moment*

1. For each word below, please choose one option to indicate how well the word describes *THE WAY YOU FEEL NOW*:

<table>
<thead>
<tr>
<th>Word</th>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irritated</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Frustrated</td>
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<td></td>
</tr>
<tr>
<td>Angry</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Annoyed</td>
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<td></td>
</tr>
<tr>
<td>Excited</td>
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<td></td>
</tr>
<tr>
<td>Energetic</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Drowsy</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Wide-Awake</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Tense</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Clutched-Up</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Happy</td>
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<td></td>
</tr>
<tr>
<td>Pleased</td>
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<td></td>
</tr>
<tr>
<td>Calm</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
</tbody>
</table>

*We understand that the time was limited and you may not have read all the stories. We would appreciate if you could take a moment to answer the following questions, to the best of your abilities.*

2. Please try to recall as much information as possible from your experience on the webpage you have just seen. Please list each idea on a separate line.

3. Please answer the following questions, to the best of your knowledge:
What region has oil hitting record prices?
Please choose one of the following
North Sea
Black Sea
Red Sea
North Pole
I do not remember

What country is causing oil prices to be high given its tensions with the international community?
Please choose one of the following
Nigeria
UK
US
Saudi Arabia
I do not remember

In US, the prices are within $3 from record prices that hit during a harsh period. What period was it?
Please choose one of the following
Last winter, when the consumption went up
Last August, when hurricanes disrupt production
Immediately after the war in Iraq started
15 year ago after the first Persian Gulf War
I do not remember

On account of whose fear does the oil hit new peaks?
Please choose one of the following
Iraq
Iran
US
China
I do not remember

Crude oil prices climbed in UK, amid reports that US considers taking action. What is the action that US is accused of considering?
Please choose one of the following
Increasing oil stocks
Increasing oil consumption
Military option against Iraq
Military option against Iran
I do not remember

How did Washington react to media reports about its intentions?
Please choose one of the following
Rejected the reports
Did not comment
Confirmed the reports
There is no clear indication of how it reacted
I do not remember
On account of whose decision do oil prices dip?
   Please choose one of the following
   UN
   US
   OPEC
   Saudi Arabia
   I do not remember

What recent rise was taking place prior to the current fall in oil prices?
   Please choose one of the following
   Rise of tension between US and Saudi Arabia
   Rise in oil consumption
   Rise in American crude stock
   Rise in American taxes
   I do not remember

What emerging economies put pressure on oil supplies?
   Please choose one of the following
   China and India
   Iraq and Saudi Arabia
   Nigeria and Iran
   China and Niger
   I do not remember

How does price fear keep the oil?
   Please choose one of the following
   At premium
   Highly priced
   Flowing
   Cheap
   I do not remember

Where did oil groups meet?
   Please choose one of the following
   Vienna
   Geneva
   Zurich
   London
   I do not remember

How much of the world's oil supply do the oil groups provide?
   Please choose one of the following
   One half
   One third
   One sixth
   One fifth
   I do not remember
How much oil does Saudi Arabia own?
   Please choose one of the following
   A half of the world reserves
   A third of the world reserves
   A fourth of the world reserves
   A sixth of the world reserves
   I do not remember

What country is the second largest oil consumer?
   Please choose one of the following
   UK
   US
   Japan
   Saudi Arabia
   I do not remember

What would you learn from alternativenergy.com?
   Please choose one of the following
   About solar cells
   About oil prices
   About clean fuels
   About oil production
   I do not remember

How can we switch off carbon emissions?
   Please choose one of the following
   With ethanol
   With low energy prices
   With sun power
   With low oil consumption
   I do not remember

The top left story was about ...
   Please choose one of the following
   North sea oil high prices
   Opec decision
   Oil prices spike on Iran fears
   Oil producers meeting
   I do not remember

The bottom left story was about ...
   Please choose one of the following
   North sea oil high prices
   Opec decision
   Oil prices spike on Iran fears
   Oil producers meeting
   I do not remember
The top right story was about ...
Please choose one of the following
North sea oil high prices
Opec decision
Oil prices spike on Iran fears
Oil producers meeting
I do not remember

The bottom right story was about ...
Please choose one of the following
North sea oil high prices
Opec decision
Oil prices spike on Iran fears
Oil producers meeting
I do not remember

The background of the top left story was...
Please choose one of the following
Light blue
Light green
Light pink
Light yellow
I do not remember

The background of the bottom left story was ...
Please choose one of the following
Light blue
Light green
Light pink
Light yellow
I do not remember

The background of the top right story was ...
Please choose one of the following
Light blue
Light green
Light pink
Light yellow
I do not remember

The background of the bottom right story was ...
Please choose one of the following
Light blue
Light green
Light pink
Light yellow
I do not remember
Again, we understand that the time was limited and you may not have read all the stories. We would appreciate if you could take a moment to answer the following questions, to the best of your abilities.

4. Approximately what percentage of the content you saw on the screen were you able to read? _______________________

5. How many stories have you read entirely? _______________________

6. Besides the stories you read entirely, how many additional ones have you 'browsed' through or skimmed?____________________

Now, please take a moment to answer a few questions about the website you just browsed

7. Thinking about the news website you have just browsed as a whole, how well would you say it utilized the capabilities of the WWW medium?

<table>
<thead>
<tr>
<th>Not Well At All</th>
<th>Extremely Well</th>
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</thead>
<tbody>
<tr>
<td>○</td>
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<td>○</td>
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<tr>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

8. For each word below, please choose one option to indicate how well the word describes THE WEB SITE YOU JUST BROWSED:

<table>
<thead>
<tr>
<th></th>
<th>Describes Very Poorly</th>
<th>Describes Very Well</th>
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</thead>
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</tr>
<tr>
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<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>Confusing</td>
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<td></td>
</tr>
<tr>
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</tr>
<tr>
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</tr>
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</tr>
<tr>
<td>Interesting</td>
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</tr>
<tr>
<td>Clear</td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
</tbody>
</table>

9. How likely are you to visit this site for your daily news needs?

<table>
<thead>
<tr>
<th>Not At All Likely</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
</tbody>
</table>
10. How likely are you to recommend this site to friends/relatives for their daily news?

<table>
<thead>
<tr>
<th>Not At All Likely</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
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<tr>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

11. How much do you think the layout of the website affected your ability to read the stories?

<table>
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<td>○</td>
</tr>
<tr>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

**Please take a moment now to answer a few questions regarding the news stories you just read**

12. For each word below, please choose one option to indicate how well the word describes in general THE NEWS STORIES YOU JUST READ:

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</tr>
<tr>
<td>Biased</td>
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</tr>
<tr>
<td>Captivating</td>
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<td></td>
</tr>
<tr>
<td>Comprehensive</td>
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<td></td>
</tr>
<tr>
<td>Clear</td>
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</tr>
<tr>
<td>Involving</td>
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<td>Important</td>
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</tbody>
</table>

13. You may or may have not seen additional windows, other than the webpage. If you did, please take a moment now to answer a few questions regarding these additional windows.

13. For each word below, please choose one option to indicate how well the word describes THE ADDITIONAL WINDOWS:

<table>
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<tr>
<td></td>
<td>○ ○ ○ ○ ○ ○ ○ ○ ○ ○</td>
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<tr>
<td>entertaining</td>
<td>○</td>
<td>○</td>
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<tr>
<td>enjoyable</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>important</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>helpful</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>informative</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>useful</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>made me curious</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>boring</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>interesting</td>
<td>○</td>
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<tr>
<td>factual</td>
<td>○</td>
<td>○</td>
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<tr>
<td>distracting</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>annoying</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

*You may or may have not seen additional windows, other than the webpage. If you did, please take a moment now to answer a few questions regarding these additional windows.*

The additional window was about ...
- Please choose one of the following
  - Oil facts
  - High oil prices
  - BP
  - There was no additional window

I have seen an additional window, but I do not remember the content
I do not remember whether I saw a window or not

---

The text in the additional window was ...
- Please choose one of the following
  - Black
  - Green
  - Blue
  - There was no additional window

I have seen an additional window, but I do not remember the content
I do not remember whether I saw a window or not

---

Please click on the button below to submit the questionnaire.

Submit
The hypertext markup language (html) is the standard encoding language of the World Wide Web. The hypertext transfer protocol (http) sets the rules on how a webpage gets transferred between a website and a computer. HTML and HTTP are not the only encoding/decoding systems that allow for pop-up windows, but they are the first ones to do so online.

Functional magnetic resonance imaging (fMRI) is a technique that provides images of localized changes in blood flow and oxygenation that are closely related to changes in neuronal activity evoked by sensory, motor, cognitive, and emotional events (DeYoe et al., 1994; DeYoe & Brefczynski, 2005).

Computer-initiated interruptions are defined as computer-based tasks (e.g., pop-up windows, alerts, notifications, etc.) presented to a user by a computer application while that user is currently performing another computer-based task (Bailey et al, 2000b).

In line with the predictions of attentional spotlight models, focal recall and recognition refer to one’s remembrance of focal information, that is, Web page information located around the pop-up window. In other words, focal recall and focal recognition are operationalized here as overall recall and overall recognition for the story associated with the pop-up location. In contrast, peripheral recall and recognition are operationalized as average recall and recognition for the other three stories.

Following the predictions of the affect-as-information model, local recall and recognition refer to one’s remembrance of story details. Thus, local recall and recognition are operationalized as overall recall and overall recognition for story bodies irrespective of story location relative to the pop-up. Similarly, global recall and recognition refer to the overall recall and recognition for story titles.
After checking the assumptions for multivariate and univariate analyses of variance, most recall and recognition measures showed to violate the assumptions of equality of variance and normality. Both recall and recognition measures were positively skewed, with mode of 0. All attempts to transform these scores did not substantially reduce skewness. Because the general linear model is generally viewed as robust to violations of normality with sample sizes larger than 20 (Tabachnick & Fidell, 1989), non-normality was not considered a problem. Some analyses also showed Box’s $M$ to be significant, suggesting that the assumption of equal variances was also violated. As this test seems to be highly sensitive to non-normality, and since the repeated measures analyses assume cell sizes to be equal and the sample size was relatively large, the assumption of equality was considered met (Tabachnick & Fidell, 1989). Some analyses also show Mauchly’s test of sphericity to be significant, suggesting that the assumption of sphericity might be violated. Although the test is very sensitive to non-normality and sample size, precaution was taken so that Greenhouse-Geisser with corrected degrees of freedom was reported in those cases. In those cases, the degrees of freedom might not be integer numbers.

The similarity in content between pop-up ads and pop-up factoids was the result of a conscious decision. Both ads and factoids were text-heavy so as to avoid the confounding effects of different processing styles. Thus, instead of ads being pictorial and inviting to visual graphic processing, they were mostly textual so that the visual verbal processing style would match the one initiated by pop-up factoids.

A lower mean indicates the pop-up to be perceived as more factual, whereas a higher mean indicates that it is perceived as more persuasive.

From here on, lower means indicate a higher score on self-reported perceptions of pop-ups.
CURRICULUM VITAE
Corina Constantin

EDUCATION

<table>
<thead>
<tr>
<th>Year</th>
<th>Degree</th>
<th>Institution</th>
<th>Location</th>
</tr>
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<tbody>
<tr>
<td>2007</td>
<td>Ph.D. / Mass Communications</td>
<td>The Pennsylvania State University</td>
<td>University Park, PA, USA</td>
</tr>
<tr>
<td>2000</td>
<td>M.A. / Public Policy</td>
<td>University of Bucharest</td>
<td>Bucharest, Romania</td>
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<tr>
<td>1998</td>
<td>B.A. / Moral and Political Philosophy</td>
<td>University of Bucharest</td>
<td>Bucharest, Romania</td>
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RESEARCH AND TEACHING INTERESTS

<table>
<thead>
<tr>
<th>Interest</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychological and Social Effects of New Media</td>
<td>Social Psychology</td>
</tr>
<tr>
<td>Consumer Behavior and Online Advertising</td>
<td>Research Methodology</td>
</tr>
<tr>
<td>Visual Processing (Virtual Reality, Videogames)</td>
<td>Media Psychophysiology</td>
</tr>
<tr>
<td>Computer-Mediated Communication</td>
<td>Interactive and Online Advertising</td>
</tr>
<tr>
<td>Search Engine Marketing</td>
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</table>

TEACHING EXPERIENCE

Fall 2006 - Spring 2007, Cornell University
- Advances in Video Game Research
- Language and Technology
- Psychology of Social Computing

Fall 2002 - Spring 2006, The Pennsylvania State University
- Research Methods in Mass Communication
- Research in Advertising and Public Relations
- Mass Media and The Public; Mass Media and Society
- Structural Equation Modeling (workshop)
- Demystifying Psychophysiology (workshop)

PUBLICATIONS


