PARSING THE EFFECTS OF WEB INTERACTIVITY AND NAVIGABILITY ON INFORMATION PROCESSING

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A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Mass Communication in the School of Journalism and Mass Communication.

Chapel Hill
2011

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ABSTRACT

BARTOSZ W. WOJDYNSKI: Parsing the Effects of Web Interactivity and Navigability on Information Processing
(Under the direction of Sriram Kalyanaraman)

Much research on the psychological impact of technological variables in online communication has focused on interactivity as a characteristic of Web sites and other digital media that subsumes many aspects of online information presentation. This dissertation sought to examine whether interactivity of Web sites could be disentangled from an often-mentioned but under-explicated technological variable, navigability.

This dissertation underwent several steps to clarify the nature and effects of interactivity by extricating the variable from another characteristic of digital media, namely navigability. The main experiment employed a 3 (interactivity: low, medium, high) X 2 (navigability: low, high) between-subjects factorial experiment to examine unique contributions of interactivity and navigability to effects on attitudes, memory of site content, and behavioral intent, as well as the mechanisms by which potential effects occur. In order to examine these mechanisms, a scale to measure user perceptions of Web site navigability was also developed and tested.

Navigability was found to have a main effect on memory of site content, such that participants in low-navigability conditions had lower memory of site content. In addition, navigability was found to have a significant indirect on attitudes toward the site

via perceived navigability. Similarly, interactivity was found to have a significant indirect on attitudes toward the site through perceived interactivity. The implications of these effects for understanding the processes through which Web site structure can affect the processing of content are discussed.

To my parents, Magdalena Wojdyńska and Wojtek Wojdyński, who with bottomless love, encouragement, and support have always encouraged and trusted me to think deeply and critically and to value family, friends, and the pursuit of knowledge.

ACKNOWLEDGEMENTS

Being able to complete graduate study in a discipline about which one is passionate is truly a privilege. I was only able to enjoy this privilege because of the support, kindness, patience, and friendship of others during these last several years. I feel overwhelmed by the amount of good fortune I have had to be surrounded by such warm and supportive people, and will try my best to reflect the kindness they have shown me in my interactions with others.

My foray into graduate school would likely have ended quickly and dismally were it not for the omni-dimensional love and support of my wife, Laura Alexander. Not only did she help put me through school, she also continued to be an enthusiastic proponent of my scholarship and academic life while completing a demanding graduate degree herself. Laura and I have also benefitted from the unequivocal backing of our four parents and other family and close friends. We hope to continue to seek ways to show our gratitude to them for keeping us going, keeping us sane, and, at times, keeping us fed.

Deepest gratitude is due to my advisor and friend Sri Kalyanaraman for his guidance, trust, and selfless dispensing of his expertise throughout my experience in the doctoral program, and particularly in the course of completing this dissertation. Sri's

commitment to science and his mentorship of students have benefitted me greatly as a pupil and imbued me with a very similar set of values and outlook on scholarship. Sri's commitment to being a kind and good person has influenced me and will continue to guide me.

I also would like to thank my other committee members, Rhonda Gibson, Francesca Dillman Carpentier, Gary Marchionini, and Abigail Panter, for answering my questions, challenging my assumptions, and guiding me to make my present and my future scholarship rigorous, theoretically significant, and informed by the right existing literature. I am humbled to have gotten to work with such a terrific group of people who are in equal measure great scholars.

Last but certainly not least, my work and graduate academic life has been buoyed by a terrific doctoral cohort, from whom I've learned enough to fill many 3-ring binders. Temple, Woody, Autumn, Brooke, Dave, Kelly, Nell, Sheetal and Yeuseung, it's been truly awesome getting to go through this with you. I know we can count on supporting each other through our continuing academic careers, but these three years have been made wonderful because of you.

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CHAPTER ONE

INTRODUCTION, LITERATURE REVIEW, AND PURPOSE

As the proliferation of Web-accessible devices continues to broaden the scope of human tasks which can be accomplished via online media, interactivity continues to be a persistent topic of discussion among scholars and practitioners alike. Interactivity has been called the single most important difference between digital media and their analog predecessors (Sundar, 2007); yet, after more than two decades of intense scrutiny (e.g., Rafaeli, 1988, Heeter, 1989; Steuer, 1992; Sundar, et al., 2003; Bucy, 2004; Liu & Shrum, 2009), there is no consensus about what it *is*, and no clarity about what it *does*. There is ample evidence for interactivity – as one oft-cited definition puts it, "the extent to which users can participate in modifying the form and content of a mediated environment in real time (Steuer, 1992, p. 84) " – being psychologically significant. On the one hand, it has been shown to lead to more favorable attitudes (Teo, Oh, Liu, & Wei, 2003; Sundar & Kim, 2005; Song & Zinkhan, 2008; Liu & Shrum, 2009), greater elaboration of content (Liu & Shrum, 2009), higher perceptions of credibility (Tao & Bucy, 2007), and improved learning outcomes (Seal, Przasnyski, & Leon, 2010). On the other hand, studies have also shown that "too much" interactivity can lead to more negative attitudes (Sundar et al, 2003; Bucy, 2004), less time spent with a message,

(Bezjian-Avery, Calder, and Iacobucci, 1998) and decreased memory (Warnick, Xenos, Endres, & Gastil, 2005). Still other studies have found interactivity's effects to be entirely moderated by characteristics of the user or content, with no main effects (e.g., Sohn, Ci, & Lee, 2007). This lack of consistency across findings in studies of interactivity can be attributed to several phenomena, among them disagreement over whether interactivity is a characteristic of media stimuli or of user behavior (see Stromer-Galley, 2004; Rafaeli and Ariel, 2007), and variation in how user perceptions of interactivity should be measured (e.g., McMillan & Hwang, 2002; Liu, 2003; Johnson, Bruner, & Kumar, 2006). However, perhaps the most evident cause of the conceptual murkiness surrounding interactivity is lack of rigor in defining what characteristics of digital media constitute interactivity, which has resulted in a body of literature that treats interactivity as catch-all for disparate characteristics of media that may in fact be independent of each other entirely.

Nass and Mason (1990) notably made the case that communication technology is best studied via a variable-centered approach, or one that studies the effects of individual – and endemic – *attributes* that vary across communication technologies, rather than broader comparisons between multiple technologies or multiple users. In the case of interactivity, while not every scholar has taken a "Nassian" approach (i.e., Rafaeli &

Ariel, 2007[1]), many have agreed that interactivity is a characteristic of digital media technologies that varies across exemplars of these technologies (e.g., Steuer, 1992; Heeter, 2000; Kalyanaraman & Sundar, 2008). However, a variety of conceptual definitions and operationalizations of interactivity abound. Scholars have laid claim to manipulating the "interactivity" of Web sites using approaches as diverse as changing the structure of the pages within a site (Sundar, et al., 2003), manipulating the technological features included in the site (Coyle & Thorson, 2001) and varying instructions given to groups of site users (Bucy, 2004). While these manipulations were each found to impact how users process the content, they also appear to represent fundamentally different characteristics which may be manipulated independently of one another.

The resulting confusion is exemplified by this statement from a widely cited paper by Sundar, Kalyanaraman, and Brown (2003, p. 48): "The key perceptual determinant of interactivity seems to lie in the relatedness of the links and the corresponding pages, that is, the overall navigational structure of the Web site." The authors concede that their manipulations of interactivity may have confounded interactivity with navigability. This tendency to confound the two variables – partially or largely – lies at the crux of this dissertation. Specifically, this research will examine whether these two variables in fact

[1] Although Rafaeli's work has served as the basis for technology-related operationalizations of interactivity, Rafaeli argues that interactivity should not be confused with any specific technological characteristic. As explicated by Rafaeli (1988), interactivity is the extent of interaction that takes place in a given communication exchange, rather than the extent of possible interaction afforded by a specific medium. Rafaeli and Ariel expand on this definition by suggesting that interactivity is "a process-related variable concerning responsiveness (2007, p. 84)."

represent orthogonal characteristics of Web interfaces, each of which may wield significant and different influence on how the content on a Web site is processed.

The navigability of a Web site can be defined as "the extent to which a visitor can follow a Web site's hyperlink structure to locate target contents successfully in an easy and efficient manner (Fang et al, 2006)." Although it may seem self-evident that Web interfaces vary in the degree to which their structure aids the finding of information, previous research into psychological effects of interactivity has largely failed to account for the effects of navigability on the dependent measures of interest, and failed to control for level of navigability in conditions of increasing interactivity. Several researchers (Sundar et al., 2003; Gwizdka & Spence, 2007) have suggested that navigability is a central and important concept in the study of how humans process information, and features that alter the navigability of digital mediated messages have been shown to affect time spent with the message (e.g. Khan & Locatis, 1998; Larson & Czerwinski, 1998), attitudes toward the message (e.g., Spyridakis, Mobrand, Cuddihy, & Wei, 2007), and comprehension of the message (Wei et al, 2005; Spyridakis et al, 2007). Web sites or interfaces that are difficult for users to "navigate" have been shown to lead to a state of disorientation, also called the "lost in hyperspace" phenomenon (see Otter & Johnson, 2000; Ahuja & Webster, 2001; Bucy, 2004). Not only have manipulations of interactivity across research studies shown a lack of cohesion with regard to their theoretical bases, but some of these manipulations (e.g., Sundar et al, 2003; Song & Zinkhan, 2008) may have confounded the independent variable of interest by making certain conditions more or less navigable for users.

The fact that elements of navigability have been subsumed in previous interactivity has obfuscated the theoretical development of navigability as a variable. In contrast to the robust and diverse literature on Web site interactivity, navigability remains a more ethereal and under-explicated concept. While several recent articles have alluded to its importance to the study of communication technology (Sundar, 2008, 2009), an established concept explication or operational definition of Web site navigability is hard to find. Additionally, no established scales exist which clearly measure variance in users' perceptions of navigability of media stimuli. As a consequence, it is difficult to examine the role navigability may play in shaping the results of other studies involving online information processing.

Although both navigability and interactivity have been found to influence a number of information processing variables, it is somewhat surprising that little research has sought to address what the unique effects of each variable could be by attempting to parse the two concepts. The current research seeks to address this issue by answering the following broad research question:

> What is the relationship between level of interactivity and level of navigability of Web sites and perceptions of its interactivity and navigability, attitudes toward the site and its content, and memory of site content?

This dissertation seeks to make a contribution to the literature on the psychological effects of technological variables in digital mediated communication in

several ways: first, by developing explicit conceptual and operational definitions of navigability, and second, by parsing the distinct effects of interactivity and navigability. This dissertation will first review the pertinent literature on interactivity and navigability. Then, based on the literature, it will propose hypotheses for study. Next, the dissertation will detail the methods of studies designed to answer the research question and address the specific hypotheses. Finally, it will conclude by presenting the studies' findings, and presenting a discussion of their significance and implications.

Problematizing Interactivity Research

Interactivity has been a widely discussed concept for the last quarter century in a number of disciplines, including communication (e.g., Rafaeli, 1988; Steuer, 1992; Heeter, 2000; Sundar, 2000; Bucy, 2004), education (e.g., Gilbert & Moore, 1998; Yacci, 2000; Stocks & Freddolino, 2000), health (e.g., Street & Rimal, 1997; Bandura, 2004; Lustria, 2007; Hawkins et al, 2010), psychology (e.g., Leahy & Sweller, 2005; Pas, Van Gerven, & Wouters, 2007), and information science (e.g., Marchionini, 1995; Borlund, 2003) . The enduring interest in interactivity has been fueled by the continual increase in online bandwidth and the proliferation of novel Web-based technologies and media formats. Media consumers encounter digital media and interfaces anytime they connect to the Web via computers or mobile devices, or run non-Web applications on those devices, or interact with other media such as DVD menus, ATM machines, and touch-

screen museum kiosks. Despite substantial scholarly interest, the findings regarding how interactivity affects information processing are not very cohesive, although there are a few general trends. At present, much dispute still remains about what interactivity refers to (Rafaeli & Ariel, 2007, Sundar, 2007; Quiring & Schweiger, 2008); where it is located in the communication process (Rafaeli & Ariel, 2007; Sundar, 2009; Wu, Hu, & Wu, 2010), and how it ought to be operationalized for study (Kalyanaraman & Sundar, 2008).

Conflicting conceptual approaches to the study of interactivity

Concept explications of interactivity as a characteristic of digital media are not lacking (Kiousis, 2002; Sundar et al., 2003; Stromer-Galley, 2004; Bucy, 2004; Rafaeli & Ariel, 2007; Sundar, 2007), and each offers a distinct system for classifying the various definitions of interactivity employed in empirical research. Of the classification systems, the approach utilized by Sundar et al. (2003) stands out in its conceptual clarity, parsimonious (two-category) taxonomy, and the exclusion of non-technological approaches which define interactivity as a characteristic of user behavior or user perceptions. Sundar et al (2003) laid out an influential road map which clearly positions interactivity as a technological characteristic of mediated messages,[2] and classifies

[2] The distinction between "*media*" and "*messages*" has added an additional and unnecessary level of distinction to the interactivity literature. Digital media platforms – that is, Web pages, software programs,

previous operationalizations under two contrasting approaches, namely the contingency, or message-based, perspective and the functional, or feature-based, perspective. These perspectives are summarized and evaluated in a subsequent article (Kalyanaraman & Sundar, 2008), which also introduces an information-control conceptualization of interactivity as a third and preferable approach.

The contingency perspective to defining interactivity has its roots in face-to-face human communication. As first proposed by Rafaeli (1988), this approach defines the interactivity as the degree to which the content of a present message is responsive to previous messages transmitted. Rafaeli offered three levels of interactivity: *non-interactive*, which involves either one-way communication or communication followed by an unrelated response; *reactive,* in which the recipient of one message returns a message that was based on the first message transmitted; and, finally, *interactive*, in which there are three or more messages sent between two communicators, each based on all the previous messages sent. Thus, higher levels of interactivity exemplify a higher degree of connectedness between messages sent.

Researchers have applied this approach to the communication exchange between a user and digital message that responds to input from the user, creating ordinal

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electronic kiosks, and other forms of information that include interfaces – all often distinguished from earlier platforms via the capacity to offer varying levels of interactivity. A specific instance of any of the above media--- one Web page, or one Web site – may be called a "medium" or a "message." This study will use the convention "message" to refer to a one-page Web site or multi-page Web site.

operational levels of interactivity in political Web sites (Sundar et al., 2003) or advertisements (Sundar & Kim, 2005) by varying how users can reach various sections of the content by clicking. The contingency approach therefore yields three levels which can be used in creating stimuli: low-interactivity (system does not respond to user input), medium-interactivity (permits one or more exchanges in which the system responds to user input) and high-interactivity (permits one or more exchanges in which the user can send a message based on system response to the user's earlier message).

Functional or feature-based operationalizations of interactivity state that certain features of a mediated message render it more interactive, and that the presence, absence, or quantity of these features is a way to determine the interactivity of the content or platform (e.g., Sundar, Kalyanaraman, Hesser, & Brown, 1998). Studies which have utilized this approach compare the effects of stimuli which include specific features with those that do not include such features. For example, one study compared two Web sites which featured identical content, with the exception of the presence of chat rooms, bulletin boards, a site map, and navigation bars in the more interactive condition (McMillan & Hwang, 2002). Other features that have specifically been used in studies include a feedback form and video player (Ahern & Stromer-Galley, 2000), and the presence of a "Frequently Asked Questions" page and links providing the ability to send an email or subscribe to a newsletter (Bos, Koolstra, & Willems, 2010).

The classification of interactivity manipulations into either the contingency or functional approach, as laid out by Sundar et al (2003), provided an important early attempt to classify interactivity. However, the contingency and functional approaches

suffer from several limitations, both individually and as an exhaustive taxonomy. First, because the contingency approach to operationalization hinges on the number of related messages in an exchange, the researcher has to decide when a user-system exchange begins; is it with the user clicking a link to the site, or with the site homepage loading in the browser, or with the user clicking a feature on the site once it has loaded? Choosing to begin at any one of these exchanges shapes how degrees of interactivity are defined. A second shortcoming is a relatively low standard for the "highest" level of interactivity under the contingency approach; which leads to an inability to discriminate between mediated messages which allow interactive message exchange. Multi-page Web sites allow users to navigate between layers of content by sending a request via clicking, downloading a successive page, and later clicking an additional link.

Finally, it bears pointing out that although the two approaches are considered to be orthogonal (Kalyanaraman & Sundar, 2008), as one (functional) focuses on adding more features and the other (contingency) on relatedness of messages in practice, it is not so. Varying features such as feedback forms, message boards, nearly created differences across conditions in the means in which users can participate in contingent message exchange. Likewise, variation in message exchange afforded by an interface can rarely be accomplished without varying the number, amount, or type of features (e.g. hyperlinks, menus, or other interface elements) present in across conditions.

These problems with the existing approaches to defining interactivity highlight the need for a perspective which does not focus solely on features or on message contingency, but which clarifies the psychological nuances underlying both approaches.

The seemingly broad gap between the feature-based and messaged-based views of interactivity is bridged by studies that define interactivity by the amount and type of control over content given to the user (Kalyanaraman & Sundar, 2008). Digital media have the capability of allowing users to control information through a wide range of graphical user interface elements such as clickable buttons, open-ended search boxes, and repositionable playhead timelines, among others. The extent to which such interface elements are available within a mediated message, as well as the extent to which a particular element allows for lesser or greater control, can be used to classify mediated messages into varying levels of interactivity. This approach is consistent with several notable definitions of interactivity, including those by Steuer – "The extent to which users can participate in modifying the form and content of a mediated environment in real time (1992, p. 185)" – and Jensen -- "A media's potential ability to let the user exert an influence on the content and/or form of the mediated communication (1998 p. 201)." Both of these definitions focus on potential control afforded by a medium or mediated message.

Experimental studies manipulating interactivity based on information control have shown a more consistent pattern of positive information processing effects, in line with those predicted in theoretical papers on interactivity (e.g., Rafaeli, 1988; Heeter, 1989; Steuer, 1992; Sundar, 2000). The bedrock of several such operationalizations has been varying the control over the pace and sequence of information given to the user. Control over pace of content, but not sequence, has been termed linear navigation, and is often accomplished through the use of two buttons (e.g., arrows labeled "next" and "previous")

which allow the user to move forward or backward through content in a pre-arranged sequence. Ariely (2000) showed that users who are given control over the order in which they view information are more accurate in evaluating that information than those given no control. Ariely's results showed that real-time control over pace and sequence yielded positive effects of user control on accuracy, while no such increase was found for control over order but not pace. Similarly, several studies of educational materials have shown that users given control over the pace and start time of a presentation exhibit greater learning than those not permitted such control (e.g., Mayer & Chandler, 2001; Tabbers & de Koeijer, 2010).

Control over sequence increases overall control over the content, by allowing users to choose what material to view next in real time. A recent study of health education Web sites (Kalyanaraman, Ito, Malik, and Ferris, 2009) manipulated interactivity by giving users different levels of control over the sequence in which content was viewed. Participants in the low-interactivity condition were given no control over the order of content, while participants in medium-interactivity conditions could control the sequences of pages viewed within a topical module, but not of modules themselves. The high-interactivity condition allowed non-linear navigation to any page regardless of module. A similar approach was used in a study of interactive information graphics accompanying news content (Wojdynski, 2010).

Operational definitions of interactivity as information control need not be restricted to control over only sequence and pace. The interactivity scale developed by Kristof and Satran (1995) identified seven ordinal dimensions of a mediated message that

could be controlled by a user – pace, sequence, media, variables, transaction, objects, and simulation – and classified these as increasing control on the part of the user and interactivity on the part of the interface. One study (Teo, et al., 2003) combined dimensions from the Kristof and Satran scale in an additive fashion to create three versions of a product Web site. The low-interactivity condition allowed users to control pace and sequence only, while the medium-interactivity condition added three more dimensions, and the high-interactivity condition comprised all seven elements. While most aspects of site content were held constant across conditions, specific features (e.g., search engine, online chat) were added to create the differences in control. The approach shown in the Teo et al. study provides a guideline for testing the effects of interactivity at multiple ordinal levels, and one that can be utilized across a number of technical features, media types or messages.

The information-control conceptualization of interactivity is compelling not only because it offers a clear direction for operationalizing experimental stimuli, but also because it is reconcilable with the central tenets of both the contingency and functional approaches – respectively, the importance of the relationship between user input and response, and the significant impact of specific site features. The contingency approach argues that the bedrock of interactivity is the extent to which message transmissions allow a threading of content from one message to the next. From the vantage point of information control, any Web site characteristic that gives the ability of the user to control aspects of the content facilitates such contingent message transmission. If user input to a Web site – by clicking, typing, etc. – results in an appropriate change in the

content displayed within a mediated message, and the user can provide subsequent input based on this change, the message can be said to be interactive according to Rafaeli's (1988) definition. Under the functional approach, the addition of specific content features is seen as increasing the level of interactivity of the site. This approach can be just as easily reconciled with the informational control perspective, but only insofar as the features being manipulated are features that permit the user to control the information. However, features that do not affect the degree to which the user can control the content – such as the presence or absence of an automatically playing video – do not affect the users ability to control the content, and thus should not be considered as manipulations of the degree of interactivity of a site.

The Psychological Effects of Interactivity

Effects on Attitudes. While studies have shown that interactivity affects attitudes, cognitions and behaviors, operationalizations of interactivity have varied greatly across studies. Of these three dependent measures, the most robust evidence for psychological effects of interactivity is in the measurement of attitudes. Yet, while the interactivity-attitudes link is robust, the direction of the findings is not, especially in findings based on functional or contingency perspectives.

The strongest support for the interactivity-attitudes link comes from studies in which scholars operationalized interactivity across three ordinal levels, and found more positive attitudes toward site content across all three conditions (Cho & Leckenby, 1999, Teo et al, 2003; Sundar & Kim, 2005). Other research employing a three-level approach

have found significant differences in attitudes only between high-interactivity conditions and the other two levels (Bos, Koolstra, & Willems, 2010). In addition, a number of studies which have operationalized interactivity across two ordinal levels have shown a significant effect on attitudinal measures.

Some evidence has also suggested that the interactivity-attitudes relationship may not be uniformly positive. Sundar et al. (2003) found that a political Web site yielded more positive attitudes (toward the candidate and toward the candidate's views) when it offered a moderate level of interactivity than at low-interactivity or high-interactivity levels. The findings showed no differences between low- and high-interactivity conditions on multiple attitude measures related to the site and its content.

Despite the strong ties between interactivity and perceptions, the literature shows a disconnect between the positive effects interactivity is expected to have on attitudes and the hodge-podge of inconsistent findings when these assumptions have been tested. The findings in studies which have operationalized interactivity in terms of user control over information (Ariely, 2000; Teo et al., 2003; Kalyanaraman, et al., 2009) show more consistently strong support for interactivity's effects on attitudes toward the content. Thus, main effects for interactivity are predicted such that the Web site will be perceived more positively when the content is more interactive. The hypotheses and research questions for the study as well as the basic rationale for each are summarized in Table 1.

H1: Higher levels of interactivity will lead to more positive attitudes toward the site.

Effects on Cognition. The relationships between interactivity and variables related to cognition have been tested less frequently than those between interactivity and attitudes, perhaps because of less theoretical consensus regarding why or how such effects might take place. The actual use of interactive features has been thought to enhance processing of the resulting content by triggering an orienting response in users (Sundar, 2007). On the other hand, the presence of more opportunities to interact with content has been thought to increase cognitive burdens on the user, and thus decrease available resources for processing the content (Bucy, 2004).

Experimental investigations of the effects of interactivity on cognition have shown mixed results. Studies of digital educational materials have found that giving users control over pace and sequence and thereby allowing non-linear access to content can improve learning (Hasler, Kersten, & Sweller, 2007; Kalyanaraman et al, 2009; Seal, Przasnyski, and Leon, 2010), comprehension (Tremayne, 2008), and performance on problem-solving tasks (Evans & Gibbons, 2007; Mayer, Dow, & Mayer, 2003). However, one study (Seal et al., 2010) showed that additional interactivity beyond control over pace led to no improvement in learning vis-à-vis a non-interactive condition, an unexpected finding which the authors attribute to increased extrinsic cognitive load (Sweller, 1999, 2010) in that condition. In some cases, interactivity has also been shown to have no effect on learning outcomes (Eveland & Dunwoody, 2001).

The Role of Perceived Interactivity. Several recent articles on interactivity's effects have offered suggestions toward remedying the lack of a clear theoretical

framework underlying the processes by which these effects take place. Kalyanaraman & Sundar (2008) suggest that content variables such as complexity and relevance may serve as key moderators in interactivity's effects. Calls have also been made for the inclusion of individual difference variables in the form of trait moderators and perceptual mediators (Bucy & Tao, 2007; Sundar, 2009) which may serve to elucidate the conditions under which interactivity plays a larger role.

Bucy and Tao (2007) proposed a model of interactivity's effects in which perceived interactivity serves as the primary mediator between objective manipulations of interactivity and attitudes toward the content. The authors argue that individuals' perception of the level of interactivity of a Web site may be more important than the degree to which site characteristics actually vary. The results of several studies have borne out that manipulations of media attributes affect perceptions of interactivity, and that the influence of media attributes on attitudes is contingent on these perceptions (Wu, 2005; Tao & Bucy, 2007). The chief implication of these results is that a stimulus that simply seems more interactive may be more favorably evaluated by its users, via what has been speculated to be a cue or heuristic effect (Sundar, 2007). The psychological significance of perceived interactivity is also supported by studies which have positioned perceived interactivity as an independent variable, and found a strong relationship with attitudes toward the content (McMillan & Hwang, 2002; Jee & Lee, 2002; Chung & Zhao, 2004; Ko, Cho, & Roberts, 2005; Song & Zinkhan, 2008).

Perceived interactivity may be a useful variable in helping explain how interactivity's effects occur. Rather than using this variable simply as a means of

validating stimulus manipulations, treating perceived interactivity as a potential mediator of interactivity's effects sheds light on the process through which interactivity's influences attitudes and other dependent measures. O'Keefe (2003) noted that the use of a perceptual variable as simply a validation check for manipulations of stimulus characteristics is unnecessary – the manipulations exist regardless of user perceptions – but that such measures instead "may usefully be understood and analyzed as assessments of potential mediating states (p. 269)." In the case of interactivity, such an approach allows the comparison of a path of interactivity's effects that occurs specifically through perceived interactivity with the remaining direct path, in addition to examining the total direct effects. The theoretical implications of each of these paths are different, with the perceptual path lending support for the notion of interactivity as a cue, and the direct path suggesting that giving users control influences attitudes in a way that occurs outside of their awareness of the site's interactivity.

Interactivity operationalized as information control can lead to differences in user perceptions of interactivity, and several studies have shown that the perception of interactivity mediates the effect of interactivity as a stimulus characteristic on attitudes (Tao & Bucy, 2007). In conjunction with strong evidence that perceived interactivity is directly related to attitudes, it is hypothesized that:

H2: Higher levels of interactivity will lead to greater levels of perceived interactivity.

H3: The relationship between interactivity and attitudes toward the site will be mediated by perceived interactivity.

Explicating Web Site Navigability

In the study of online information processing, the interconnection of Web content through the use of hyperlinks lends a high level of importance to understanding how information is structured within a given Web site. The volume of content accessible while viewing a typical Web site is much greater than that available when reading a print publication, and the range of outcomes of unsuccessful navigation is much broader, with potentially more severe consequences. Navigating in printed text can certainly be disorienting; users may turn to the wrong page, and have to backtrack or rely on a table of contents (where available) to locate the desired content. But, such disorientation is magnified in the online world. With one incorrect click on the Web, a user hoping to view a page on the same site may instead have an entirely new site load, have a file open up in a new software program, or have content start downloading automatically. Additionally, unlike users of print or broadcast media, Web users must also be wary of the information they transmit through various input elements. Although a number of message characteristics can provide Web site users with the cues to be able to make informed decisions, the extent to which such cues are provided makes the Web site easier or harder to navigate, thereby more or less navigable.

Defining Web Site Navigability

Although a clear conceptual and operational approach to navigability is lacking in the current literature, the creation of such an approach ought to address both its ontological elements and its psychological relevance. A primary step in isolating navigability as a variable requires defining it as a characteristic of a particular object (see Nass & Mason, 1990). According to Balakrishnan and Sundar (2009), navigability may be viewed either as an attribute of technology or an attribute of the user. User perceptions of navigability are inherently a subjective factor; individual users of a mediated message may differ in experience, cognitive resources, and other factors that influence how they perceive the ease of finding information on a given Web site.

As noted by O'Keefe (2003), media research that positions a subjective user state as an independent variable related to other outcomes does little to illuminate the process by which effects take place. Missing from such models is the role that specific characteristics of messages (in this case, design features) play in influencing variance in the perceptual state (perceived navigability). A number of studies have shown that specific design elements of Web sites affect how the content is processed. In order to organize this knowledge into a theoretically significant approach to defining navigability, it is important to identify conceptual similarities underlying design components that have been shown to affect users' ability to locate and process information within the message. These concepts, or dimensions, could then be used to create stimulus materials designed to differ in the level of navigability. Exposing participants to the varying stimuli,

measuring users' perceptions of navigability, and testing to see whether perceived navigability plays a role in mediating the effect of navigability on dependent measures, would lead to a more ecumenical understanding of not just the effects but also the processes underlying the notion of navigability.

At its simplest level, Web site navigability can be defined as how easy it is for the user to find information on the site (Huizingh, 2000). Navigability therefore is closely related to the broader concepts of ease of use or usability, but with a specific focus on those elements on a site which allow users to locate information. Other researchers have defined Web navigability explicitly, usually with an emphasis on the degree to which a site facilitates specific user tasks. Fang et al. (2006, p. 196) described navigability as "the extent to which a visitor can follow a Web site's hyperlink structure to locate target contents successfully in an easy and efficient manner." Castro et al. (2007, p. 420) presented a definition of "the efficiency, effectiveness and satisfaction with which a user navigates through the system in order to fulfill her goals under specific conditions."

Providing users with clear and useful navigational elements has been a hallmark of successful Web design. Early guidelines for the usability of information systems included having a consistent navigational interface and using visual maps and metaphors (Nielsen, 1993). According to Web design expert Steve Krug, navigation "compensates for [the Web's] missing sense of place by embodying the site's hierarchy, creating a sense of 'there (2004, p. 59).'" Krug outlined six specific purposes for navigation on the Web: to help the user find desired information, to inform the user as to "where" she is on

the site, to help the user feel grounded, to convey information about what the site contains, to tell the user how to use the site, and to convey credibility of the site.

Two differing conceptualizations of navigability can be found in the information technology literature. The first of these defines navigability as the simple ability to traverse information in a digital space, or the "degree of navigation afforded by an interface (Sundar, 2004)." According to this approach, a Web page with 500 hyperlinks would be more navigable than a page with 100 hyper links. This definition has several shortcomings in terms of utility for scholarship or popular use. First, it leads to counterintuitive labeling, such as in the example above, in which interfaces that are cluttered or designed in a way that is makes them more frustrating to use may be classified as more navigable. Secondly, such a definition does not discriminate between differential layout, link clarity, and other aspects of interface design that have shown to have an influence on how users navigate through information, whether they use particular navigational elements, and how satisfied they are with their navigation experience.

A second, more nuanced approach to navigability may be more useful to the development of theory related to psychological effects of new media. This approach treats navigability as a measure of the degree of ease with which a user can orient to the structure of a site and explore content. There are numerous characteristics of information interfaces that have been shown to affect users' ability to find information on a site and their perceptions of how to get around on the site (e.g., Mobrand, et al., 2007; Khan & Locatis, 1998). Whether navigability of a Web site is consciously perceived or subconsciously affects performance, these studies have shown that variations in how link

descriptors and other navigational elements are displayed and presented impacts the use of a site, even when controlling for the structure of the site itself.

A paradigm that is useful in examining how message characteristics may influence users' ability to find information in digital environments is the information foraging approach detailed by Pirolli & Card (1999). The authors posit that humans consume information in a manner akin to foraging for food in the wild. On the Web, information may be part of larger patches, but can be organized into several broader categories: the whole Web, a Web site, or a page (Card, Pirolli, & van der Wege, et al., 2001). Pages may include content elements, which contain content that can be consumed and link descriptors, which serve to provide information about content that may be available at another URL. Users foraging through one of these information patches must continually decide between visually searching within the patch and traversing between patches via links (Card, et al., 2001). In keeping with the foraging metaphor, patches that appear to present high-value information are said to be high in information scent. When scanning for information, humans evaluate the expectancy value of consuming information based on its information scent. The information scent of a link has been called "one of the major controlling variables in Web foraging behavior" (Card, et al., 2001). Information scent in the form of search engine result relevance has been shown to affect users' perceptions toward the search engine (Kalyanaraman & Ivory, 2009). While information scent is largely an attribute that is highly based on the nature of the content being sought by the user, based on the information-foraging perspective, the presentation of information in a manner that allows the user to efficiently make accurate and efficient

determinations about its value can be seen as navigability. Accordingly, navigability may be most noticed when it is relatively lacking: when a site is highly navigable, a user can browse or search for information without difficulty; when a site is not very navigable, attempts at finding information may be fruitless or frustrating.

Navigability's Influence: Effects and Processes

Accepting a working definition of navigability as the ease of accessing desired content through an interface, it stands that Web sites or interfaces that afford higher levels of navigability facilitate the accessibility and processing of information, and interfaces that provide low or sub-standard levels of navigability have detrimental effects on the consumption of information. One area of literature that has explored negative consequences of poor design is the study of perceived disorientation on the Web (Ahuja & Webster, 2001; Baylor, 2001). Web disorientation, also known as the "lost in hyperspace" phenomenon, has been described as stemming from one or more of three situations users might encounter: not knowing where to navigate next, knowing where to navigate next but not knowing what to do to get there, or not knowing their current position relative to the overall structure of the hypertext environment (Edwards & Hardman, 1989). Such disorientation can lead to consequences such as users taking longer to find information, unintentionally opening the same sections of a Web site repeatedly, or ceasing to search for information on a page entirely (McDonald & Stevenson, 1996, 1998). Being unable to complete desired tasks in an efficient manner,

or at all, arouses psychological reactance in users (Dailey, 2004), which results in negative emotions and negative evaluations of the site.

Increasing the navigability of Web sites through the addition or modification of structural elements has been shown to improve user performance and perceptions of the site (see Spyridakis, Cobrand, Cuddihy, & Wei, 2007). Sundar (2007) has argued that navigability affordances on a Web site can influence perceptions through one of two heuristics it can trigger in users. First, there is the "sheer presence" effect – well-structured navigation on a site may immediately cue the user to perceive the site as more credible. Secondly, the content of the hyperlinks themselves, or generated by the hyperlinks, could subsequently trigger other heuristics that cause the user to perceive the site as more or less credible. A more direct measure for navigability's effects on attitudes may be related to the increased self-efficacy associated with helping users complete specific tasks quickly.

The two paths for navigability's influence suggested by Sundar highlight the importance of well-formed hyperlinks in governing the experience of using a Web site, and are consistent with Pirolli & Card's (1999) notion of information scent. Although the approaches to studying effects of hyperlink labeling have been diverse, evidence points to labeling having a significant impact on information processing. Adherence to usability guidelines in site labeling has been shown to increase memory of site content (Crystal & Kalyanaraman, 2004). Intuitive link structures, or those most closely resembling ties between concepts in human memory (Marchionini, 1997) have also been shown to lead to increased perceptions of navigability. Text hyperlinks with more explicit wording have

been shown to lead to more positive attitudes toward the Web site than those with vaguer wording (Spyridakis, et al., 2007). Despite the availability of established guidelines, existing Web sites may be lacking simple elements (e.g. site map, links that open in new windows, permanent site navigation across pages) that would improve navigability (Hernandez-Ortega, Jimenez-Martinez, & Martin-DeHoyos, 2007).

Review of the studies that have examined the influence of characteristics of Web site navigation on information processing shows that most research has examined the effects of one or two design characteristics in isolation. The operational definitions of some of these elements may be only applicable to sites that display a particular type of content, or a particular volume of content. Nevertheless, the elements manipulated in studies can be classified into several meaningful groups based on the function fulfilled by the navigational elements being described. A taxonomy based on function makes a greater contribution than one organized by specific feature, in that it can be used to classify navigability of media across multiple forms, and provide continued utility as features evolve.

Based on the existing literature, it is proposed that the design features which may affect site navigability can be sorted along three dimensions which facilitate the accessing and processing of information: the clarity with which the target of a navigational element is described by that element (*clarity of target*), the clarity with which a navigational element conveys the underlying structure of site information (*clarity of structure*), and the degree to which the site content is appropriately subdivided or hierarchically organized with respect to the relationships between the content sections (*logic of*

structure). Each proposed dimension is explained below, and – supported by empirical evidence – points to significant positive effects on user behavior, user performance, and user perceptions of the site and its content (see Table 2 for review of empirical data).

Proposed Dimensions of Navigability

Dimension 1: Clarity of target. Effective use of hyperlinks is essential to designing a navigable interface. Links not only serve as a conduit to allow the user to view different content, but they also convey a lot of information about the site to users very quickly. Early studies of how users navigate through hypermedia focused on properties of links as central to satisfaction with the user experience. Khan and Locatis (1998) identified two such properties; *Link cues* are the degree to which a link conveys the information that can be obtained by clicking, and *link correspondence*, or the degree to which link wording matches the nature of the search tasks. The authors found that link correspondence plays a substantial role in affecting a combination of accuracy, time, and other factors related to a search task. Other elements of links that have been found to affect performance and comprehension include explicit wording of text in hyperlinks, and providing context to link target content via information provided around the link itself. Links that avoid ambiguous words and include details about the content found on the target pages have been found to improve performance on search tasks and user perceptions of the site (Wei et al., 2005; Campbell and Magglio, 1999). Contextual positioning of links has been shown to impact the manner in which users navigate

through informational interfaces. Mobrand et al., (2007) found that embedding sub-section links in a contextual paragraph enhanced comprehension of site content vis-à-vis providing links in a list, but that users were more likely to visit the sub-sections in the "list" condition.

Dimension 2: Clarity of Structure. A second dimension of Web interface navigability is the degree to which an interface helps the user orient herself within the interface. These navigational aids can not only convey the overall scope of the content within a particular interface, but also have the potential to suggest relationships between the content found on various pages by denoting the relationship between various pages, such as whether the content of one page is a subsection of content on another page. Site maps, representational landmarks in virtual domains, and hierarchical depictions of links (Sundar, 2007) have been thought to substantially improve navigability by clarifying how information on the site is organized. While the presence of a site map has been shown to reduce disorientation in hierarchical structures (Beasley & Waugh, 1995), it may not have any effect on improving task performance or task speed when tested using a non-hierarchical site (Dias & Sousa, 1997).

The homepage of a site, which serves as the first page viewed for many users, plays a crucial role in conveying site structure. From an organizational point of view, it can be viewed as a special case among Web pages with regard to navigation, because all its links point downward in terms of the site's hierarchical structure while at other pages within a site, a user can choose to navigate to higher- or lower-order levels (Farkas &

Farkas, 2000, p. 349). Hyperlink clarity and structure have also been shown to impact perceptions of a Web site. Providing semantic cues (names of pages) and organizational cues (order of the current page in a series) in hyperlinks improves perceptions of the site as well as comprehension and time spent on the site (Spyridakis, Mobrand, Cuddihy, & Wei, 2007; Mobrand & Spyridakis, 2007). Other studies have shown that users evaluate online shopping environments in terms of factors related to spatial clarity of their layout (Hopkins, Grove, & Raymond, 2005) or their personal ability to make sense of the content presented and its structure (Demangeot & Broderick, 2010).

Dimension 3: Logic of Structure. While clarity of the underlying structure of a site is one important facet of navigability, evidence suggests that the nature of the structure also affects the ease of use. The nature of the structure of individual Web sites can vary, from highly organized hierarchical structures, to looser linear or multipath structures which offer one or more distinct sequences for users to follow, and to disordered web structures which feature haphazard connections between pages (Farkas & Farkas, 2000). Within a given structure, the depth and breadth of navigational menus also plays a role in aiding user navigation. Larson and Czerwinski (1998) showed that users have a harder time finding information if it is buried too deep within a site, while the number of top-level categories in an interface did not affect information seeking.

Although a hierarchically organized interface may always provide value by relationships between pages, users may anticipate a specific structure for a Web site based on the site's content domain, and these expectations influence perceptions of navigability. Users have distinct mental models of how content should be organized on

Web sites belonging to a specific category, such as online shopping, organization, or news portal (Bellman & Rossiter, 2004; Roth, et al., 2010). The degree of confluence between a particular Web site and the users' mental model influences their ability to find information as well as the extent to which they engage with site content.

The three dimensions of navigability proposed above have been shown to affect users' ability to accomplish tasks on Web sites and comprehend site content, both of which should lead to negative evaluations of the site through processes of psychological reactance (Dailey, 2004). Studies that have directly examined the relationship between features that aid in navigation and attitudes (e.g., Spyridakis et al., 2007) have shown that users have less favorable attitudes toward less navigable Web sites. Thus, it is predicted that:

H4: Higher levels of navigability will lead to more positive attitudes toward the site.

Examining navigability as a characteristic of Web sites and other media interfaces allows the examination of the direct effects of site design and structure on outcome variables. The hypothesis above predicts that simply varying the structure and design of the content should affect users' attitudes. As in the case of interactivity, however, it is unclear whether this effect would result from the structural characteristics of the site itself, or as a means of users' perceptions of how easy the site is to navigate.

Some portion of variance in users' perceptions of navigability may be caused by state and trait individual differences in past experiences, environmental factors in which the Web use takes place, and potentially other individual difference factors. On the other hand, studies have shown that differences in support and structure offered by online systems can lead to varied perceptions of perceived disorientation (Ahuja & Webster, 2001; Webster & Ahuja, 2006) and perceived navigation convenience (Park & Kim, 2000). On the basis of these studies, as well as the formative research, the following hypothesis is proposed:

H5: Higher levels of Web site navigability will lead to increased perceived navigability of the Web site.

H6: The relationship between navigability and attitudes toward the site will be mediated by perceived navigability.

In addition to influencing how users perceive a site and its content, there is also evidence that navigability may affect the processing and encoding of site content. Studies focused on the impact of specific navigation features have demonstrated that they have been shown to both improve comprehension of content and memory of content. The specific site characteristics that have demonstrated this effect primarily deal with the content of hyperlinks. Explicitness of wording in hyperlinks (Spyridakis et al, 2007;

Mobrand & Spyridakis, 2007), level of information provided in those links (Wei et al, 2005) have been shown to impact comprehension of site content. When the impact of such factors on measures of memory has been tested, it has been found that more descriptive links lead to greater recall of site content (Crystal & Kalyanaraman, 2004). In additional to characteristics of the hyperlinks themselves, some evidence suggests that the structure of sites influences the type of learning that takes place (Eveland, Cortese, Park, & Dunwoody, 2004). In addition, visual representations of site structure have also been found to impact memory of site information (Hussein, Mughal, Anceaux, Leleau-Merviel, 2005). Additional support for a navigability-cognition link is provided by the persistent link between low levels of navigability and perceived disorientation (e.g., Webster & Ahuja, 2006), and evidence that perceived disorientation is related to lower levels of learning (Baylor, 2001). On the basis of the findings summarized above, the following hypothesis is proposed:

H7: Higher levels of navigability will lead to higher levels of recall of site content.

The Interplay Between Interactivity and Navigability

Experimental research into interactivity's effects has largely ignored the role of navigability in influencing how users process information. Some research on effects of structural elements in Web-based information processing has shown that those elements

which facilitate finding information can reduce the amount of time it takes users to complete information seeking tasks (Norman & Chin, 1998; Khan & Locatis, 1998), increase comprehension of content (Spyridakis, et al., 2007, Wei, et al., 2005), and decrease feelings of disorientation (Beasley & Waugh, 1995). Increased comprehension and decreased disorientation as mechanisms are germane to the study of interactivity because they have been often discussed as facilitating deleterious effects of interactivity. By clearly defining and manipulating navigability in Web site stimuli, this study hopes to shed light on how navigability and interactivity potentially interact to shape attitudes, behaviors, and cognitions of Web users.

Several scholars (Bucy and Tao, 2007; Liu and Shrum, 2009; Sundar, 2009) have pointed out that the effects of technological variables should be studied with attention to conditions that may strengthen or weaken these effects. In the case of interactivity, early evidence suggests that the ability to effectively use a site may be necessary for interactivity to improve outcomes. User characteristics including internet self-efficacy (Bucy & Tao, 2007) and Web use experience (Liu & Shrum, 2009) have been shown to be significant moderators, such that individual users who are more able to use site features effectively reap positive benefits from higher levels of interactivity, while those who are less able to not.

While differences between users may be one major source of variance in the ability to use the site effectively, differences between Web sites have been shown to be another. Specifically, the literature supporting the impact of Web navigability suggests that low levels of navigability may serve to impede users' ability to find information on

the site, creating a situational effect similar to that experienced by users low in experience or Web self-efficacy. This may lead to one or more of several negative outcomes ranging from frustration to total abandonment of the original task, which would preclude interactivity from being able to impact users' experience.

Although some scholars have postulated that the impact of interactivity occurs through perceptual or heuristic processes that involve little or no changes in degree of elaboration of site content (e.g., Bucy & Tao, 2007), others have speculated that interactivity also directly affects how users process content by increasing elaboration (Tremayne & Dunwoody, 2001) or increased attention to the resulting content (Sundar, 2004). Design features that have manipulated site navigability, one the other hand have been shown to both improve comprehension of content and to reduce the time users spend locating relevant information. These findings raise the question of whether navigability may play a facilitating role for cognitive effects of interactivity. In short, increased navigability of a site may make it easier for all users of a Web site to use the site effectively. To explore the interplay between interactivity and navigability with regard to how users process the content, the following research question is proposed:

RQ1: What is the relationship between interactivity, navigability, and participants' memory of site content?

In order to provide some situational context with regard to the importance of attitudes toward the Web site as a dependent variable, this study also sought to examine

the relationship between interactivity and navigability of the Web site, attitudes toward the Web site, and participants' intentions with respect to the organization. The relationship between attitudes and intended behavior raises the question of whether the technological characteristics of the Web site may have an impact beyond perceptions of the Web site itself. To examine this relationship, and the role of attitudes toward the site in shaping intended behavior, the following research question is proposed:

> RQ2: What is the relationship between interactivity, navigability, and participants' intended behavior with respect to the organization?

No formal hypotheses guided the exploration of these research questions.

CHAPTER TWO

FORMATIVE RESEARCH

Prior to conducting the main experiment, several studies were conducted to inform the development of stimulus materials and/or measures for the main experiment. This phase of the research consisted of three studies:

Study 1: Development and testing of a scale to measure perceived navigability;

Study 2: Pre-testing of Web site content domains to minimize ceiling and floor effects due to interest level

Study 3: Pilot testing the effect of navigability manipulations on perceptions of navigability.

Study 1: Development of a Scale to Measure Perceived Navigability

Because navigability is a variable that has been underexplicated and not often studied, there are few existing valid and reliable measures of perceived navigability of a Web site. The purpose of this study was to test items which would be used to develop and a measure of perceived Web navigability. A measure of Web site users' perceptions of navigability was sought for two reasons: in order to serve as a manipulation check for

the independent variable of Web site navigability and also serve as a perceptual mediator for examining the processes behind navigability's effects.

Item Development Process

Two experimental procedures were used to generate statements related to perceptions of Web site navigability, utilizing both emic and etic approaches (Berry, 1980). In order to ensure that item development utilized language consistent with how participants typically use and evaluate Web sites, participants (n = 79) in one study were asked to answer an open-ended question about Web site navigability as follows: "In your own words, in one or two sentences, what makes a Web site navigable?" Participants' open-ended responses to this question were rephrased to form declarative statements for use with Likert-type responses and added to the item pool.

An additional cluster of items was created on the basis of statements made by research participants (n=5) using a think-aloud protocol (e.g., Ericsson & Simon, 1993) while viewing several existing news and organizational Web sites selected to represent variety in topic and navigation design. For each Web site, participants were asked to find specific content, and to speak their thoughts aloud while they completed the task. The researcher asked them to explore several established Web sites selected to represent sites of varying levels of navigability. After using each site, participants were asked two questions about what aspects of the sites made finding information easier, and what aspects of the site could be improved to make the site easier to navigate. These responses and notes from subjects' description of their navigation process were utilized to create declarative statements for use with a Likert-type scale.

The final pool of 54 items was created using the sets of statements from the above research tasks, in addition to modified items from existing related scales, including Ahuja & Webster's (2001) measure of perceived disorientation. Consistent with the explication, a scale was developed to tap into a comprehensive understanding of navigability, including overall perceptions of the ease of navigating on the site, as well as perceptions of the three dimensions: clarity of target, clarity of structure, and logic of structure. Because a critical goal of item generation is to adequately sample the content domain, it is important to generate a larger pool of items than needed for the final scale (Devellis, 2003). Therefore, the item generation process yielded 18 items measuring general Web navigability, and an additional 12 items for each of the three proposed dimensions. The items were written as declarative statements to facilitate their use in a 9-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree."

Item Reduction

Once the 54 items for the pool were generated, the researcher selected representative items for use in pre-testing a measure of perceived navigability scale. Because navigability was being proposed as a variable consisting of three distinct dimensions, items were selected on the basis of affinity to one of the proposed dimensions (clarity of target, clarity of structure, and logic of structure) as well as to the overall construct (Loevinger, 1957). Twelve items were selected on the basis of relevance, use of unambiguous language, and similarity to other items (Devellis, 2003). All items were worded to reflect participants' exposure to a Web site prior to completing the scale (e.g., "The site was…;" "While using the site, I felt…"). Six of the items were

worded so that a higher level of agreement with the statement indicated a higher level of perceived navigability, and six items were worded so that a higher level of agreement with the statement indicated a lower level of perceived navigability. The latter set of statements was reverse-coded for analysis.

Pre-testing the Scale Items

The twelve-item proposed navigability scale was pre-tested in a Web site evaluation study (n = 126). Participants were asked to browse a Web site on their own, spending approximately three minutes on the Web site. After browsing the site, participants were asked to complete a brief questionnaire containing the navigability scale and several items measuring attitude toward the Web site. Four Web sites (*Bloomberg News*, *USAToday.com*, *Buy.com*, and *TheDenverChannel.com*) were chosen by the researcher to represent varying approaches to site layout, and thereby to minimize the influence of any particular site's characteristics on scale evaluation. Participants were randomly assigned to view one of the four Web sites.

The 12-item scale demonstrated a high level of internal consistency (Cronbach's α = .94). As a second test of internal consistency, corrected scale-item correlations were examined for value and consistency. Eleven of the twelve items exhibited a scale-item correlation above the common threshold of .50 (e.g., Churchill, 1979; Ong, Day, & Hsu, 2008; Glynn, 2009), with the range among these items being from .686 to .754. One item, N6, ("When I clicked a link on the site, I usually didn't know what to expect") did not meet this threshold (r =.486).

Means on each of the items were close to the midpoint of the scale, ($4.52 < M < 5.36$; see Table 3 for a full list of item statistics). Item responses varied with a high degree of consistency ($1.40 < SD < 1.63$). Individual items were also assessed for construct validity by examining item correlation with a single-item measure of overall navigability, "On a scale of 0 to 9, with 0 being very difficult to navigate and 9 being very easy to navigate, how would you rate the site you just viewed?" All items demonstrated a statistically significant ($p <. 01$) correlation with the single-item measure. Eleven of the 12 items exhibited moderate to moderately high correlation with this item, with Pearson's *r* values ranging from .417 to .680. Again, item N6 demonstrated the lowest correlation ($r = .249$). Further examination of the wording of item N6 suggests that the generalization connoted by the wording "usually didn't know" may have made it difficult for users to endorse this item. Low inter-item correlations between N6 and other scale items further indicate that the item did not function very similarly to the majority of the scale items.

Factor Structure

In order to examine the underlying dimensional structure of the scale, an exploratory factor analysis with maximum likelihood extraction and varimax rotation was conducted on the set of 12 items. The rotation method was chosen to identify potential orthogonal factors which might influence variance in the items. The analysis yielded two factors with an eigenvalue above 1, (7.07, 1.08), with the next largest eigenvalue being below .7. These factors combined to explain 67.9 percent of the variance in the 12 items. Eleven items loaded primarily on Factor 1 with factor loadings ranging from .739 to .818,

and with no second factor loading exceeding .388, thus all full filling “60-.40” criterion (e.g., McCroskey & Young, 1979; Rains, 2008). The twelfth item, N6, was the only item substantially loading onto Factor 2 (.687) and which also had a substantial cross loading onto Factor 1 (.540).

Scale Validity

In order to assess the construct validity of the navigability scale, the correlation between the scale mean and a single-item question assessing the navigability items were also examined. The validity item was worded, “On a scale of 0 to 9, with 0 being very difficult to navigate and 9 being very easy to navigate, how would you rate this Web site?” The entire scale showed a high correlation with this item ($r = .733$, $p < .01$).

Conclusion

The scale items tested proved to have a high degree of reliability, and appeared to validly measure what the participants considered navigability of the Web site. Because several pieces of evidence pointed to item N6 functioning differently from other items in the scale, the choice was made to remove this item from the scale for future use. The revised 11-item scale ($\alpha = .95$) was deemed a valid and reliable measure of perceived navigability.

Study 2: Measuring Effects of Content Domain on Perceived Involvement and Interest.

The objective of this pilot test was to inform the choice of content domains for the navigability pre-test Web site and the main experiment Web sites. Since the target subjects for the main study were college students, 10 content domains were chosen that would be of reasonable interest to college-aged users, and where the level of interest and involvement would not be likely to vary drastically based on other characteristics (i.e., gender). Thirty participants evaluated a series of Web site screenshots. The independent variable, content domain, was manipulated across 10 categories (local news, health news, sports news, environmental news, environmental non-profit, third-world health non-profit, finance education non-profit, wild animal information page, and student entrepreneurship club).

Participants

Undergraduate students (N = 30) were recruited from a student research pool at a large Southeastern university.

Procedure

The study took place in a campus computer lab containing 21 computers. Upon arrival, participants provided informed consent and received general procedural instructions for participating in the study session. Then they clicked on a hyperlink in a pre-loaded document to begin this study. The link loaded the first page of an online questionnaire containing both the stimulus materials and dependent measures.

Participants viewed each screenshot for approximately 15 seconds, and then advanced to a screen containing dependent measures pertaining to that particular screenshot.

Stimulus Materials

Ten static screenshots (resolution: 1024 x 768) of hypothetical Web pages were created. Each screenshot featured a home page including a site banner, basic information about the site topic, and at least two images germane to site content, and a similar six-category hierarchical navigation. Site screenshots were modified from extant Web sites.

Dependent Measures

Participants were asked to rate each screenshot on the basis of their perceived interest in the content domain. Perceived interest was measured using two statements with which participants were asked to rate their agreement on a 7-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree." The two statements were "I'm interested in the content of the Web site" and "I would be interested in exploring this Web site further."

Results

Reliability of the two-item interest measure was calculated separately for each application of the scale to a screenshot, and the reliability between the two items was high and consistent across screenshots, with Pearson's *r* values ranging from .877 to .968). An "interest" index was created for each screenshot by averaging the two interest items. Mean scores on the index ranged from 3.02 to 5.21, and standard deviations

ranged from 1.28 to 1.88. The overall mean of the interest index across all ten screenshots was 4.49.

Conclusion

In order to minimize the risk of low variance in dependent measures on the basis of unusually low or high involvement with the content domain, sites with the highest and lowest scores on the measure were excluded from consideration. The five sites with an interest level closest to the overall mean were retained as potentially usable content domains: student entrepreneurship club (M = 4.48, SD = 1. 58), financial literacy non-profit organization (M = 4.58, SD = 1. 88), entertainment news organization (M = 4.31, SD = 1. 82), environmental protection non-profit organization (M = 4.58, SD = 1. 68), and health news organization (M = 4.36, SD = 1. 51).

Study 3: Pre-Test of Navigability Manipulations

The objective of this study was to examine the effectiveness of manipulations of Web navigability by asking users to evaluate the perceived navigability of various versions of Web site.

Study Design

This study involved a two-level, single-factor (navigability: high, low) between-subjects design.

Participants

Participants (*N*=54) consisted of undergraduate students recruited from the research subject pool at a large Southeastern university. Participants received course credit for participating in the experimental session.

Procedure

Upon entering the computer lab, each participant took a seat at a computer that was pre-loaded with a document containing instructions for the study. Participants were briefed on study procedures and asked to sign an informed consent form. Then they clicked on a link to begin the main portion of the experiment. Prior to evaluating the Web site screenshots, participants completed a questionnaire pertaining to demographic information and Web use habits. Once they had completed this questionnaire, they began viewing and evaluating the Web site. Participants were asked to spend up to two minutes using the Web site, at which point they were taken to a screen that contained the dependent measures. Once participants completed the questions referring to the site, they were asked to proceed to the next study in the research session.

Stimulus Materials

A health news Web site was chosen as the stimulus for this pre-test based on the results of the content domain pre-test. Two different versions of a Web site representing a fictitious news organization, WellNews.com, were created (see Figures 2 and 3), with each condition representing a different level of navigability (low vs. high). Each Web

site consisted of a homepage that introduced the purpose of the site, relevant navigation, and seventeen secondary pages representing different health news stories.

Navigability was operationalized in a manner isomorphic with the conceptual definitions from the earlier explication, by manipulating each of three dimensions: clarity of target, clarity of structure, and logic of structure. Navigability manipulations were achieved by varying each of the three dimensions across two ordinal levels, low and high, as follows:

Clarity of Target. In the low-navigability condition, links in the main navigation consisted of single-word descriptors. Links within page content were presented as free-standing, single-word links, outside of paragraphs. In the high-navigability condition, menu links included longer and more specific wording, and links on a page were embedded within paragraphs to provide specific context.

Clarity of Structure. In the low-navigability condition, hyperlinks did not contain information about the position of a specific page within the site. In the high-navigability condition, this information was provided in the form of a number presented parenthetically (e.g., "Page 2 of 4"). In addition, the high-navigability condition included a link to a site map, and clickable hyperlinks at the top of the page that explain its hierarchical location ("breadcrumbs"), neither or which were available in the low-navigability version.

Logic of Structure. In the low-navigability condition, all the pages of the site were presented from the main menu, and organized alphabetically rather than semantically. In the high-navigability condition, the menu content was organized into five specific categories based on topic, and a drop-down structure was created so that

users could see the second-level categories when they rolled over one of the five broader categories with their mouse.

Dependent Measures

Perceived Navigability. Perceived navigability was measured using the 11-item scale developed in Study 2. Participants were asked to rate their agreement with a series of statements about the Web site on a 7-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree."

Attitude toward the Web site. Because navigability was hypothesized to have a direct effect on users' attitudes toward the Web site, participants' attitudes toward the Web site were measured. A significant relationship between the navigability manipulations and attitudes would provide evidence of the scales the predictive validity of the experimental manipulations. Participants were asked to rate their feelings about the Web site using three 7-point semantic differential items (Coyle & Thorson, 2001; Song & Zinkhan, 2008), with the respective anchors for each item being Bad/Good, Favorable/Unfavorable, and I disliked this site/ I liked this site.

Results

Prior to conducting the main analysis, the 12-item navigability scale was analyzed for internal consistency and unidimensionality. The scale proved highly internally consistent ($\alpha = .945$). An maximum likelihood exploratory factor analysis with varimax rotation showed that the items loaded principally on one factor (7.70, 0.72, 0.65…),

which explained 64.1 percent of the variance in the 12 items. The loadings of the 12 items on this factor ranged from .697 to .873.

To test the efficacy of the navigability manipulations, a t-test was conducted with navigability condition as the fixed factor and perceived navigability as the dependent variable. The effect of the navigability manipulations on perceived navigability scale scores was significant, t (45) = *3.17*, $p < .01$, $d = 0.91$, such that perceived navigability scores were significantly higher for participants in the high-navigability condition (M = 5.18, SD = 0.83) than for those in the low navigability condition (M = 4.06, SD = 1.49).

To test whether attitude toward the Web site varied as a result of navigability, a t-test was used to compare attitude toward the Web site between participants in the low-navigability and high-navigability conditions. The effect of the navigability manipulations on attitude toward the Web site was significant, t (50) = *2.12*, $p < .01$, d = 0.60, such that attitudes toward the Web site were significantly higher in the high-navigability condition (M = 4.49, SD = 1.37) than in the low navigability condition (M = 3.64, SD = 1.51).

Conclusion

The results of this study provided support for an operationalization of navigability by manipulating three dimensions of Web site navigation: clarity of target, clarity of structure, and logic of structure.

CHAPTER THREE

MAIN EXPERIMENT

Method

A 3 (interactivity: low, medium, high) by 2 (navigability: low, high) fully-crossed factorial between-subjects experiment was designed to test the hypotheses. Interactivity was manipulated across three levels in order to allow examination of potential threshold effects as found in earlier studies (e.g. Sundar et al., 2003). Since existing theoretical and empirical evidence pointed to linear effects of navigability, two ordinal levels of navigability were deemed sufficient to examine its effects.

Participants

The dissertation involved 120 undergraduate students who participated in the research study in exchange for course credit. Mean participant age was 20.7, and all participants were between 19 and 24 years of age. The population was heavily female (83 percent), and of non-Hispanic ethnicity (93 percent). The racial distribution of the participant sample was 82 percent White or Caucasian, 8 percent Asian or Asian

American, 6 percent Black or African American, and the remaining 4 percent listing more than one race, other, or Native American.

Stimulus Materials

Six different versions of the stimulus Web site were created, each representing a different combination of interactivity level and navigability level. Based on the results of the content domain pre-test, a Web site representing a fictitious non-profit organization with an environmental focus was chosen for the study. The fictitious organization, "WorldGreen International," was presented as an international group offering conservation and education programs in more than 20 countries to address various threats to the environment (such as coastline erosion, deforestation, unsustainable agricultural practices, etc.).

Each Web site included a home page that explained the organization's purpose, featured the same banner, images, and text content, and contained a horizontal menu located directly under the site banner which served as the primary navigation. The structure of the navigation in the menu varied based on experimental condition. In each condition, the site consisted of a total of 28 pages. The content of the pages was held constant across condition, with the exception of characteristics varied to manipulate ihe independent variables, such as navigation elements, text surrounding links, controls offered on video and slideshow players, and the presence (or absence) of a site map and search engine. All pages contained a site footer that provided contact information for the organization and links to a frequently asked questions (FAQ) page and a site privacy

policy page. The Web site contained no advertising (see Appendix 1 for stimulus screenshots).

The various conditions were hosted at a URL designed to maximize participants' perception that the site belonged to a real organization. Each condition was hosted at a different sub-domain of the URL "http://worldgreenintl.org," with each subdomain being a combination of the letters "en" (an English-language version of the site) and or "us" (ostensibly for a site version that targets visitors from United States-based IP addresses). Examples of URLs included "http://worldgreenintl.org/en" and "http://worldgreenintl.org/us_en."

Navigability Manipulations. Navigability was manipulated across two levels, low and high. These levels were achieved by manipulating site features to reflect the clarity of target, clarity of structure, and logic of structure. Consistent with the results of the navigability manipulation pre-test, specific site characteristics were chosen to represent low and high levels of each dimension.

In the low-navigability condition, the logic of the navigational structure was created so that the structure provided no additional information or hierarchy to the user. Sites in this condition contained three main sections, which were labeled with the ambiguous headings "About," "General," and "Information." These sections consisted of seven, eight, and thirteen pages, respectively. Pages were assigned to a particular section using a random number generator, and a second iteration of random numbers was used to generate page order within a section. Clarity of target was manipulated via the use of single-word link text for all hypertext elements; for example, the pages in the "General"

section included Mission, Privacy, Forests, FAQ, Farms, Communities, News, Conservation, Multimedia, News Item #5, Issues, and Jobs. A low level of clarity of structure was achieved by presenting no visual cues explaining the relative position of the specific page within the context of the larger site. Although the medium- and high-interactivity manipulations mandated a hyperlinked list of all the pages within a section, no visual indicators were given to highlight the relative position of the current page within the section.

The high-navigability condition was intended to present a more logical site structure by organizing site information into categories that conveyed additional meaning about the pages found in that section. The main navigation bar of sites in the high-navigability condition presented six sections: About Us, Key Issues, Our Programs, News, Join/Donate, and Multimedia. These sections consisted of four, seven, six, six, one, and one pages, respectively. Each section featured a main or home page which explained the purpose of the content in that section. Pages were assigned to sections based on their content; for example, the "About Us" section included the section home page as well as "Our Mission," "Our Leadership," and "Jobs and Internships."

The high-navigability condition also provided more clarity of link target by using slightly longer link text. The text linking to every page was presented using a two-, three-, or four-word description of the page content, as demonstrated above. High clarity of structure was conveyed via two elements: a hyperlink to a site map page was accessible from any page on the site, and each page featured clickable "breadcrumbs" between the site banner and the page content which denoted the hierarchical position of the page being viewed (see Figure 4c).

Interactivity Manipulations. Interactivity was operationalized in terms of three levels of information control – low, medium, and high – afforded by the interface. Control over various aspects of site content was modified on the basis of categories proposed by Kristof and Satran (1995), according to which interactivity increases as participants are allowed to control successive facets of site content (pace, sequence, media, variables, transaction, objects, and simulation). This classification is intended to cover a wide scope of interactive media, and assumes that media forms which allow control over later dimensions also allow control over any earlier dimensions. Previous work by Teo et al. (2003) successfully manipulated Web site interactivity across three conditions on the basis of this classification by adding site features which offered greater levels of control. The manipulations in this study (see Table 4) were designed to expose users to the same content across all conditions while varying only the level of the information control.

The low-interactivity condition offered users minimal control while still allowing access to all of the site content. Participants were given control over the pace at which they viewed pages on the site, and partial control over the sequence in which they viewed site content. Users were able to access any of the site's main sections at any time, but within each section, users were able to only navigate "forward" or "back" to the next page within the section. In order to give users no degree of control over media, none of the videos on the site contained any player controls, and all videos began playing automatically upon page loading.

The medium-interactivity condition allowed increased control over sequence vis-à-vis the low-interactivity conditions. In addition to allowing users to access any main section at any given time, each page within a section also contained a secondary navigation bar which allowed the user to access any page within that section (see Figure 4b). Interactivity was also increased by giving users some control over media, in the form of a stop/play toggle control on video clips. Users were also given a degree of control over variables in the site's FAQ page, via the presence of hyperlinks for each question which allowed the answer to that question to be visible on the screen.

The high-interactivity condition further increased control over sequence, media, and variables, while also adding control over transaction via a user submission form. Control over sequence was increased via a drop-down list of section contents from the main navigation bar that allowed users to navigate to any of the site pages from any other site page. Control over media was increased via the presence of a playhead on video files which allowed the user to skip ahead to any section of the video. Control over variables was increased via the presence of a keyword search engine box in the banner of each page, which allowed users to search for site content. Control over transaction was introduced via an interactive form which allowed users to submit contact information and areas of interest if they were interested in receiving more information about how they could volunteer with the organization.

Dependent Measures

Attitudes toward the Web site. The dependent variable of attitudes toward the Web site was operationalized in the form of twelve Likert-scale items adapted from

Sundar and Kalyanaraman's Web site perceptions scale (2004). These questions asked participants to rate how well a series of twelve adjectives (e.g., "useful," "positive," "interesting") described the site they had just viewed. Participants rated their agreement on a 9-point scale on which "1" was labeled "Strongly Disagree" and "9" was labeled "Strongly Agree."

Memory of site content. Memory of site content was measured using a combination of open-ended free recall questions and multiple-choice recognition question. Eight open-ended recall questions were written based on site content, (e.g., organization's key issues, programs, location of activities). In addition, eight multiple choice questions were written to assess participants' ability to remember key content information from the Web site, ranging from identifying the names of countries in which the organization's programs took place to recognizing the name of the organization's president.

Behavioral Intent. Two single-item measures were used to assess participants' perceptions of WorldGreen International as an organization by measuring their intentions to be involved with the organization. Participants were asked to rate their likelihood of donating to WorldGreen International in the future, and their likelihood of volunteering time to WorldGreen International in the future on 9-point Likert scales ranging from "Very Unlikely" to "Very Likely."

Volunteer Behavior. In the absence of being able to measure students' actual behavior with respect to helping the organization in the experiment, a behavioroid measure (Aronson & Carlsmith, 1968) of volunteer behavior was used to gauge potential effects. One question told participants that representatives from WorldGreen

International would be recruiting volunteers at their University's campus at a future date two months from the date of the experiment, and that the organization was looking for students to volunteer time to help with these efforts. Participants were asked to provide the number of hours, in 1-hour increments, that they would be willing to help.

Manipulation Check / Perceptual Mediator Measures

Perceived interactivity. Perceived interactivity was measured by using a 10-item measure adapted from several existing interactivity scales (see Table 12 for full list of items). The items asked subjects to rate their agreement with statements on a 9-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree." The items included several items from the perceived interactivity scale developed by Liu (2003), which measures three separate sub-dimensions of perceived interactivity: two-way communication, active control, and synchronicity. This scale was chosen because of its proven reliability among diverse groups of Web site users (see Liu). Four of the items were worded so that higher agreement indicated lower perceptions of interactivity, and these items were reverse-coded for analysis.

As a check on the construct validity of the perceived interactivity scale, a bivariate correlation examined the relationship between the scale measure and two separate single-item measures previously used to measure overall interactivity. on a 9-point Likert scale with the statement, "The Web site was interactive." This correlation between this item and the scale was high ($r = .502$, $p < .001$). Participants also answered the question "Compared to other sites you read on the Web, how interactive would you say this Web site was?" by rating the site on a 9-point Likert scale ranging from "Not at

All Interactive" to "Very Interactive." This correlation between this item and the scale was high (r = .467, p <.001).

Perceived navigability. Perceived navigability was measured using the 12-item scale developed during the formative research. Participants assessed their agreement with a series of 12 statements about the Web site (e.g., "The way in which information was structured on the site made sense to me;" see Table 13 for the full list of items) using a 9-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree." Six of the items were worded so that higher agreement indicated lower perceptions of navigability, and these items were reverse-coded for analysis.

As a check on the construct validity of the perceived navigability scale, a bivariate correlation examined the relationship between the scale measure and a single-item explicit measure of navigability, which asked participants "On a scale of 1-9, with '1' being 'very difficult to navigate' and '9' being 'very easy to navigate', how would you rate the Web site you just viewed?" The correlation between this item and the scale was high (r = .866, p <.001).

Perceived Web site credibility. In light of research that has shown perceived credibility to function as a mediator of the effects of technological variables (e.g., Kalyanaraman & Sundar, 2006), a measure of perceived credibility was included as a potential mediator of navigability's effects. Perceived credibility of the Web site was measured using a 6-item Likert scale used in previous online communication research (Bucy, 2004; Magee & Kalyanaraman, 2010). Participants rated their agreement with a series of statements (e.g., *I would trust information on this Web site; I believe this Web*

site to be credible) using a 9-point scale ranging from "Strongly Disagree" to "Strongly Agree."

Control Measures

Several additional measures were collected as control measures.

Perceived Involvement with Content. Participants' perceived involvement with the Web site was measured using ten 9-point semantic differential items adapted from Zaichkowsky (1985). Participants evaluated the content of the Web site by responding to a series of items which were preceded by the stem "The information provided on this Web site:" (e.g., *Matters to me/Doesn't matter to me; Is Relevant to me /Is Irrelevant to me)* .

Web Design Experience. Participants were asked to rate their experience with Web design by marking their response to the question "How experienced are you with Web Design" on a 9-point Likert scale ranging from "Not at All Experienced" to "Very Experienced."

Daily Web Use. Participants were asked to indicate their average daily use of the Web by providing an open-ended response to the question, "How many hours do you spend using the Web (via computer or mobile device) per day?"

Procedure

The main experiment took place in a computer lab. The number of participants taking part in each session ranged from 13 to 17. After providing informed consent,

participants were asked to read a brief primer on their computer screen and click a link to begin the study. On the next screen participants were told that a non-profit organization was testing potential designs for their Web site, and that the organization needed users to evaluate the design and provide feedback. Participants were randomly assigned via online questionnaire software to one of six experimental conditions. The questionnaire instructed participants to click a link which opened the Web site in an adjacent tab in their Web browser, and to spend at least five minutes exploring the Web site. After five minutes, participants were allowed to access an electronic questionnaire containing the dependent and control measures. Once participants finished browsing the site, they were asked to close the Web site and continue to the questionnaire, which included the dependent and control measures.

Results

Descriptive Statistics

Prior to tests of hypotheses, the data were screened for outliers with regard to the three principal dependent variables (memory, elaboration, attitudes) as well as the proposed mediating variables (perceived interactivity, perceived navigability, perceived involvement, and perceived credibility). All dependent measures were assessed for internal consistency and unidimensionality (see Table 5). Composite variables were screened for univariate normality (see Table 5). Analysis of scale standard deviations showed that the distribution of scores was within acceptable range.

Attitudes toward the Web site. The attitude toward the Web site measure demonstrated a high level of internal consistency ($\alpha = .96$). All 12 items were averaged to form an overall score of attitudes toward the site. Unidimensionality of the scale was assessed using a maximum likelihood factor analysis with direct oblimin rotation. The analysis showed that one factor (eigenvalue = 8.13) explained 65.7 percent in the variance, and a second factor explained 6.7 percent of the variance after rotation. Given the high bivariate correlation between these two factors ($r = .747$, $p < .01$), the items were summed to form one composite index of attitudes.

Memory of site content. Participant responses to memory questions were combined into several indices for analysis (see Table 17 for distributions on each item). Responses to open-ended questions were coded for correct responses and summed to create an overall recall score. Of the seven recall questions, one question allowed

multiple component responses (e.g., “Please list any of WorldGreen’s legislative priorities that you remember”). Responses to these questions were scored as correct as long as at least one of the correct answers was provided. One open-ended recall item suggested a ceiling effect (94.2% correct), and was excluded from the final index . Responses to the remaining items were summed to create an index for open-ended recall, which was scaled to have a possible range from 0 to 1. Four participants whose open-ended recall scores deviated by more than 2.5 standard deviations (Giles, 2002), were deleted from analysis of the recall measures to avoid their undue influence on the overall recall scores in that condition.

Responses to multiple-choice questions were scored as correct or incorrect and summed to create an overall multiple-choice recognition score, which was scaled to have a possible range from 0 to 1. One multiple-choice item suggested a floor effect (95% incorrect) and was excluded from the final scale.

The recall and recognition scores ($r = .419$, $p < .01$), were combined to form an index of overall memory for site content. This measure was transformed to a 9-point scale ($M = 2.09$, $SD = 3.07$) to allow easier interpretations of relationships between recall and the other dependent measures.

Behavioral Intentions

The two items measuring participants’ future intention to contribute to the organization were assessed for unidimensionality. Examination of the bivariate correlations for the items showed strong a relationship intent to volunteer in the future

and intent to donate money in (r = .620, p <.001). These two items were combined to form a single measure of behavioral intent, (M = 3.72 , SD = 1.89).

Volunteer Behavior

Participants' responses to the number of hours they would be willing to volunteer on campus on the organization's behalf in were used as an indicator of volunteer behavior (M = 2.09 , SD = 3.87). Responses ranged from zero to 20 hours, with 49 participants indicated they would not volunteer any hours.

Analysis of Potential Control Variables

The control measures were analyzed as potential covariates when examining the effects of the independent variables on the dependent measures. In addition to including these items as covariates in the analyses of variance for main effects, two-way ANOVAs were conducted to test for uneven distribution of the covariates between experimental conditions.

Perceived Involvement. The ten-item perceived involvement scale was assessed for unidimensionality (α = .870), and the items were averaged to form a single score for perceived involvement with the content domain (M = 6.65, SD = 1.22). Bivariate correlations showed that the involvement measure was highly correlated with attitude toward the site (r = .504, p < .001) and with behavioral intent (r = .554, p < .001), and moderate correlations with perceived interactivity (r = .317, p < .001), volunteer hours (r = .252, p <.01), and perceived credibility (r = .370, p <.001). This measure was included as a covariate in analysis of effects on attitudes. Because of its significant relationships

with multiple dependent measures, and lack of significant relationships with the independent variables, this measure was also included in the path analysis as an exogenous variable.

Web Design Experience. Participants reported their Web design experience as relatively low (M = 3.24, SD = 2.09). Bivariate correlations showed moderate relationships between Web design experience and several dependent measures: perceived interactivity (r = -.262, p <.01), perceived navigability (r = -.299, p <.01), attitude toward the Web site (r = -.231, p <.05), and perceived credibility (r = -.300, p <.01).

Because the bivariate correlation between navigability condition and Web experience approached statistical significance (r = -.164, p <.10 , a t-test was conducted to test whether mean Web design experience varied between participants in the low-navigability and high-navigability conditions. The analysis showed that the distribution of Web design experience across the conditions varied across navigability at a partially significant level, F (1, 113) = 1.80, p < .10, such that participants in the low-navigability condition had a higher level of Web design experience (M = 3.58, SD = 2.20) than those in the high-navigability condition (M = 2.90, SD = 1.95). This variable was included as a covariate in categorical analyses of variance.

Average Daily Web Use. Participants reported an average daily web use of 4.85 hours (SD = 2.49). Bivariate correlations showed no significant relationships between average daily Web use and the dependent measures, although the correlation with perceived credibility approached significance (r = -.170, p < .10). In addition, the correlations with both interactivity (r = .177, p < .10) and navigability (r = .164, p < .10) approached significance. Because average daily Web use was not related to any

dependent measures at a statistically significant level, it was not included in further analyses.

Familiarity with the Web site. As expected, participants showed very little familiarity with the stimulus Web site (M = 1.03, SD = 0.29). Because of the low variance in scores, this variable was not included in further analyses.

Tests of Hypotheses

Direct Effects on Attitudes. Main effects were hypothesized for interactivity (H1) and navigability (H4) on attitudes toward the Web site, such that conditions offering higher levels of interactivity and navigability would lead to more positive attitudes toward the Web site. These hypotheses were tested by means of an ANCOVA with interactivity and navigability as the fixed factors, content domain involvement and Web design experience as covariates, and attitudes toward the Web site as the dependent variable.

The analysis (see Table 7) showed that much of the variance in attitudes toward the Web site was driven by variance in participants' level of involvement with the content domain, F (1, 111) = 47.03, p <.001, $\eta_p 2$= .298. The analysis showed no significant main effect for interactivity, F (2, 111) = .747, p > .05. Thus, H1 was not supported. The analysis showed no significant main effect for navigability, F (1, 111) = .934, p > .05. Thus, H3 was not supported. The test also revealed a significant interaction effect for interactivity and navigability, F (2, 111) = 3.32, p < .05. Post-hoc analysis of the simple effects of navigability at each of the three interactivity conditions via one-way ANCOVAs with a Bonferroni correction showed a significant effect for navigability at

the medium-interactivity condition ($F = 7.95$, $p < .016$), such that participants in the high-navigability medium-interactivity condition ($M = 6.66$, $SD = 1.69$) had more positive attitudes toward the site than participants in the low-navigability medium-interactivity condition ($M = 5.75$, $SD = 1.13$). There was no significant of navigability at the other two levels of interactivity.

Effects on Perceptual Measures

Perceived Interactivity. H2 predicted a main effect of interactivity on users' perceived interactivity. The ten scale items were averaged to form a single measure of perceived interactivity ($M = 6.11$, $SD = 1.09$). To test whether perceived interactivity was manipulated between interactivity conditions without differing by navigability conditions, an ANOVA was conducted with interactivity and navigability as fixed factors and perceived navigability as the dependent variable (see Table 8). The main effect of the interactivity manipulations on perceived interactivity scale scores was significant, $F(2, 114) = 4.20$, $p < .05$, $\eta_p^2 = .07$. A post-hoc analysis using Tukey's HSD showed that the significant omnibus was driven by significant differences between the low-interactivity ($M = 5.73$, $SD = 1.09$) and high-interactivity ($M = 6.39$, $SD = 1.03$) conditions, and that the medium-interactivity condition ($M = 6.2$, $SD = 1.08$) did not differ significantly from the other two. The effect of the navigability manipulations on perceived interactivity scores was not significant, $F(1, 114) = 0.54$, $p > .05$, and there was no significant interaction between interactivity and navigability on perceived interactivity, $F(1, 114) = 1.62$, $p > .05$. A plot of perceived interactivity by interactivity and navigability level is shown in Figure 6.

Perceived Navigability. H5 predicted a main effect of navigability on users' perceived navigability. The eleven scale items were combined to form a single measure of perceived navigability (M = 6.07, SD = 1.72). To test whether perceived navigability was manipulated between the navigability conditions without differing significantly between interactivity conditions, an ANOVA was conducted with interactivity and navigability as fixed factors and perceived navigability as the dependent variable (see Table 9). The effect of the navigability manipulation on perceived navigability was significant, F (1, 113) = 19.81, p < .001, η_p^2= .15, such that perceived navigability scores were significantly higher for the high-navigability condition (M = 6.68, SD = 1.44) than for the low navigability condition (M = 5.54, SD = 1.78). The effect of the interactivity manipulations on perceived navigability scores was not significant, F (2, 113) = 2.03, p > .05, and there also was no significant interaction between interactivity and navigability on perceived navigability F (2, 114) = 1.77, p > .05. A plot of perceived navigability by interactivity and navigability level is shown in Figure 7.

Perceived Credibility. The six items used to measure perceived credibility were summed to create a measure of overall perceived credibility (M = 6.70, SD = 1.39). A two-way ANOVA was conducted with interactivity and navigability as the independent variables and perceived credibility of the Web site as the dependent variable. The analysis showed that perceived credibility did not vary as a result of either interactivity, F (2, 114) = .122, p = .299, or navigability, F (1, 114) = .289, p = .592. The interaction effect for interactivity and navigability was not significant, F (2, 114) = 1.053, p = .352.

Effects of Interactivity and Navigability on Attitudes Mediated Through Perceived Interactivity and Perceived Navigability

Additional analyses were conducted to further explore the relationships between interactivity and navigability, user perceptions of interactivity and navigability, and, ultimately, attitudes toward the Web site. Specifically, these analyses were conducted to test H3, which predicted a significant indirect effect for interactivity on attitudes mediated by perceived interactivity, and H6, which predicted a significant indirect effect for navigability on attitudes through perceived navigability. In the absence of main effects for interactivity or navigability on attitudes, these tests sought to examine whether the hypothesized indirect pathways through perceptual mediators were significant but suppressed (see Hayes, 2009; Zhao, Lynch, & Chen, 2010).

A path analysis was conducted to explore how the perceived interactivity and perceived navigability contribute to variance in attitudes toward the Web site, behavioral intentions regarding the organization depicted in the Web site, and volunteer hours. In this analysis, interactivity and navigability were treated as exogenous variables, and behavioral intent toward the organization and volunteer hours were treated as the final variables in the path. The approach to analysis involved including paths between all significant correlations, and removing non-significant paths to form the final model (cf. Segrin & Nabi, 2002; Oliver, Kalyanaraman, Ramasubramanian, & Mahood, 2007). The independent variables were coded such that a one-point increase represented an increase in one operational level of the independent variable. Because user involvement with the

content domain was a significant covariate in effects on perceived interactivity, perceived navigability, and attitudes toward the site, but not significantly related to the independent variables, it was included as an exogenous variable with paths to the two perceptual variables and attitudes.

Figure 9 contains the final model in the analysis, with all path values shown in the form of unstandardized regression coefficients. This model is associated with $\chi^2 = 16.53$, $df = 17$, p = .486, suggesting a good fit. The other fit indices were consistent with this conclusion: RMSEA= .000; NFI = .945, RFI = .966. Consistent with hypothesis H3, the model suggests there is a significant indirect path between interactivity and attitudes toward the site, through the variable of perceived interactivity. Specifically, higher levels of interactivity were associated with higher levels of perceived interactivity (β= . 27), and higher levels of perceived interactivity were associated with more positive attitudes toward the site (β= . 24)[3]. Likewise, consistent with hypothesis H6, the model suggests a significant indirect path between navigability and attitudes toward the site, wherein higher levels of navigability were associated with higher levels of perceived navigability (β= . 32), and higher levels of perceived navigability were associated with more positive attitudes toward the site (β= . 26). Bootstrapping of the indirect effects of perceptions of

[3] Coefficients for paths involving the experimental conditions connote the effect on the dependent measure of moving between one level of experimental condition.

the technological characteristics on attitudes toward the site revealed significant indirect effects for both interactivity (β= . 07, p < .05) and navigability (β= . 08, p < .001).

The model also suggested a strong relationship between perceived interactivity and perceived navigability (β = . 65). Although the path between navigability and perceived interactivity was not significant, and neither was the path between interactivity and perceived navigability, the strength of the relationship between the two perceptual variables was the highest within the model. Additionally, perceived involvement was associated with perceived interactivity (β= . 34), attitudes toward the site (β= . 35), and future intentions toward the organization (β= . 55).

Effects on Memory

H7 predicted a main effect for Web site navigability on memory of site content. In order to test this hypothesis, a two-way ANOVA was conducted with interactivity and navigability as the independent factors and memory as the dependent variable. The results showed a significant main effect for navigability, F (1, 114) = 6.60, $p < .05$, $\eta_p 2$= .055 such that users in the high-navigability condition (M = 2.94, SD = 1.48) demonstrated better memory of site content than those in the low-navigability condition (M = 3.71, SD = 1.82). Thus, H7 was supported.

RQ1 sought to investigate whether the influence of interactivity on memory of content was greater under conditions of high navigability than under conditions of low navigability. The interaction effect between navigability and interactivity was not statistically significant, F (1, 114) = 2.10, $p > .05$, indicating no interaction (see Figure 8).

CHAPTER FOUR

DISCUSSION

It has been suggested that interactivity and navigability are distinct characteristics that play a role in shaping the psychological outcomes of Web site use (Zhou & Leung, 2007; Sundar, 2008, 2009), but heretofore there has been little empirical data to back up this claim. The overarching purpose of this dissertation was to add conceptual clarity to the study of technological variables in online communication by examining the effects of Web site interactivity and navigability and the mechanisms by which those effects occur. In doing so, the dissertation put forth a three-dimensional concept explication of navigability, and developed and validated a scale to measure perceived navigability. Overall, the findings from this research suggest that these two variables should be viewed as separate characteristics of Web sites, that users can discriminate between perceptions of each, that perceptions of interactivity and navigability inform attitudes toward the Web site, and that navigability has a significant effect on memory of site content.

Interpretation of Findings

Interactivity. The extant literature shows mixed findings regarding interactivity's effects, and the broad variety of conceptual and operational definitions of interactivity employed (Kalyanaraman & Sundar, 2008) contributes to the confusion.

This dissertation hoped to disentangle navigability from the many technological characteristics of Web sites which prior studies had included under the category of interactivity, by focusing on interactivity as information control, and orthogonally manipulating navigability in terms of clarity of target, clarity of structure, and logic of structure. While information-control-based operationalizations of interactivity had been utilized in the past (Teo, et al., 2003; Kalyanaraman et al, 2009), studies had not tested whether interactivity was psychologically significant when controlling for the level of navigability. Recent theoretical work (Sundar, 2008) has suggested that interactivity and other technological variables affect outcomes by triggering heuristics rather than by directly influencing individuals' ability or motivation to process content, and while these findings did not explicitly test for use of heuristics, they suggest that in interactivity's case, perception may drive attitude effects.

The findings suggest that giving users greater options to control more dimensions of content (e.g., pace, sequence, media) had a significant effect on the degree to which users perceived the site as interactive. While the main effect of the interactivity manipulations on attitudes was not significant, the strong relationship between perceived interactivity and attitudes lends some support to claims that how interactive users perceive the to be site is of key importance in shaping user opinion of the site as a whole. The significance of the mediation pathway between interactivity and attitudes through perceived interactivity, suggests that the interactivity-attitudes relationship may be largely or solely driven through user perceptions of how interactive a site is; in essence, that perceived interactivity provides an indicator of overall quality of the site. The

significance of the mediated pathway also suggests that greater variation in user control is likely to lead to greater differences in user attitudes toward the site.

Navigability. Previous research on the impact of specific navigational elements on Web sites has suggested the potential for design to influence users' information processing in several ways. This study sought to examine whether these design characteristics can be viewed as part of a single construct, navigability, and to elucidate the processes through which navigability's effects take place. The findings indicate that both navigability as a stimulus characteristic and users' perception of navigability influence the processing of content, albeit in different ways. With regard to attitudes, the findings did not show support for the hypothesized main effect of level of navigability on attitudes toward the Web site. Participants' mean attitude toward the Web site was higher in the high-navigability condition than in the low-navigability condition, but the small size of this difference and the variance among attitude scores in each condition rendered this difference not statistically significant. The results also showed that at medium levels of interactivity, navigability had a significant effect on attitudes, such that attitudes were significantly higher for participants in the high-navigability condition than in the low-navigability conditions. There are several possible interpretations of this finding. First, the finding suggests that at low or high levels of information control – perhaps lower or greater than participants are used to – the effects navigability may be subsumed by interactivity; that is, perhaps when a site offers much more or much less control than users expect, greater weight is given to these features in shaping attitudes.

An alternate explanation that has to be considered is that this significant difference is due to Type II error.

The findings also showed the importance of perceived navigability in driving navigability's effects. The significance of the pathways between navigability and perceived navigability and between perceived navigability and attitudes show that, to the extent that the experimental conditions manipulated participant perceptions of navigability, they were also successful in affecting participants' attitudes. The results also show that much of the variance in *perceived* navigability scores is unaccounted for by structural manipulations of the site, at least within the present study. It can be assumed that some of this variance occurs as a result of individual differences between participants, some may be accounted for by differences in site content, and some may occur on the basis of an interaction between participants and content. The lack of a direct effect suggests that some characteristics of the stimulus materials may have suppressed the impact of navigability on attitudes.

In addition, as expected, navigability exerted a significant main effect on memory of site content, while the findings showed no support for a significant relationship between *perceived* navigability and memory. These findings suggest that the actual process of using the low-navigability site may have been more cognitively demanding. When users have a more difficult time understanding the structure of a Web site, the process of information seeking on the site demands a greater allocation of cognitive resources. In keeping with the notion that humans capacity of such resources is limited (Lang, 2006), resources allocated by users to figuring out the structure of the site can not be applied to encoding site content. Thus, regardless of whether users perceived a site as

navigable, the actual manipulations of site navigability (in accordance with the proposed three dimensions) impacted the degree to which users can remember the content. The broader significance is that the same Web site content, distributed across the same number of pages may still be perceived differently on the basis of how clear the links are, whether a logical hierarchical structure is adopted for the pages, and whether that structure is conveyed to the clearly user.

Overall, the findings with respect to navigability provide support for two separate paths of influence for Web site navigability: a perceptual or associational path through which navigability influences attitudes, and a direct, perception-independent path through which navigability influences memory of site content. In addition, the results suggest support for a perception-mediated path by which interactivity influences attitudes. The implication of this is that navigability may function not (only) as a heuristic, but as a determinant of users' ability to process content. In the context of dual-process persuasion models of persuasion (e.g., Petty & Cacioppo, 1986), this would situate navigability as a moderator of the degree of elaboration applied to content online, a proposition that should be tested in future studies.

Interaction Between Navigability and Interactivity. This dissertation also attempted to make a contribution by exploring whether navigability served as a moderator for interactivity's effects on memory. Specifically, an interaction effect was predicted for interactivity's effects on memory, wherein under low levels of navigability, interactivity would have no relationship to memory, but under high levels of navigability, level of interactivity would be positively related to memory scores.

Analysis of the effects of the independent variables on memory showed no significant interaction effect. An examination of the cell means shows great similarity in memory scores across the three low-navigability conditions, and slightly less similarity across the three high-navigability conditions, with scores in the high-navigability, medium-interactivity condition ($M = 4.31$) exceeding those in the other conditions by more than 0.8 on a 9-point scale. Potential statistical significance of this effect might have suffered from a lack of power to detect the interaction, but also may have been affected by the high degree of variance in memory scores overall. These results, in conjunction with the significant main effect of navigability on memory, suggest that navigability itself may be a key driver of effects on memory, and its effects appeared to subsume the predicted interaction. An interaction effect between interactivity and navigability was also tested with regard to attitudes toward the Web site. The lack of significance of the interaction term in the analysis of variance suggests that interactivity and navigability work separately to influence attitudes, a process supported by the lack of significant relationships between interactivity and perceived navigability, and between navigability and perceived interactivity. However, in light of the significance of navigability, future research should continue to examine whether the level of one of these variables may influence the impact of the other.

Implications

This dissertation and its findings bear several implications not only for the development of theory, but also for the practices of Web site design and experimental research using Web site stimuli.

Theoretical Implications

This study sought to contribute to theory by focusing on the explication and extrication of variables that were assumed to be important in the study of digital mediated communication. The findings herein, however, have several implications for the development and application of communication theory.

Support for Interactivity as Information Control. Kalyanaraman and Sundar (2008) suggested that a perspective that conceptualizes interactivity in terms of information control could contribute greater clarity to the scholarship in this area. This study is one of few to date that have empirically tested this approach, and it sought to enhance the understanding of how it can be operationalized with regard to increased both degree and type of control offered across conditions. Unlike in many previous studies which employed a feature-based approach, the manipulations were achieved without adding additional content across conditions. The findings demonstrate that interactivity manipulated in this manner is consistent with the way the interactivity has long been theorized to function by Heeter (1989), Steuer (1992) and others; that is, the manipulations affected perceptions of interactivity, which had a significant linear relationship with attitudes toward the site.

The question of "too much" interactivity. A persistent theme in interactivity scholarship since the publication of the study by Sundar et al. (2003) has been whether beneficial effects of increased interactivity might be limited to moderate levels, and accordingly, whether high levels of interactivity may, in fact, have deleterious effects. The findings from this study do not provide support to the claim that interactivity's effects are limited at high levels of interactivity. Attitude scores showed a positive linear relationship across all three levels of interactivity. In addition, users' mean perceived interactivity in all three conditions was above the midpoint of the provided scale, as were measures of users' overall attitudes toward the site.

Conceptual and Operational Framework for Navigability. Although several scholars (e.g. Sundar, 2008) have posited that navigability is a key factor that plays a significant role in mediating the communication process, this study is among the first to propose a multi-dimensional operational definition of Web site navigability. Several previous studies have identified specific design features which influence users' subjective experience with a Web site (Khan & Locatis 1998; Spyridakis et al., 2007). However, little, if any, previous work has empirically examined the role of navigability as a characteristic of Web sites.

Likewise, existing research has largely left unaddressed the question of how individuals' perceptions of navigability can and ought to be measured. The 11-item perceived navigability scale developed and validated for this study provides a internally consistent measure that was shown in two different experiments to distinguish between two ordinal levels of navigability. Evidence for the scale's merit and function include

construct validity in the form of its relationship to other items aimed to tap in to navigability, predictive validity in the form of the relationship between scale scores and scores on attitude toward the site and memory of site content, and concurrent validity in the form of the scale's ability to discriminate between sites designed to provide varying levels of navigability. The scale also demonstrated reliability and unidimensionality in three separate evaluations, using both real-world and experimenter-developed Web sites. The main experiment also provided some evidence of discriminant validity in showing that responses on this measure do not vary significantly as a result of level of interactivity or perceived involvement with the content domain,

The findings that level of navigability had a significant effect on users' memory of site content are consistent with the notion that low levels of navigability impede users' ability to encode content for storage. Limited capacity models of message processing (Lang, 2006) suggest that such diminished encoding is due to greater allocation of limited cognitive resources to the site structure. While this proposition was not explicitly tested in this study, it provides a possible explanation for the discrepancy in memory between low navigability and high navigability conditions. Future research should test whether low navigability functions as a deterrent to encoding content, or whether the memory findings here may be due to effects on other steps such as storage or retrieval.

Practical Implications

This dissertation has several implications for practitioners of Web site design. Chief among them is that design choices made with respect to navigation matter in multiple areas of user experience. It has long been said in news and other industries that

"content is king." While this study was not designed to verify or falsify that claim, the results here suggest that design may be a worthy queen. Users' perceived interactivity and perceived navigability each made an additional unique contribution to users' evaluation of the site, even controlling for the effect of participants' varying levels of involvement with the content domain. In line with the claims of usability evangelists such as Jakob Nielsen and Steve Krug, this study shows that adherence to basic principles of effective design can facilitate the impact of site content. There may exist limits on the extent to which navigability can influence attitudes toward a site, but in an online business landscape in which the competition is always just a click or two away, any opportunity designers have to make a positive impression is one worth taking. The allocation of financial, personnel, and time resources to the incorporation of navigability in design, and to user-testing to assess perceptions of navigability, may yield benefits regarding users' opinion of the Web site and resulting behavior with respect to the organization.

The implication that there may not be, after all, such a thing as "too much" interactivity is also of significance to practitioners and decision-makers in online media design. The significant positive effects of perceived interactivitysuggests that designers should make sure users understand the control afforded them by a Web site. Because of this, the provision of instructions and other means which call attention to site interactivity may be cost-effective. Having a site that allows the user control over many dimensions of content, and particularly having a site than is *perceived* as interactive, may have beneficial effects that last beyond consumer's Web site viewing experience, as evidenced by the positive relationship between perceived interactivity and behavioral intentions.

Implications for Researchers Studying Online Media. Researchers studying media effects of "new" media often feel like they have to make choices between ecological validity and manipulation strength. Part of this comes from an understanding that online information processing is a confluence of structure, content, user, and situation, each of which may contribute significant variance to any dependent measure in question. Researchers may often feel the need to "stack the deck" with respect to independent variable manipulations in an effort to make them stand out among the other influences. However, when this process produces experimental stimuli that no longer resemble their real-world counterparts, then claims of the generalizability of the results become tenuous at best.

This study, it is hoped, provides a useful template for researchers attempting to manipulate and investigate the effects of technological variables in online media environments in a manner that does not sacrifice ecological validity. The conditions varied only with regard to structural or design-related characteristics presented as operationalizations of the two independent variables. The data collected suggest that the site was successful in presenting a realistic Web site: the mean credibility score was 6.70 on a 9-point scale, and more than half of participants expressed an interest in volunteering time to help the organization. It is possible that the relatively high verisimilitude of the site across all three conditions contributed to the relatively small degree of variance in key dependent measures. However, this same factor factors makes it more likely that the variable relationships and effect sizes found in this study are

accurate representations of the real-world impact of changing structural characteristics of a Web site while keeping the content constant.

Limitations

Threats to Internal Validity. Any experiment which involves the presentation of serial dependent measures opens the possibility of question order effects. In this study, the dependent measure questionnaire was designed to minimize potential carryover effects from previous measures, and thus the order of dependent measures was kept constant for all participants (see Appendix B for full questionnaire).

In addition, the measure of involvement with the content domain was administered after participants had used the Web site, which may have led to carryover effects from the stimulus affecting this measure. Although the perceived involvement measure did not vary as a result of experimental condition, its significant relationships with perceived interactivity and perceived navigability are difficult ones for which to establish a clear causal pathway. In line with some previous research, this study assumed that users' involvement with the content taps into pre-existing attitudes with regard to the content domain – whether it is "interesting," "trivial," "mundane," etc. – but it is impossible to discount the possibility that responses were influenced by exposure to the site.

Threats to External Validity. The artificiality of any laboratory setting must be recognized as a threat to the external validity of experimental research. In this

experiment, several specific characteristics of the study should be taken into account in any generalization of its findings.

The first of these factors is involvement with the content domain. Despite pre-testing to select a content domain in which participants could be expected to have a moderate level of involvement, the high overall level of involvement with the domain may have had an effect on the results. The involvement measure – designed to tap into users' feelings of involvement with the content domain rather than the specific Web-site-use experience – registered fairly high levels of involvement with the area of environmental conservation.

A second characteristic that should be considered in generalizability of the results is the broader category or function of the Web site used. Because the Web site used as the stimulus in this study represented an organization, the independent variables may have played a different role in shaping use and perceptions of the site than they would for other form of sites (e.g., e-commerce, news, or education sites).

The nature of the task may also have played a role in shaping the effects. Research has shown that users of hyperlinked interfaces process information differently when engaged in a task that involves perusing content – a "browse" task – that when being prompted to find specific information in that content – a "search" task (Marchionini, 1995; McDonald & Chen, 2006) . The implication is that users that engage in goal-directed search may be more frustrated by poor navigability because it limits their ability to achieve that goal. Conversely when the user's task involves open-ended browsing, it may be less imperative or less noticeable to them that navigational elements

adequately present the structure of the site's content or information about the targets of hyperlinks.

Task involvement may also have had influence on the results. Because the participants were told to browse the site for a minimum of five minutes, and that they would be evaluating a test version of the site for the company, it's possible that participants paid a greater level of scrutiny to site content than they might have were they to encounter this site in a real-world setting. Future studies should examine the effects of Web site navigability under different task conditions.

Sample characteristics should also be considered in generalizing the results to other populations. The sample consisted entirely of college students, nearly all of whom were between 18 and 22 years of age. Participants' average of 4.8 hours of daily Web use was high compared to Americans overall, who average just under an hour a day (The Nielsen, Company, 2010). In addition to Web use, other characteristics of the age group, such as Web experience (Liu & Shrum, 2009) or Web self-efficacy (Bucy & Tao, 2007) may make the results less generalizable to populations of other ages.

Other Limitations. Although the online questionnaire containing the dependent measures presented the dependent measures in an order designed to minimize question effects, it is possible that the order and layout of the questionnaire had a negative impact on measurement validity. All scale measures were presented within a distinct question block design, which may have contributed to measures of scale reliability. The ordering of the dependent measures may have introduced contrast or assimilation effects.

Finally, it is possible that the limited sample size of this study led to the commission of Type II error, whereby findings that would be statistically significant with

a larger population did not reach significance. However, given the effect sizes for statistically significant effects found, and the relative homogeneity of variance in most of the measures across conditions, it can be assumed that any non-significant findings herein that might reach statistical significance as a result of larger power would be of little real-world importance.

Suggestions for Future Research

The findings of this study raise several interesting points and questions which offer an instructive road map for future research, in addition to the suggestions already mentioned above.

Although the results regarding navigability in this study are promising with regard to its impact, the nature of the experimental manipulations offers no insight into the relative impact of each of the three dimensions of navigability. While orthogonally manipulating each of the three dimensions in a fully-crossed design may pose some challenges, such as presenting the structure of a Web site clearly while having the navigational links reveal little about page targets, a successful and rigorous examination of how these factors impact dependent variables would be useful for practitioners and researchers alike.

Future research can also aid the development of theory by shedding more light on the role of content domain involvement. In this study, involvement was a measured variable on which many of the participants scored rather high. Future experiments

involving navigability and interactivity should involve the manipulation of content domain as an independent variable in an effort to see whether different levels of condtent domain involvement may moderate technological variables' effects. Many categories of involvement have been utilized in past communication research, and care should be taken to isolate pre-existing content domain involvement from perceived involvement with the specific content of the stimulus materials.

Coda

In conclusion, this discussion has uncovered evidence for two distinct constructs, interactivity and navigability, that each play a role in how users process information online. Given that the presence of these elements informs the design of most existing Web sites, we hope that this dissertation is a useful if preliminary step in pointing to the importance of treating them as related but yet distinct entities. It is our hope that the die has been cast, and that these methods and findings will inspire other scholars and researchers in the psychological effects of new communication technology to devote further attention to these topics, supporting the goal of systematic and programmatic research on the influence of technological design variables. In that hope and expectation, we invite other scholars to join us on this odyssey.

Table 1
Dimensions of Web Navigability and Evidence of Their Psychological Impact

Proposed Dimension	Study	Web Site Feature	Effect on Dependent Measure(s)
Clarity of Target			
	Khan & Locatis (1998)	Correspondence between link and task	reduced search time
	Spyridakis, et al., (2007)	Explicitness of link wording	Comprehension of content
	Wei, et al., (2005)	Informativeness of link wording	inferential comprehension of content
Clarity of Structure			
	Spyridakis, et al., (2007)	Cue of sequential position of page	Increased attitudes toward site
	Beasley & Waugh, (1995)	Presence of a site map	Decreased disorientation
	Mobrand et al., 2007	Navigational tab menus	Perceptions of site, exploration of site content
Logic of Structure			
	Larson & Czerwinski, (1998)	Breadth of navigational structure	Increased performance during search task
	Norman & Chin (1998)	Breadth of navigational structure	Reduced task time

Table 2.
Hypotheses, Rationale, and Summary of Findings

Number	Dependent Variable	Hypothesis / Research Question	Rationale	Supported
H1	Attitudes toward site	Higher levels of interactivity will lead to more positive attitudes toward the site.	Main effect of interactivity	Not significant
H2	Perceived interactivity	Higher levels of Web site interactivity (as user control) will lead to greater levels of perceived interactivity	Main effect of interactivity	Supported
H3	Attitudes toward site	The relationship between interactivity and attitudes toward the site will be mediated by perceived interactivity.	Mediation effect of perceived interactivity	Supported
H4	Attitudes toward site	Higher levels of navigability will lead to more positive attitudes toward the site.	Main effect of navigability	Not significant
H5	Perceived navigability	Higher levels of navigability (as clarity of target, clarity of structure, and logica of structure) will lead to greater levels of perceived navigability.	Main effect of navigability	Supported
H6	Attitudes toward site	The relationship between navigability and attitudes toward the site will be mediated by perceived navigability	Mediation effect of perceived navigability	Supported
H7	Memory of site content	Higher levels of navigability will lead to higher levels of memory of site content.	Main effect of navigability	Supported

Table 3.
Scale Development: Item and Scale Statistics for Perceived Navigability Measure

Items	Mean (SD)	alpha if item deleted	Corr. w/ single-item Nav	Corrected Item-Total Corr.
Please rate your experience viewing this Web site using by rating your agreement with each statement...				
1. I always knew where I was on this site.	5.19 (1.50)	.930	.654**	.726
2. It was clear to me how the information on the Web site was structured.	5.17 (1.55)	.928	.673**	.770
3. I felt disoriented while using the site. (R)	4.52 (1.66)	.929	.680**	.754
4. I felt like I was going around in circles. (R)	5.07 (1.42)	.929	.575**	.751
5. The way in which information was structured on the site made sense to me.	4.94 (1.58)	.929	.646**	.750
6. When I clicked a link on the site, I usually didn't know what to expect. (R)	5.36 (1.40)	.938	.249**	.481
7. Navigating between pages on the site was a problem. (R)	5.23 (1.45)	.930	.483**	.734
8. I knew my current position on the Web site.	5.07 (1.44)	.931	.558**	.700
9. I didn't know how to get to my desired location. (R)	5.01 (1.49)	.931	.517**	.686
10. The main sections of the site were made clear to me.	5.16 (1.63)	.929	.582**	.739
11. I had no problem going back-and-forth between pages.	5.19 (1.41)	.930	.417**	.723
12. It was difficult to know how to move around on this site. (R)	4.96 (1.51)	.929	.616**	.757

(R): Item was reverse-coded prior to calculating means and correlations
Cronbach's alpha for entire 12 item scale: .935
** $p < .01$

Table 4.
Experimental Manipulations of Interactivity

Interactivity Level	Available Features	Type of Control
Low		
	Ability to navigate forward and backward within section	• Control over Pace
	Ability to navigate between main sections	• Control over Sequence
Medium		
	Ability to navigate freely within section	• Control over Sequence (increased)
	Ability to pause/play site videos	• Control over Media
	Ability to toggle FAQ text	• Control over Variables
High		
	Ability to navigate freely to any page in site	• Control over Sequence (increased)
	Ability to navigate freely within site videos	• Control over Media (increased)
	Ability to search site content via keyword search engine	• Control over Variables (increased)
	Ability to submit user information and request more information via form	• Control over Transaction

Table 5.
Descriptive Statistics for Dependent Measures

	Perc Int.	Perc. Nav	A_{site}	Memory	Perc. Cred.	Content Inv.	Behavioral Intent	Volunteer Hours
N Valid	120	119	119	120	120	120	120	117
Missing		1	1					
Mean	6.05	6.00	6.15	.389	6.69	6.64	3.72	2.09
SE of Mean	1.01	.159	.145	.015	.127	.114	.173	.284
Median	6.10	6.25	6.42	.570	7.00	6.75		
Mode	6.30	7.42	6.67	.400	7.00	7.50		
Std. Deviation	1.11	1.73	1.59	.165	1.39	.165	1.89	3.07
Variance	1.23	2.98	2.51	.027	1.92	1.57	3.58	9.45
Skewness	-.004	-.343	-.482	.831	-.839	-.646	.284	2.73
SE of Skewness	.221	.222	.222	.221	.221	.221	.221	.224
Kurtosis	-.565	-.509	-.455	1.386	.964	.256	-.495	10.45
SE of Kurtosis	.438	.440	.440	.438	.438	.438	.438	.444
Range	5.40	7.17	7.42	.86	7.00	6.10	8.00	20.00
Maximum	9.00	9.00	9.00	.93	9.00	8.70	9.00	20.00
Minimum	3.60	1.83	1.58	.07	2.00	2.60	1.00	0.00

Table 6.

Matrix of Pearson Correlations Between Dependent Measures

Dependent measure		1	2	3	4	5	6	7	8	9	10
1. Perceived Interactivity (1-9)	Corr (Sig. 2- tailed)	1									
	N	120									
2. Perceived Navigability (1-9)	Corr (Sig. 2- tailed)	**.661(**)**	1								
	N	120	120								
3. Attitude Toward The Site	Corr (Sig. 2- tailed)	**.543(**)**	**.497(**)**	1							
(1-9)	N	119	119	119							
4. Recall of Site Content (1-9)	Corr (Sig. 2- tailed)	**.068**	**.072**	**.073**	1						
	N	120	120	119	120						
5. Behavioral Intent (1-9)	Corr (Sig. 2- tailed)	**.205(*)**	**.099**	**.330(**)**	**.164**	1					
	N	120	120	119	120	120					
6. Volunteer Hours (0-20)	Corr (Sig. 2- tailed)	**-.038**	**-.039**	**-.077**	**-.035**	**.356(**)**	1				
	N	117	117	116	117	117	117				
7. Involvement w/ Content Domain (1-9)	Corr (Sig. 2- tailed)	**.317(**)**	**.160**	**.504(**)**	**.021**	**.552(**)**	**.252(**)**	1			
	N	120	120	119	120	120	117	120			
8. Perceived Credibility(1-9)	Corr (Sig. 2- tailed)	**.553(**)**	**.527(**)**	**.516(**)**	**-.149**	**.294(**)**	**.056**	**.370(**)**	1		
	N	120	120	119	120	120	117	120	120		
9. Web Design Experience	Corr (Sig. 2- tailed)	**-.262(**)**	**-.299(**)**	**-.231(*)**	**-.175**	**-.020**	**.140**	**.031**	**-.300(**)**	1	
(1-9)	N	120	120	119	120	120	117	120	120	120	
10. Average Daily Web Use (1-15)	Corr (Sig. 2- tailed)	**-.045**	**.046**	**.019**	**.025**	**-.013**	**-.005**	**-.060**	**-.170**	**-.073**	1
	N	120	120	119	120	120	117	120	120	120	120

Table 7.
Analysis of Covariance for Effects on Interactivity and Navigability on Attitudes

Dependent Variable: Attitude Toward the Site

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	107.835(a)	7	15.405	9.108	.000	.365
Intercept	16.372	1	16.372	9.680	.002	.080
Involvement	79.540	1	79.540	47.029	.000	.298
Web Design Exp.	16.214	1	16.214	9.587	.002	.079
Interactivity	2.528	2	1.264	.747	.476	.013
Navigability	1.580	1	1.580	.934	.336	.008
Int * Nav	11.233	2	5.617	3.321	.040	.056
Error	187.733	111	1.691			
Total	4761.458	119				
Corrected Total	295.568	118				

a R Squared = .365 (Adjusted R Squared = .325)

Table 8.
Analysis of Variance for Effects on Interactivity and Navigability on Perceived Interactivity

Dependent Variable: Perceived Interactivity

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	13.694(a)	5	2.739	2.424	.040
Intercept	4474.965	1	4474.965	3961.346	.000
Navigability	.833	1	.833	.738	.392
Interactivity	9.197	2	4.599	4.071	.020
Nav. * Int.	3.663	2	1.832	1.621	.202
Error	128.781	114	1.130		
Total	4617.440	120			
Corrected Total	142.475	119			

a R Squared = .096 (Adjusted R Squared = .056)

Table 9.
Analysis of Variance for Effects on Interactivity and Navigability on Perceived Navigability

Dependent Variable: Perceived Navigability

Source	Type III Sum o Squares	df	Mean Square	F	Sig.
Corrected Model	63.903(a)	5	12.781	5.044	.000
Intercept	4416.533	1	4416.533	1743.037	.000
Navigability	45.428	1	45.428	17.929	.000
Intearactity	9.330	2	4.665	1.841	.163
Nav. * Int.	9.146	2	4.573	1.805	.169
Error	288.855	114	2.534		
Total	4769.292	120			
Corrected Total	352.758	119			

a R Squared = .181 (Adjusted R Squared = .145)

Table 10.

Summary of Means for Control Measures by Condition

	Navigability		Interactivity		
Measure	Low	High	Low	Medium	High
Content Involvement	6.77	6.52	6.69	6.79	6.47
Web Design Experience	3.58	2.90	3.63	3.03	3.08
Avg. Daily Web Use (Hrs)	4.44	5.26	4.27	4.93	5.35

= .05 < p < .10

Table 11.
Summary of F-Values and Means for Dependent Measures

	Navigability			Interactivity			
Measure	Low	High	*F*	Low	Medium	High	*F*
Attitudes Toward Site	6.03	6.22	0.44	5.93	6.21	6.25	0.47
Memory of Site Content	2.94	3.71	6.60*	3.13	3.56	3.28	0.70
Volunteer Hours	2.48	1.72	1.87	1.38	2.47	2.31	1.61
Behavioral Intent	3.79	3.64	0.18	3.81	3.46	3.48	0.48

* $p < .05$

Table 12.
Descriptive Statistics for Perceived Interactivity Scale Items

Items	Mean (SD)	alpha if item deleted	Corrected Item-Total Corr.	Skewness (SE)	Kurtosis (SE)
Please rate your perceptions of the Web site by rating your agreement with the following items using the scale provided.					
I felt that I had a lot of control over my visiting experiences at this website.	6.39 (1.79)	.804	.553	-.572 (.221)	-.202 (.438)
The website processed my input very quickly.	6.08 (1.82)	.807	.519	-.431 (.221)	-.172 (.438)
It is difficult to offer feedback to the website. (R)	5.10 (1.95)	.839	.225	-.018 (.221)	-.550 (.438)
Getting information from the website is very fast.	5.83 (1.98)	.792	.649	-.396 (.221)	-.478 (.438)
While surfing the website, I had absolutely no control over what I can do on the site. (R)	7.46 (1.42)	.814	.451	-1.05 (.221)	.665 (.438)
The website makes me feel it wants to listen to its visitors.	4.89 (1.72)	.815	.441	.191 (.221)	-.217 (.438)
I was able to obtain the information I want without any delay.	5.92 (1.85)	.792	.662	-.313 (.221)	-.268 (.438)
When I clicked on the links, I felt I was getting information immediately.	6.28 (1.93)	.786	.704	-.808 (.221)	.196 (.438)
The website does not at all encourage visitors to talk back. (R)	5.30 (1.82)	.814	.458	.136 (.221)	-.924 (.438)
The website was very slow in responding to my requests. (R)	7.20 (1.46)	.814	.455	-.702 (.221)	-.069 (.438)

Cronbach's alpha for scale: .850

Table 13.
Descriptive Statistics for Perceived Navigability Scale Items

Items	Mean (SD)	alpha if item deleted	Corrected Item-Total Corr.	Skewness (SE)	Kurtosis (SE)
Please rate your experience viewing this Web site using by rating your agreement with each statement...					
1. I always knew where I was on this site	5.68 (2.33)	.941	.815	-.347 (.199)	-.913 (.396)
2. It was clear to me how the information on the Web site was structured	5.63 (2.37)	.943	.851	-.414 (.199)	-.970 (.396)
3. I felt disoriented while using the site (R)	6.26 (2.14)	.940	.772	.640 (.199)	-.601 (.396)
4. I felt like I was going around in circles (R)	5.64 (2.27)	.944	.717	.228 (.199)	-.998 (.396)
5. The way in which information was structured on the site made sense to me	5.44 (2.13)	.941	.814	-.194 (.199)	-.961 (.396)
6. Navigating between pages on the site was a problem (R)	6.58 (2.02)	.944	.727	.861 (.199)	.054 (.396)
7. I knew my current position on the Web site	6.13 (2.14)	.944	.711	-.551 (.200)	-.699 (.397)
8. I didn't know how to get to my desired location (R)	6.29 (2.22)	.942	.805	.700 (.199)	-.507 (.396)
9. The main sections of the site were made clear to me	6.49 (1.86)	.945	.682	-.761 (.199)	-.023 (.396)
10. I had no problem going back-and-forth between pages	6.33 (2.02)	.946	.662	-.689 (.199)	-.316 (.396)
11. It was difficult to know how to move around on this site (R)	6.15 (2.25)	.942	.780	-.479 (.199)	-1.040 (.396)

Cronbach's alpha for scale: .948

Table 14.
Descriptive Statistics for Perceived Involvement Scale Items

Items	Mean (SD)	alpha if item deleted	Corrected Item-Total Corr.
Please rate your agreement with the following items using the scale provided.			
The content featured on this website:			
Is Important – Is Unimportant (R)	7.23 (1.62)	.854	.646
Is Of No Concern to Me – Is Of Concern to Me	6.29 (2.08)	.853	.650
Is Irrelevant – Is Relevant	6.74 (1.99)	.883	.282
Means a Lot to Me – Means Nothing to Me (R)	5.88 (2.01)	.858	.586
Is Useless – Is Useful	6.98 (1.78)	.865	.493
Is Trivial – Is Fundamental	6.79 (1.54)	.858	.602
Is Beneficial – Is Not Beneficial (R)	6.70 (1.89)	.857	.604
Matters to Me – Doesn't Matter (R)	6.46 (1.82)	.843	.776
Is Significant – Is Insignificant (R)	7.24 (1.58)	.850	.707
Is Mundane – Is Fascinating	6.04 (2.02)	.855	.623

Cronbach's alpha for scale: .870

Table 15.
Descriptive Statistics for Perceived Credibility Scale Items

Items	Mean (SD)	alpha if item deleted	Corrected Item-Total Corr.
Please rate your perceptions of characteristics of the Web site using the scale provided below.			
I would trust information on this Web site.	6.72 (1.53)	.946	.905
I believe this Web site to be credible.	6.78 (1.56)	.946	.903
I found the information featured on this Web site to be of high quality.	6.42 (1.63)	.960	.787
I found the information featured on this Web site to be accurate.	6.63 (1.49)	.952	.856
I found the information featured on this Web site to be reliable.	6.61 (1.47)	.947	.905
I found the information featured on this Web site to be believable.	6.99 (1.48)	.951	.867

Cronbach's alpha for scale: .958

Table 16.
Descriptive Statistics for Web Site Attitude Scale Items

Items	Mean (SD)	alpha if item deleted	Corrected Item-Total Corr.	Skewness (SE)	Kurtosis (SE)
Please provide an overall evaluation of the Web site you have just viewed. *Select the number that best represents your opinion, where "1" means you "Strongly disagree" that the term describes the Web site, and "9" means you "Strongly agree" that the term describes the Web site.*					
Appealing	5.86 (2.00)	.948	.862	-.352 (.221)	-.449 (.438)
Useful	6.51 (1.79)	.953	.690	-.308 (.221)	-.210 (.438)
Positive	6.88 (1.76)	.956	.575	-.616 (.221)	-.045 (.438)
Good	6.75 (1.70)	.950	.820	-.524 (.221)	-.139 (.438)
Favorable	6.52 (1.70)	.948	.879	-.292 (.221)	-.502 (.438)
Attractive	6.02 (2.29)	.948	.870	-.437 (.221)	-.856 (.438)
Exciting	5.11 (2.02)	.951	.770	-.345 (.221)	-.653 (.438)
Pleasant	6.27 (1.81)	.949	.845	-.466 (.221)	-.340 (.438)
Likeable	6.38 (1.96)	.948	.874	-.477 (.221)	-.363 (.438)
High Quality	5.63 (2.13)	.952	.741	-.199 (.221)	-.773 (.438)
Interesting	6.28 (1.96)	.951	.776	-.462 (.221)	-.269 (.438)
Sophisticated	5.53 (2.05)	.954	.681	-.147 (.221)	-.447 (.438)

Cronbach's alpha for scale: .955

Table 17.
Descriptive Statistics for Memory Measures

Question	Mean	No. of Participants Answering Correctly	No. of Participants Answering Incorrectly
Open-Ended Questions:			
1. In what country does WorldGreen engage in coastal conservation efforts?	.33	40	80
2. Approximately how many acres of forest does WorldGreen help save each year?*	.05	6	114
3. What does the site claim is the main problem with current global agriculture?	.13	15	105
4. Please list any of WorldGreen's legislative priorities that you remember.	.19	23	97
5. The most recent "News" on the site proclaimed a successful recently passed bill that protects land in which U.S. state?	.29	35	85
6. What are any of Worldgreen's "Key Issues" that you remember?	.87		
7. What is one of the purposes of WorldGreen's "Safeguarding Communities" Initiative?	.08	10	110
Total for open-ended questions:	0.32 (0.22)		
Multiple Choice Questions:			
1. WorldGreen International claims to be a pioneer in what health-related field?	.49	59	61
2. What is the name of WorldGreen International's president?	.34	41	79
3. What are the two main types of environmental conversation WorldGreen International is involved in?*	.94	113	7
4. How many countries is WorldGreen active in?	.41	49	71
5. In which two African countries does WorldGreen have ongoing conservation efforts?	.52	52	48
6. WorldGreen's Internships are currently managed in partnership with what organization?	.44	53	67
7. According to the WorldGreen page, fossil fuels account for approximately what percent of U.S. glo...	.35	42	78
Total for multiple-choice questions	0.43 (0.23)		
Total for all memory items	.37 (0.19)		

* Item deleted from overall means on basis of ceiling/floor effect.

Figure 1a.
Navigation Manipulation Pre-Test: Low-Navigability Condition Stimulus Home Page

Figure 1b.
Navigation Manipulation Pre-Test: High-Navigability Condition Stimulus Home Page

Figure 2a.
Main Experiment: Stimulus Site Homepage, High-Interactivity High-Navigability Condition

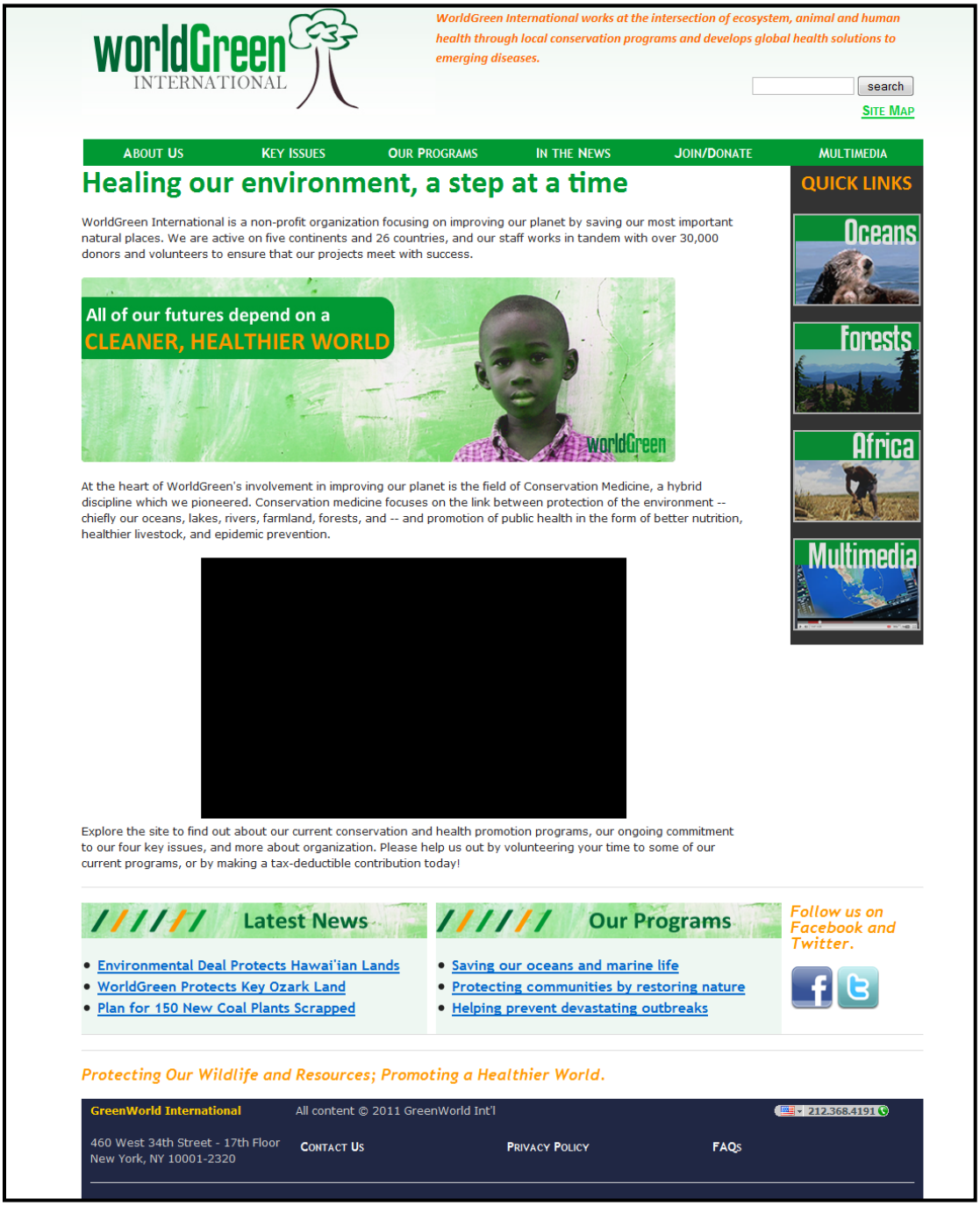


Figure 2b.
Main Experiment: Stimulus Site Homepage, Medium-Interactivity High-Navigability Condition (Navigation Roll-over shown)

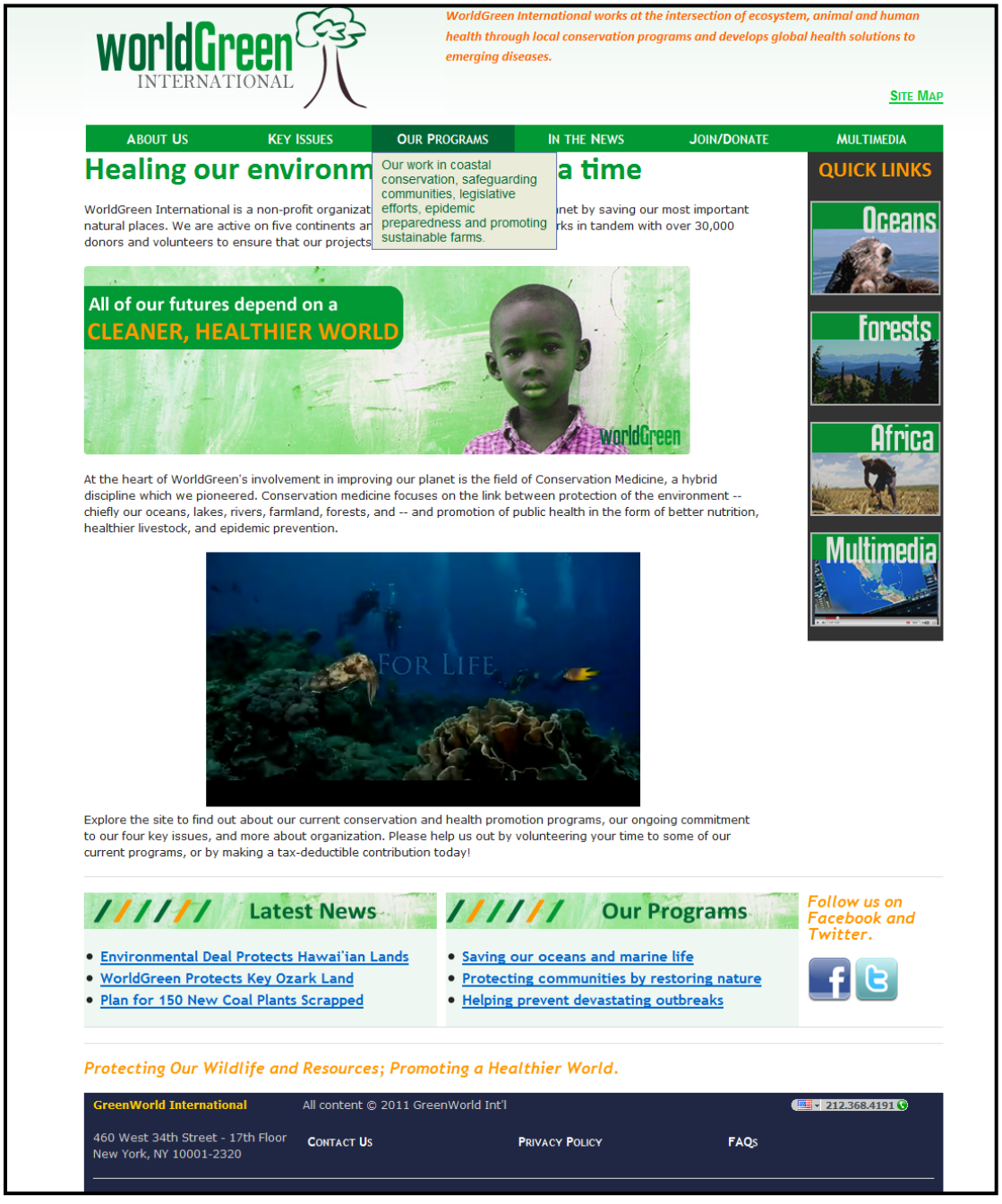


Figure 2c.
Main Experiment: Stimulus Site Homepage, Low-Interactivity High-Navigability Condition

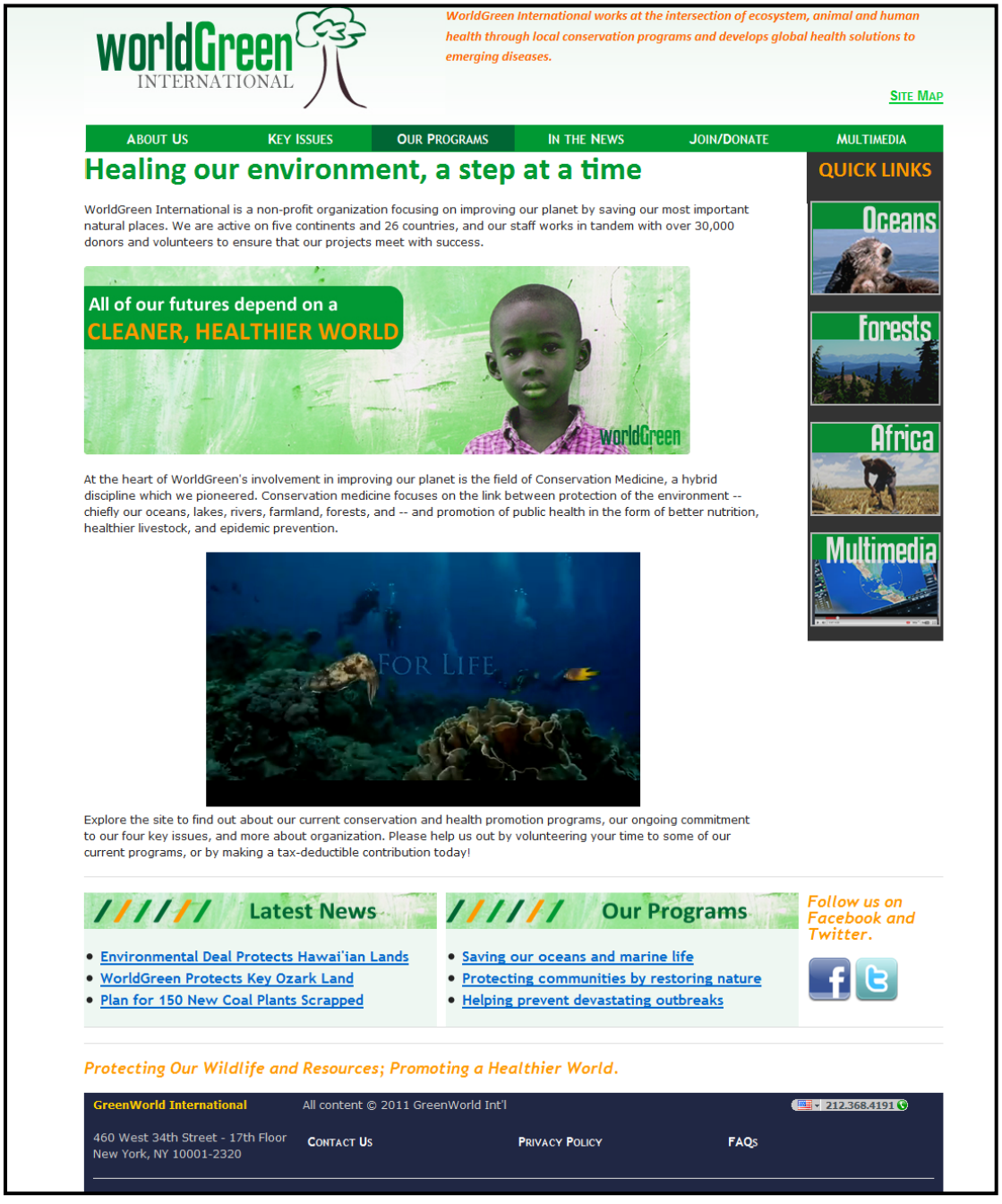


Figure 2d.
Main Experiment: Stimulus Site Homepage, High-Interactivity Low-Navigability Condition

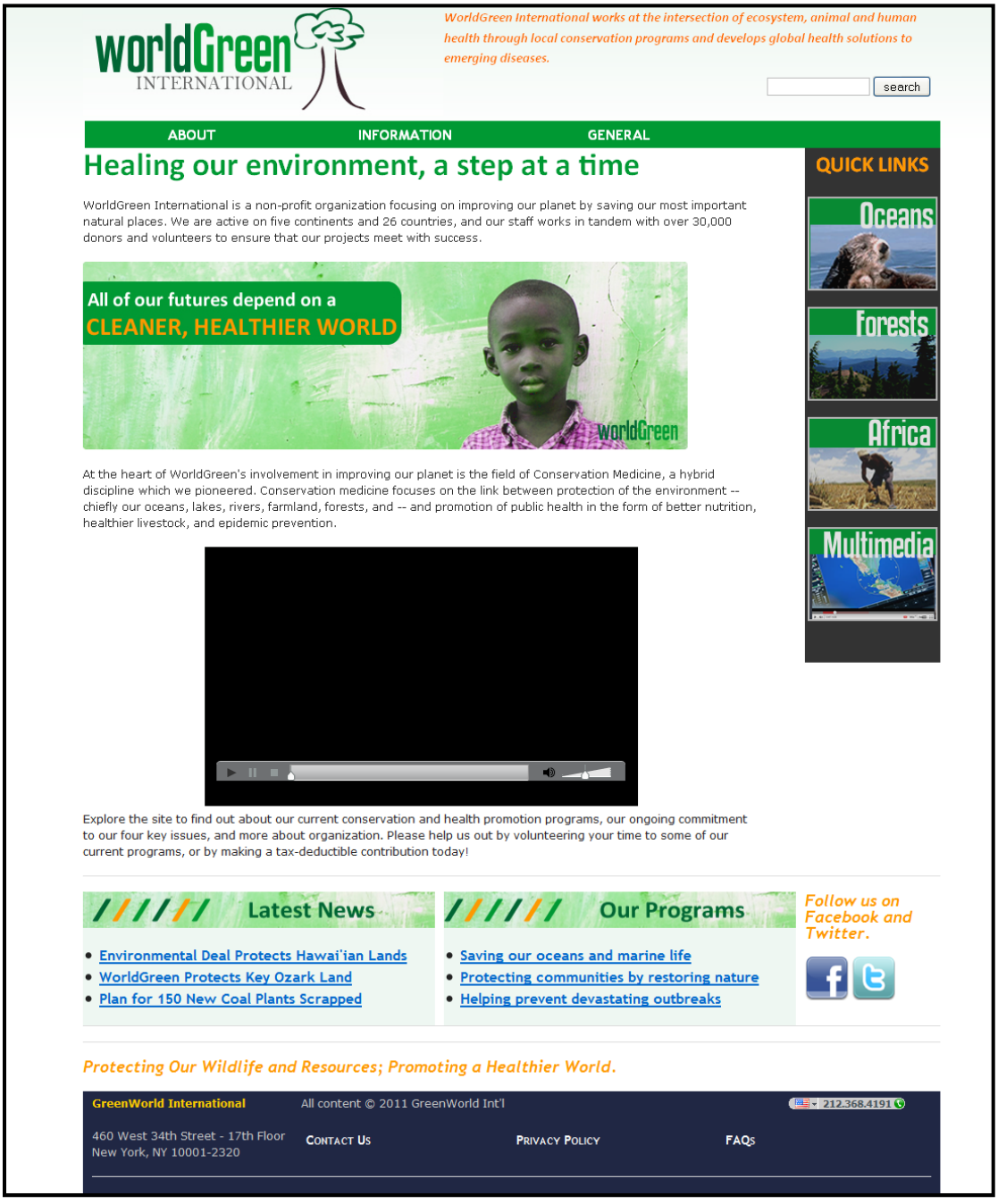


Figure 2e.
Main Experiment: Stimulus Site Homepage, Medium-Interactivity Low-Navigability Condition

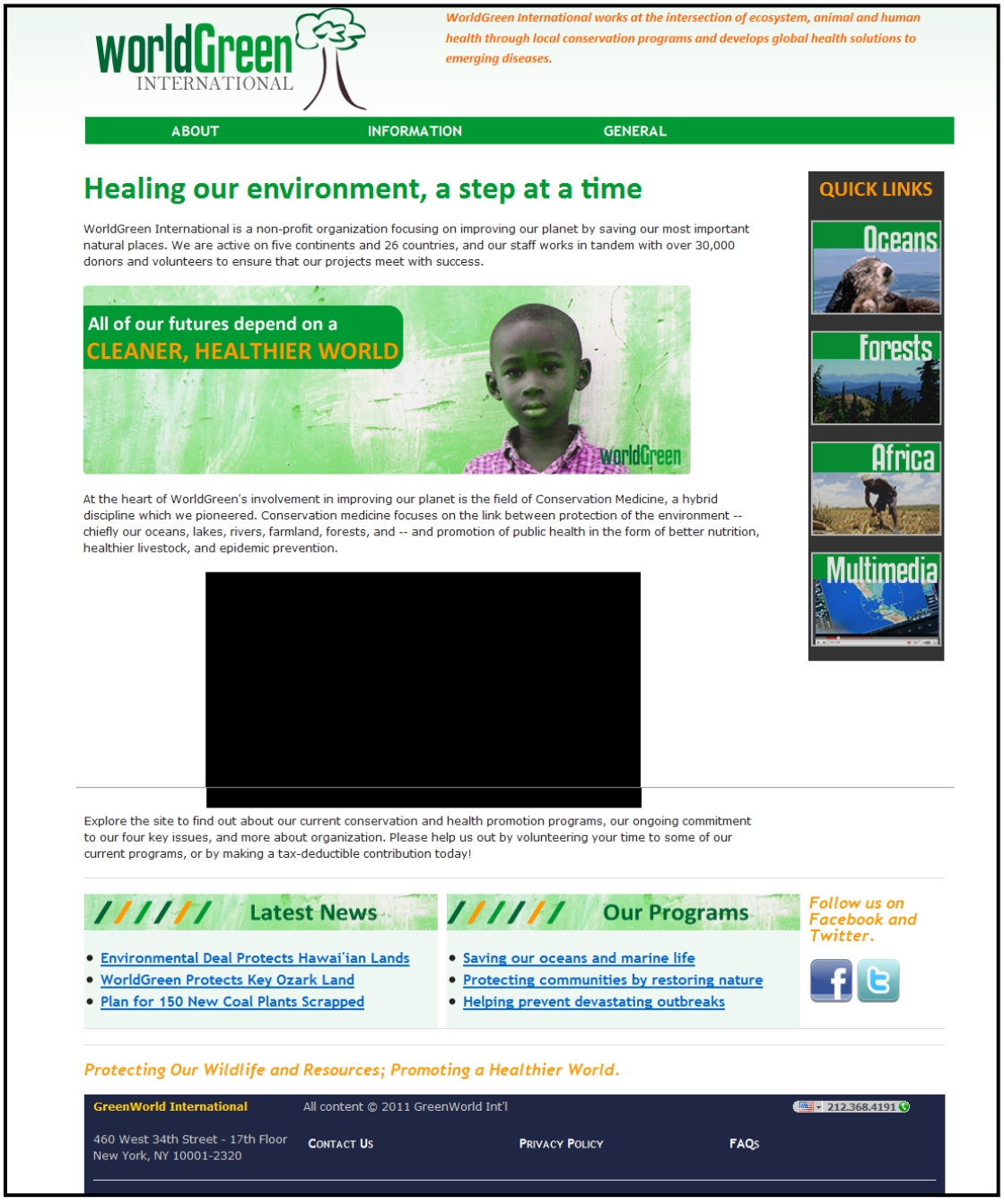


Figure 2f.
Main Experiment: Stimulus Site Homepage, Low-Interactivity Low-Navigability Condition (Rollover Shown)

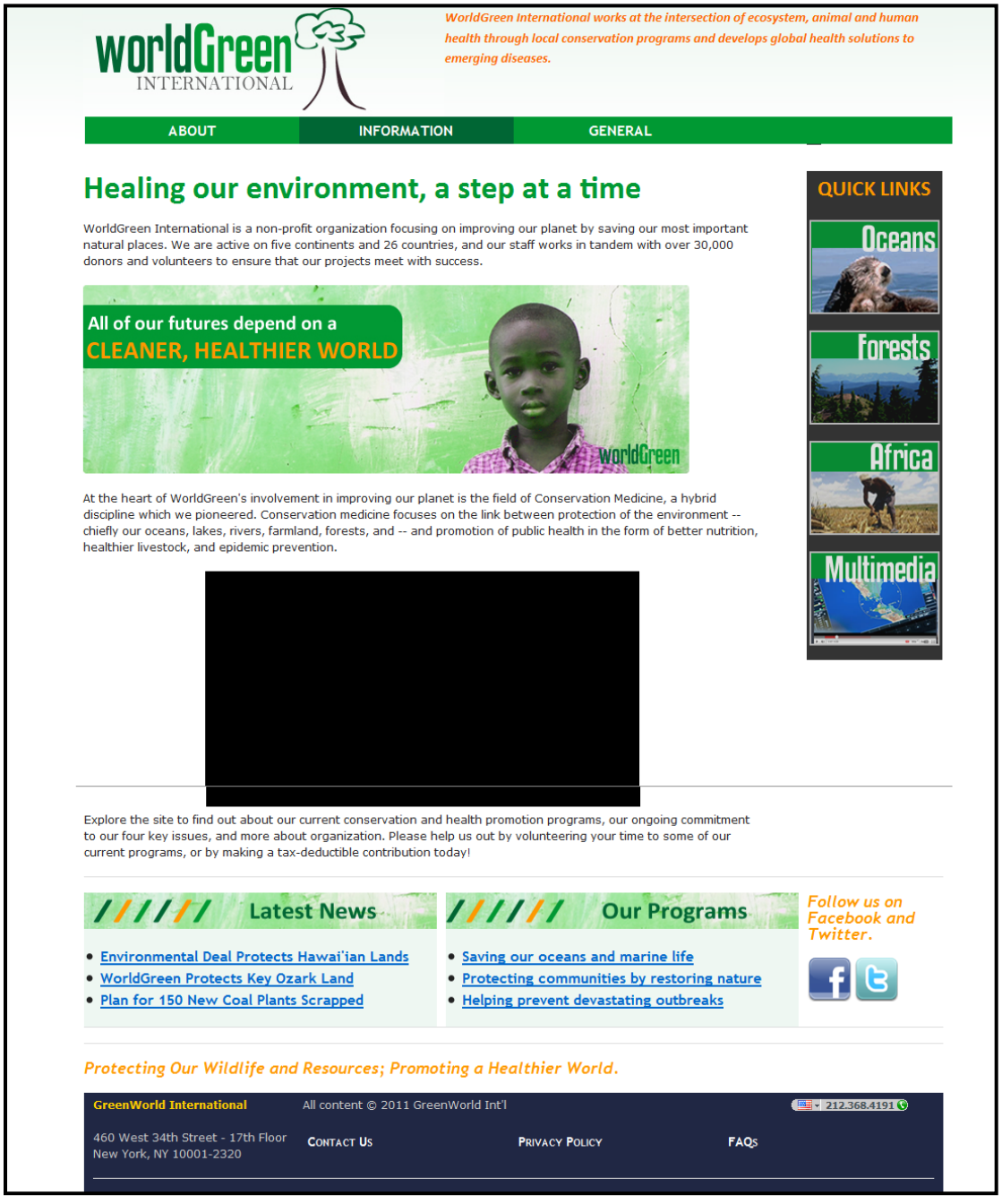


Figure 3a.
Main Experiment: Stimulus Site Content Page, High-Interactivity High-Navigability Condition (Rollover Shown)

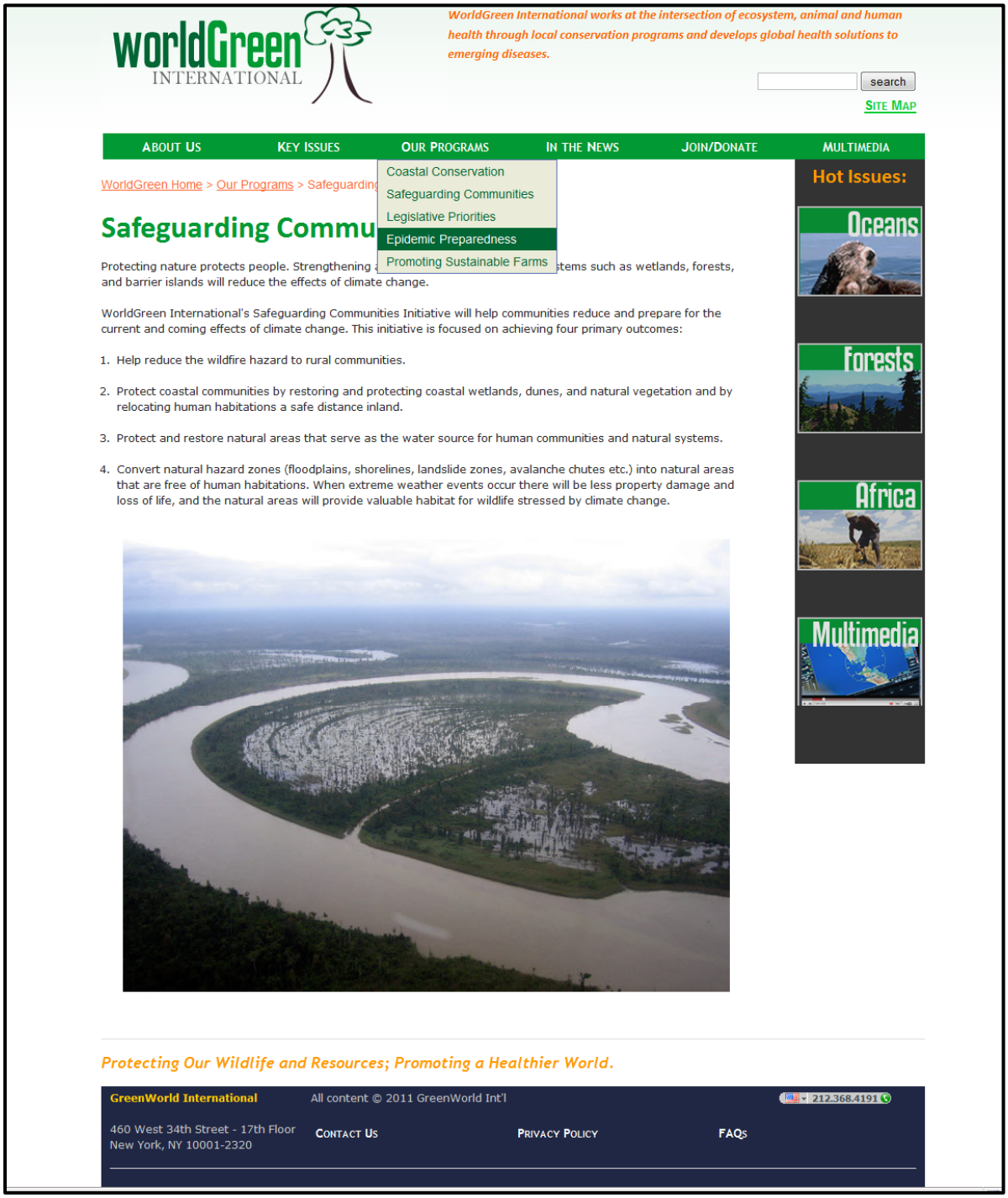


Figure 3b.
Main Experiment: Stimulus Site Content Page, Medium-Interactivity High-Navigability Condition

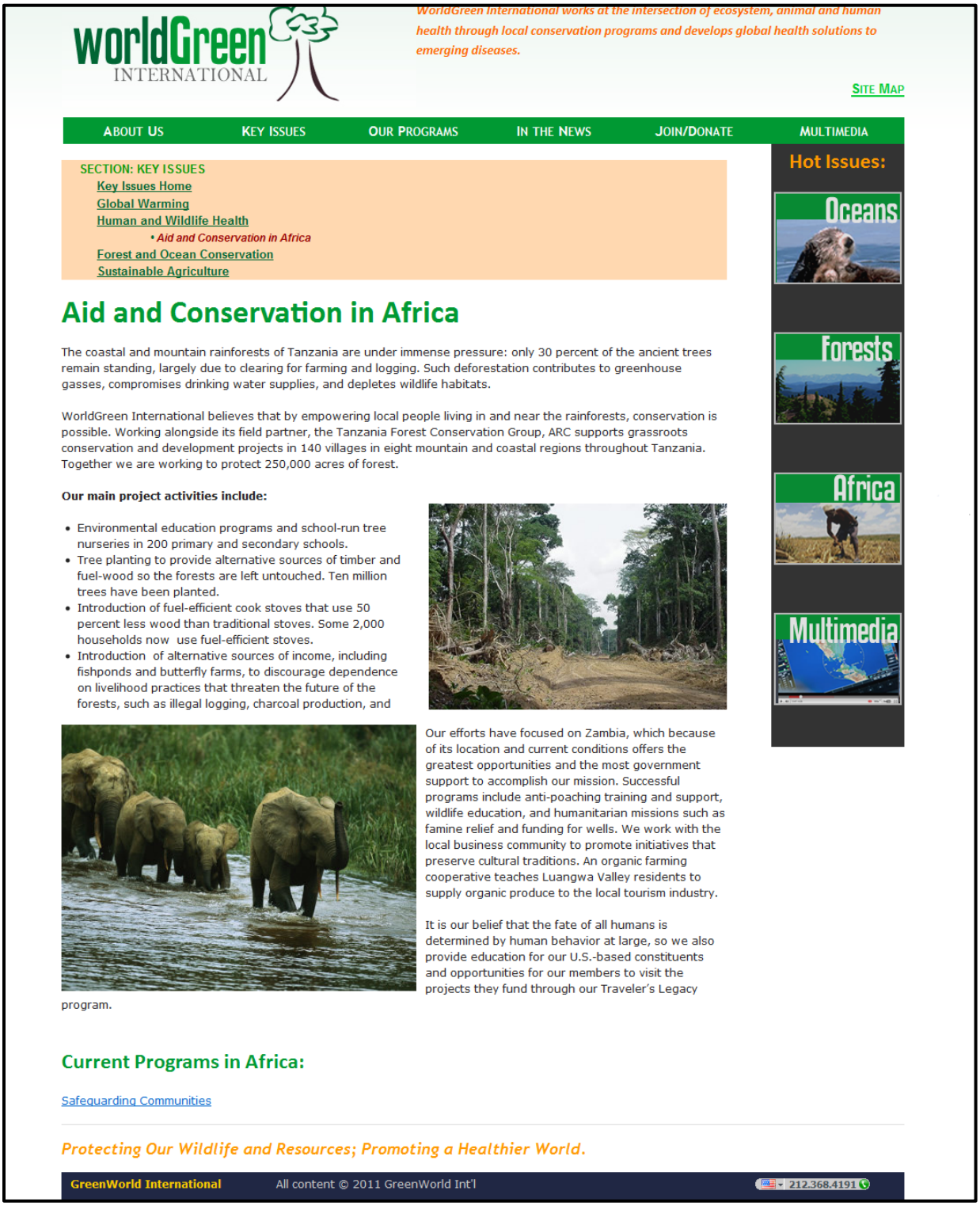


Figure 3c.
Main Experiment: Stimulus Site Content Page, Low-Interactivity High-Navigability Condition

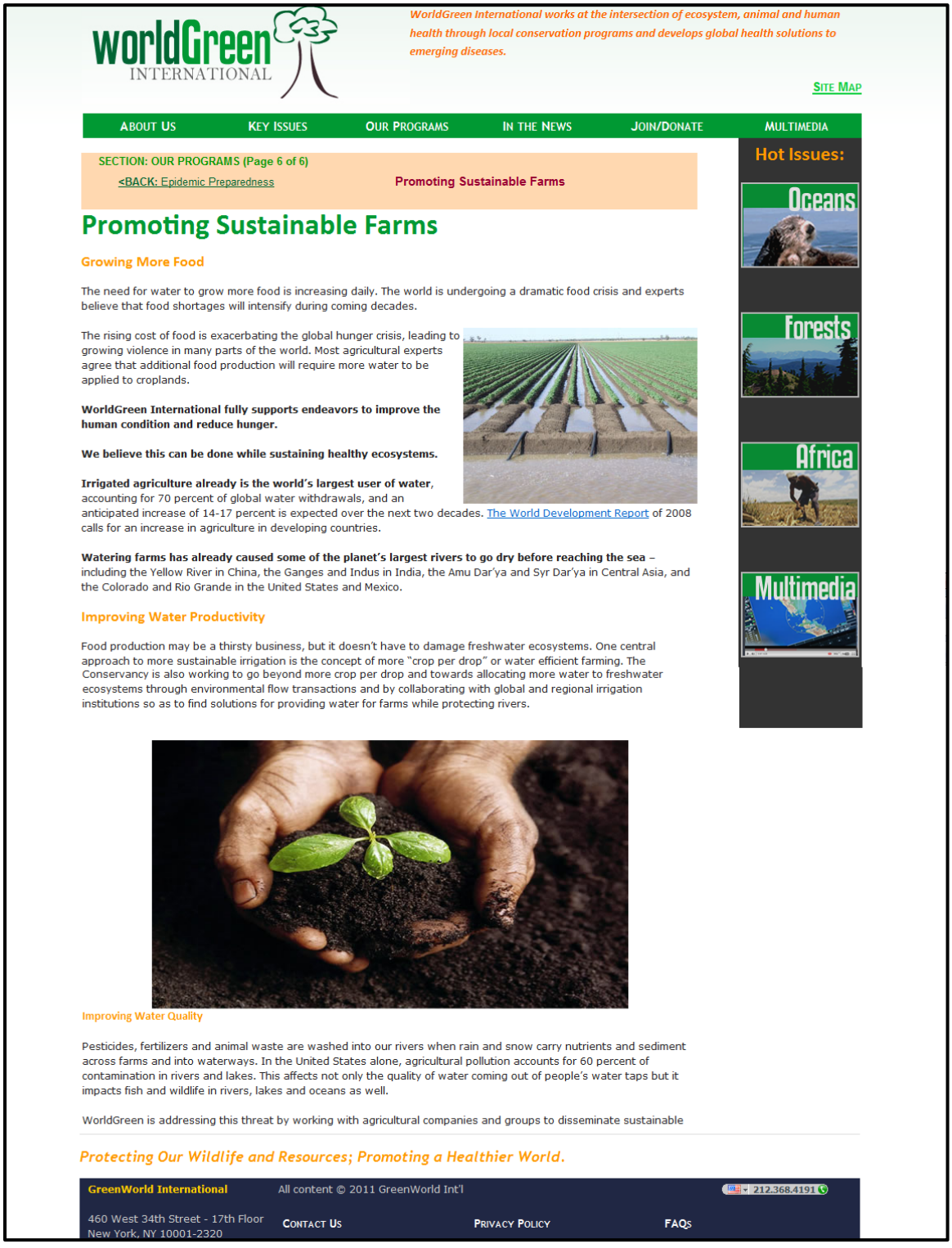


Figure 3d.
Main Experiment: Stimulus Site Content Page, High-Interactivity Low-Navigability Condition (Rollover Shown)

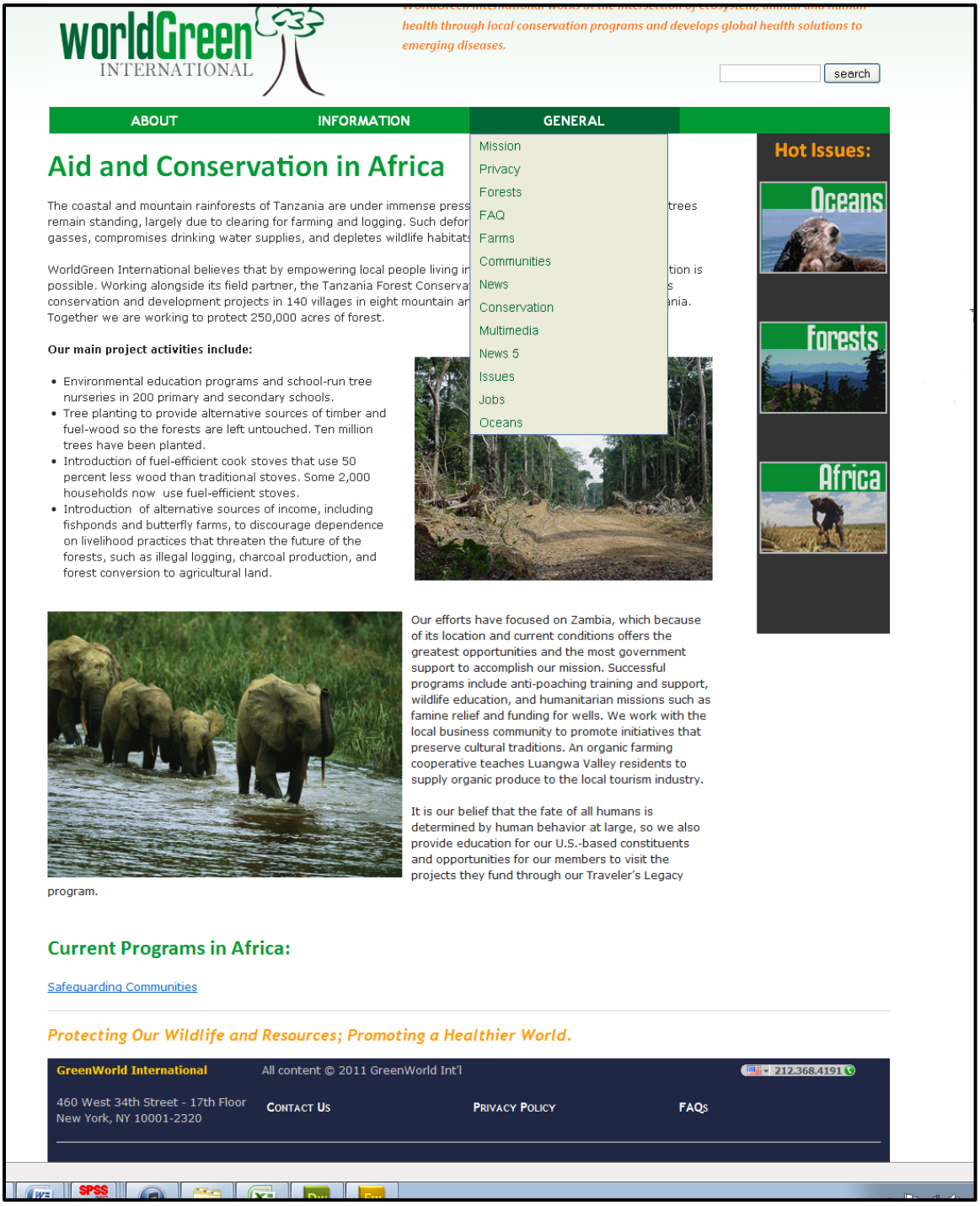


Figure 3e.
Main Experiment: Stimulus Site Content Page, Medium-Interactivity Low-Navigability Condition

Figure 3f.
Main Experiment: Stimulus Site Content Page, Low-Interactivity Low-Navigability Condition

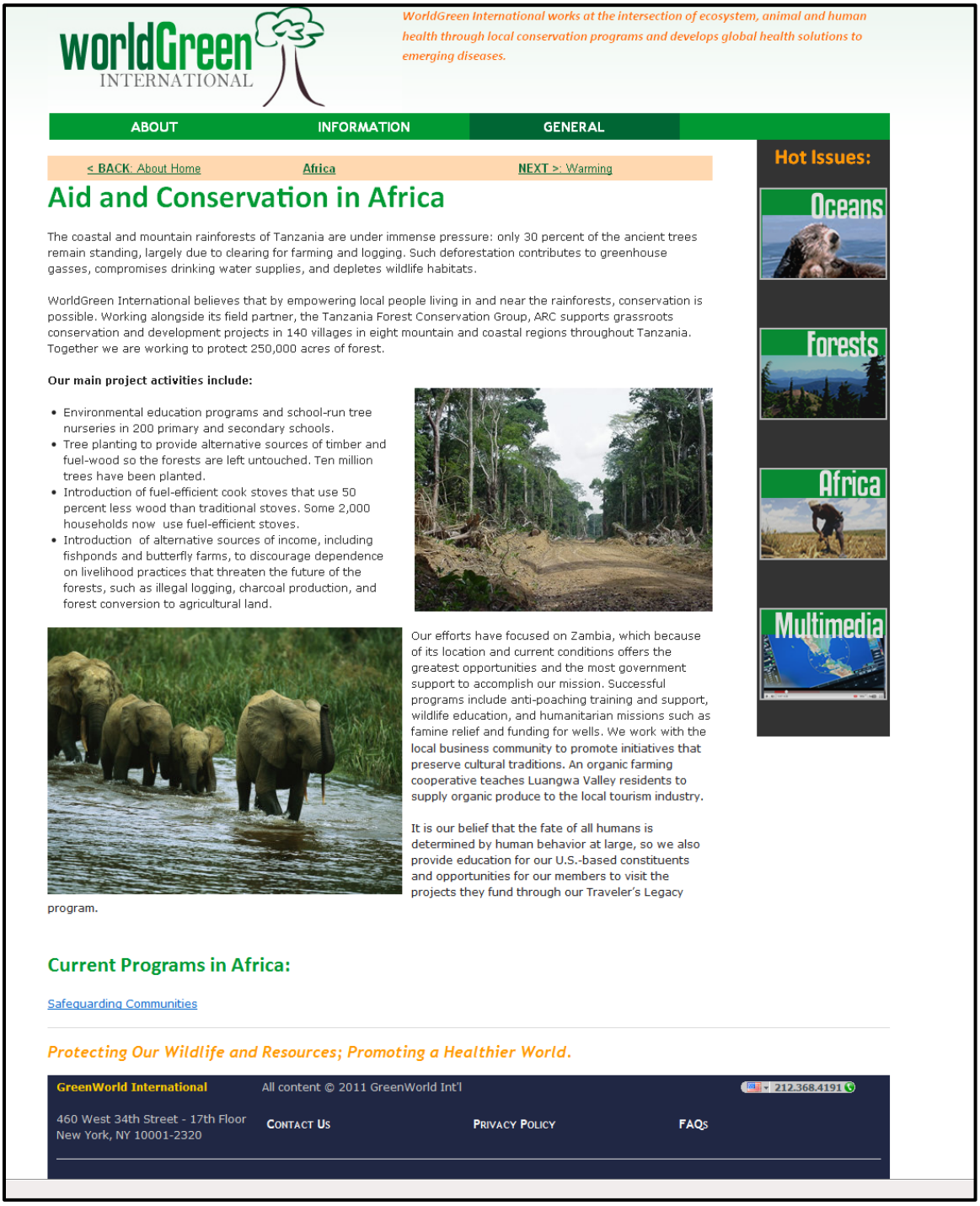


Figure 4.
Main Experiment: Stimulus Site Content Page Breadcrumbs (High-Navigability Conditions)

Figure 5.
Attitudes Toward the Web Site By Interactivity and Navigability Condition

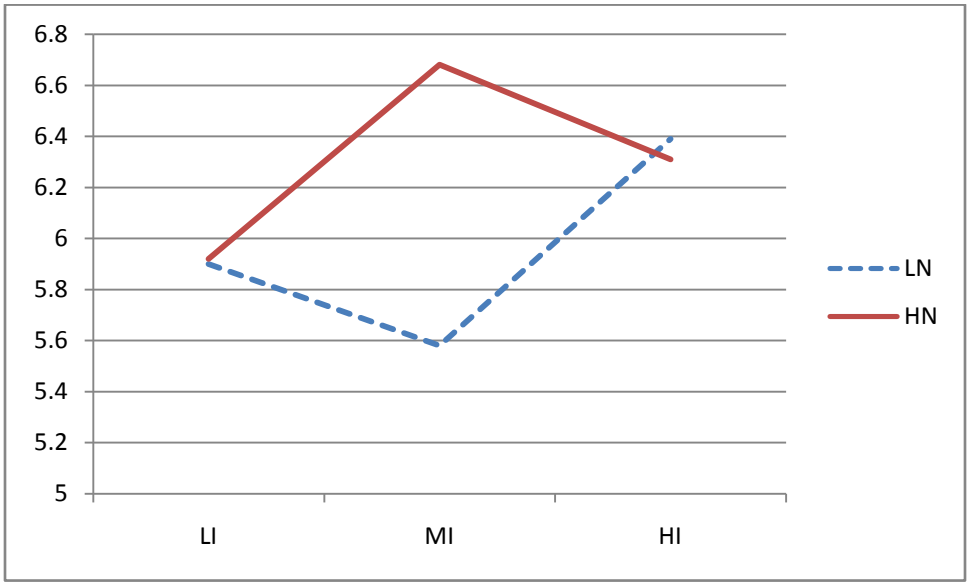


Figure 6.
Perceived Interactivity by Interactivity and Navigability Condition

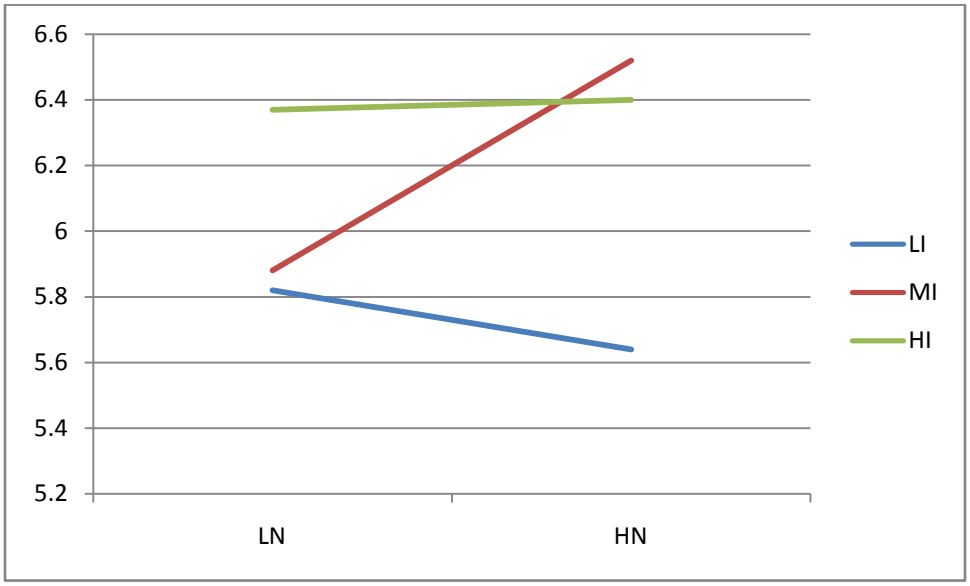


Figure 7.
Perceived Navigability by Interactivity and Navigability Condition

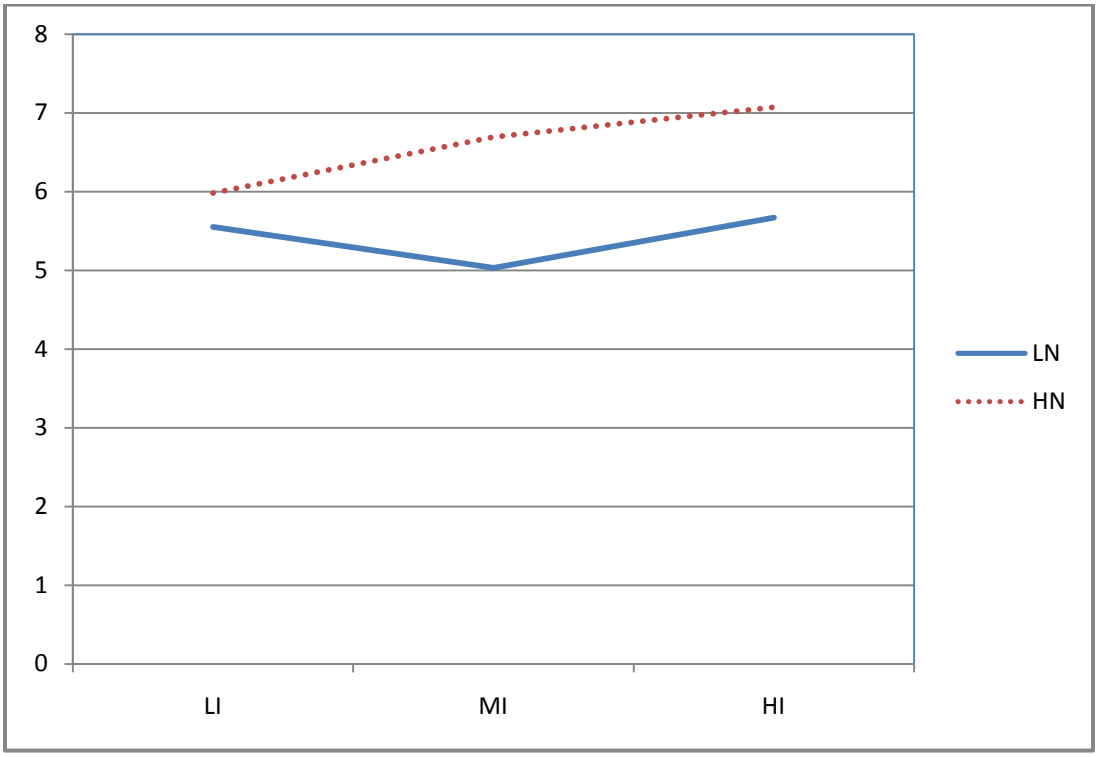


Figure 8.
Recall of Web Site Content by Interactivity and Navigability Condition

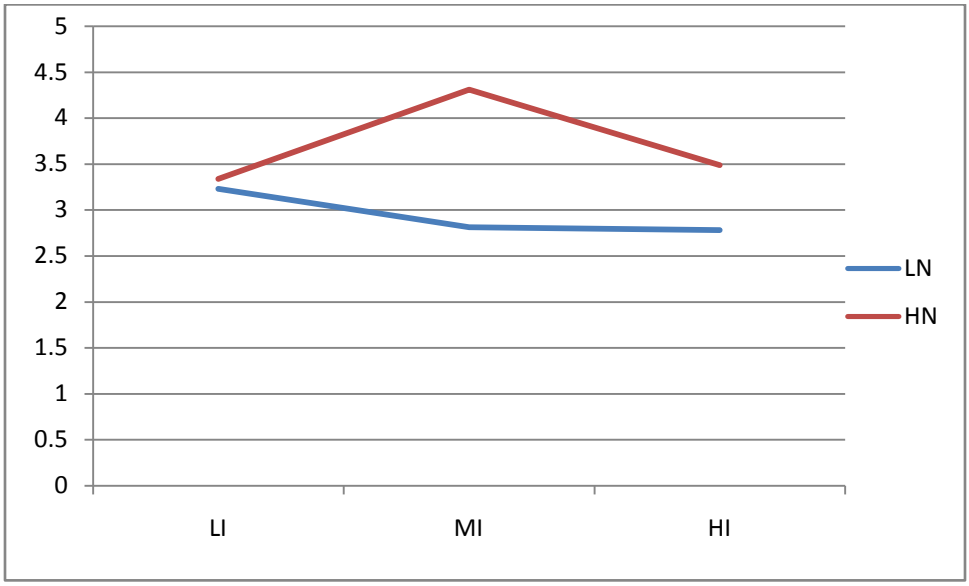
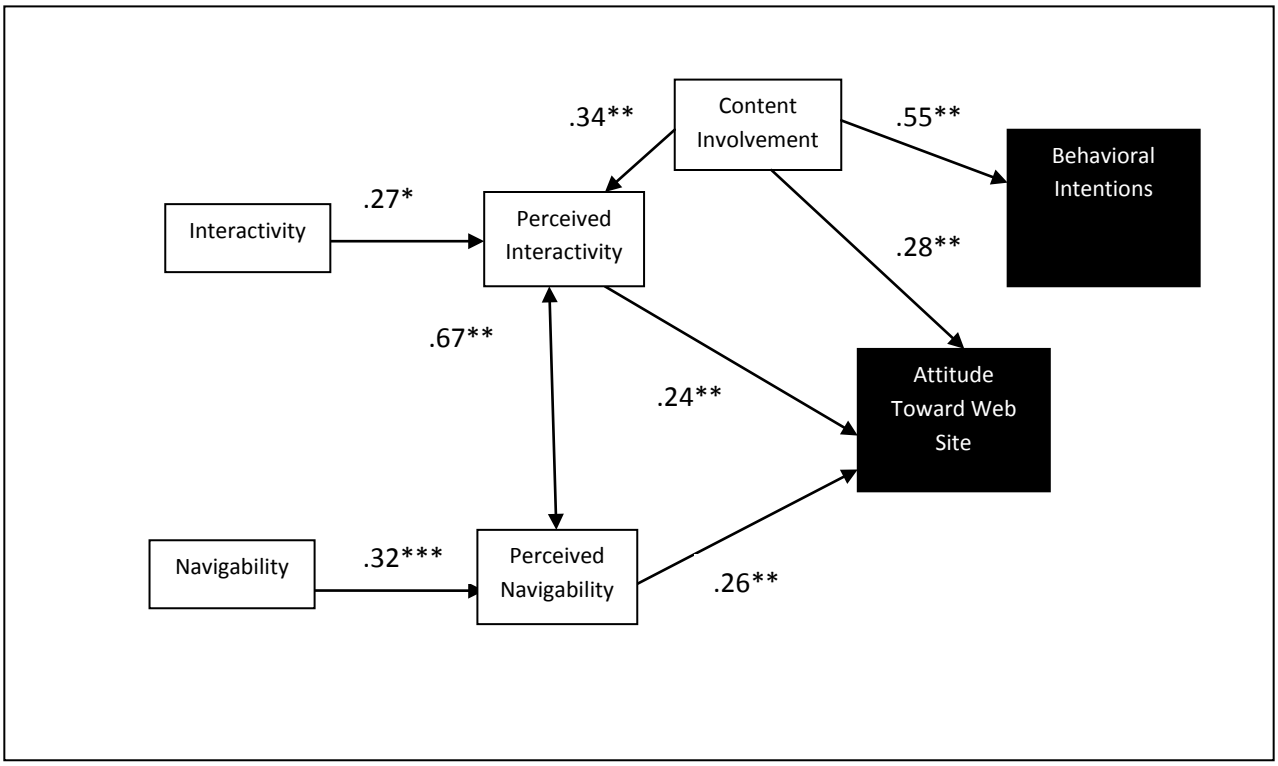


Figure 9.
Path Analysis of Effects of Interactivity and Navigability on Attitudes and Behavioral Intentions



Note: Values represent standardized regression coefficients. $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

APPENDICES

Appendix A: Main Experiment Consent Form

University of North Carolina-Chapel Hill
Consent to Participate in a Research Study
Adult Participants
Social Behavioral Form

IRB Study #11-0011
Consent Form Version Date: 1/12/2011
Title of Study: Characteristics of Web Sites and Their Influence
Principal Investigator: Bartosz W. Wojdynski, M.A.
UNC-Chapel Hill Department: School of Journalism & Mass Communication
UNC-Chapel Hill Phone number: (919) 843-8307
Email Address: bartw@email.unc.edu

Faculty Advisor: Sri Kalyanaraman, Ph. D.
Faculty Advisor Phone Number: (919) 843-5858
Faculty Advisor Email Address: sri@ unc.edu

What are some general things you should know about research studies?
You are being asked to take part in a research study. To join the study is voluntary. You may refuse to join, or you may withdraw your consent to be in the study, for any reason, without penalty.

Research studies are designed to obtain new knowledge. This new information may help people in the future. You may not receive any direct benefit from being in the research study. There also may be risks to being in research studies.

Details about this study are discussed below. It is important that you understand this information so that you can make an informed choice about being in this research study. You will be given a copy of this consent form. You should ask the researcher named above or your research session facilitator any questions you have about this study at any time.

What is the purpose of this study?
The purpose of this research study is to learn about how individuals read online news stories, and how elements of Web site design may influence their perceptions.

How many people will take part in this study?
If you decide to be in this study, you will be one of approximately 150 people in this study.

How long will your part in this study last?
This study is one of two studies that constitute today's research session. Participation in this particular study will take approximately 30 minutes, and participation in the whole

session will take no more than 1 hour. There will be no follow up. Remember also that there are other ways to fulfill your research requirement in addition to study participation.

What will happen if you take part in the study?

First, you will sign this consent form prior to starting the research. You also will be given your own copy of this consent form. Then, you will be introduced to a computer program that houses the materials for the research session. You will be asked to spend a few minutes browsing a Web site.

Once you have finished viewing the site, you will be asked to click a link that will take you to a set of questions about the site you viewed and its content. Once finished, you will receive a handout that provides some information about the premise of this Web site study.

What are the possible benefits from being in this study?

Research is designed to benefit society by gaining new knowledge. You may also expect to benefit by participating in this study by receiving credit for your participation requirement.

What are the possible risks or discomforts involved from being in this study?

There are no known risks in participating in this study. However, there may be uncommon or previously unknown risks. You should report any problems to the researcher.

How will your privacy be protected?

Your name will only appear on this informed consent form and in the records for the Journalism Subject Pool. Your responses to the questions cannot be connected with your name in any way. Thus, there will be no way to identify which responses are yours. The data will only be accessible to the researchers, and will be stored separately from consent forms and anything that might identify you. All data collected from this study will be kept on a password-protected computer and paper forms will be kept in a locked cabinet behind a locked door. Data from this study may be kept for seven years, in keeping with the requirements of academic journals, after which time the data may be destroyed. In any presentations, written reports, or publications, no one will be identifiable and only group results will be presented.

Although every effort will be made to keep research records private, there may be times when federal or state law requires the disclosure of such records, including personal information. This is very unlikely, but if disclosure is ever required, UNC-Chapel Hill will take steps allowable by law to protect the privacy of personal information. In some cases, your information in this research study could be reviewed by representatives of the University, research sponsors, or government agencies for purposes such as quality control or safety.

Will you receive anything for being in this study?

You will receive one departmental research credit for participating in this one-hour research session. Participation consists of completion of the two 30-minute studies. You will receive a half hour of credit for each study you complete.

Will it cost you anything to be in this study?
There will be no costs for being in the study. You may choose not to be in the study or to stop being in the study before it is over at any time. This will not affect your class standing or grades at UNC-Chapel Hill. You will not be offered or receive any special consideration if you take part in this research.

What if you have questions about this study?
You have the right to ask, and have answered, any question you may have about this research. If you have questions, or concerns, you should contact the researchers listed on the first page of this form.

What if you have questions about your rights as a research participant?
All research on human volunteers is reviewed by a committee that works to protect your rights and welfare. If you have questions or concerns about your rights as a research subject you may contact, anonymously if you wish, the Institutional Review Board at 919-966-3113 or by email to IRB_subjects@unc.edu.

- -

Participant's Agreement:

I have read the information provided above. I have asked all the questions I have at this time. I voluntarily agree to participate in this research study.

_____ _____
Signature of Research Participant Date

_____
Printed Name of Research Participant

Appendix B: Main Experiment Questionnaire

Please enter your participant ID (the letter/number in the blue box on your instructions) below:

Thank you for participating in this website evaluation.
The next page will contain a link to a website. Please take several minutes to view the Web site and check out any content that interests you.

Please take the time to explore and familiarize yourself with the content on the site. Once you are done, you will be asked to answer some questions about the site you viewed. Because the site contains some video content, **PLEASE USE THE HEADPHONES** provided while viewing the site.

Web site (will open in a new tab)

When you have finished viewing the site, please return to this tab to complete the site questionnaire. **A "Next" button will appear underneath this box once you have browsed the site for at least 5 minutes.** Please click the "Next" button to begin answering questions about the site.

We are interested in everything that went through your mind as you viewed the Web site. On the next page, for approximately three minutes, please list these thoughts (**positive** thoughts, **negative** thoughts, and **neutral** thoughts) regarding the site you viewed. You may use single words or full sentences. Ignore spelling, grammar and punctuation.

We have deliberately included more space than we think people will need to ensure that everyone would have plenty of room.

Please be completely honest. Your responses will be anonymous.

The next page contains the form we have prepared for you to record your thoughts and ideas. Simply write down the first thought you had in the first box, the second thought in the second box, etc.

Please put only **one** idea or thought in a box.

Based on previous results, we find that people need an average of 3 minutes to record all of their thoughts.
After 3 minutes, the page will automatically advance to the next part of the questionnaire.

Please list any thoughts you had while reading this story. Remember, please put only one thought or idea per box. Thank you.

This next section is designed to see how well the story conveyed some information. Please answer the following questions about the story you read, to the best of your ability. We are not testing your knowledge, just how well the Web site conveyed information.

1. In what country does WorldGreen engage in coastal conservation efforts?

2. Approximately how many acres of forest does WorldGreen help save each year?

3. What does the site claim is the main problem with current global agriculture?

4. Please list any of WorldGreen's LEGISLATIVE PRIORITIES that you remember.

5. The most recent "News" on the site proclaimed a successful recently passed bill that protects lands in which U.S. state?

6. What are any of Worldgreen's "Key Issues" that you remember?

7. What is one of the purposes of WorldGreen's "Safeguarding Communities" Initiative?

1. WorldGreen International claims to be a pioneer in what health-related field?

- Environment Ecology
- Biological Humanism
- Conservation Medicine
- Protective Field Work
- Green Ornithology

2. What is the name of WorldGreen Intenational's president?

- James Wickizer
- Annie Potter
- Kent Mullikin
- Jane Kepner
- Robert Melloy

3. What are the two main types of environmental conversation WorldGreen International is involved in?

- Stream and Ocean
- Ocean and Seasonal
- Farmland and Forest
- Mountain and Freshwater
- Forest and Ocean

4. How many countries is WorldGreen active in?

- six
- "more than 10"
- "more than 20"
- "more than 50"
- "more than 100"

5. In which two African countries does WorldGreen have ongoing conservation efforts?

- Morocco and Namibia
- Ethiopia and Tanzania
- Kenya and Uganda
- Tanzania and Zambia
- Uganda and Zambia

6. WorldGreen's Internships are currently managed in partnership with what organization?

- The Student Action Coalition
- The Nature Conservancy
- The Student Conservation Association
- AmeriCorps
- The Civilian Conservation Corps

7. According to the WorldGreen page, fossil fuels account for approximately what percent of U.S. global warming pollution?

- 90 percent
- 80 percent
- 70 percent
- 60 percent
- 50 percent

Please rate your agreement with the following items using the scale provided.

The content featured on this website:

Is Important									Is Unimportant
Of No Concern to Me									Of Concern to Me
Is Irrelevant									Is Relevant
Means a Lot to Me									Means Nothing to Me
Is Useless									Is Useful
Is Trivial									Is Fundamental
Is Beneficial									Is Not Beneficial
Matters to Me									Doesn't Matter
Is Significant									Is Insignificant
Is Mundane									Is Fascinating

Please provide an overall evaluation of the website you have just viewed.

Select the number that best represents your opinion, where "1" means you "Strongly disagree" that the term describes the Web site, and "9" means you "Strongly agree" that the term describes the Web site.

		1 Strongly Disagree	2	3	4	5	6	7	8	9 Strongly Agree
Appealing										
Useful										
Positive										
Good										
Favorable										
Attractive										
Exciting										
Pleasant										
Likeable										
High Quality										
Interesting										
Sophisticated										

Please indicate the extent to which you agree or disagree with the following description:

The Web site was interactive.

1 Strongly Disagree	2	3	4	5	6	7	8	9 Strongly Agree
-	-	-	-	-	-	-	-	-

Compared to other sites you read on the Web, how interactive would you say this website was?

Not Very Interactive								Very Interactive
-	-	-	-	-	-	-	-	-

Please rate your perceptions of the website by rating your agreement with the following items using the scale provided.

	1 Strongly Disagree	2	3	4	5	6	7	8	9 Strongly Agree
I felt that I had a lot of control over my visiting experiences at this website.	-	-	-	-	-	-	-	-	-
The website processed my input very quickly.	-	-	-	-	-	-	-	-	-
It is difficult to offer feedback to the website.	-	-	-	-	-	-	-	-	-
Getting information from the website is very fast.	-	-	-	-	-	-	-	-	-
While surfing the website, I had absolutely no control over what I can do on the site.	-	-	-	-	-	-	-	-	-
The website makes me feel it wants to listen to its visitors.	-	-	-	-	-	-	-	-	-
I was able to obtain the information I want without any delay.	-	-	-	-	-	-	-	-	-
When I clicked on the links, I felt I was getting information immediately.	-	-	-	-	-	-	-	-	-
The website does not at all encourage visitors to talk back.	-	-	-	-	-	-	-	-	-
The website was very slow in responding to my requests.	-	-	-	-	-	-	-	-	-

Please rate your experience viewing this website by rating your agreement with each statement below.

	1 Strongly Disagree	2	3	4	5	6	7	8	9 Strongly Agree
I always knew where I was on this site.									
It was clear to me how the information on the Web site was structured.									
I felt disoriented while using the site.									
I felt like I was going around in circles.									
The way in which information was structured on the site made sense to me.									
Navigating between pages on the site was a problem.									
I knew my current position on the Web site.									
I didn't know how to get to my desired location.									
The main sections of the site were made clear to me.									
I had no problem going back-and-forth between pages.									
It was difficult to know how to move around on this site.									

On a scale of 1 to 9, with 1 being very difficult to navigate and 9 being very easy to navigate, how would you rate this website?

1 Very Difficult to Navigate	2	3	4	5	6	7	8	9 Very Easy to Navigate
○	○	○	○	○	○	○	○	○

Thank you for your help today. We have just a few more questions which will help us use the input you've given us today more effectively.

What is your gender?

- ○ Male
- ○ Female

How would you describe your race?

- ○ Black or African American
- ○ White or Caucasian
- ○ Asian or Asian American
- ○ Native American or American Indian
- ○ Asian Indian
- ○ Two or more of the above
- ○ Other

Are you of Hispanic or Latino ethnicity?

- ○ No, not Hispanic/Latino
- ○ Yes, Hispanic/Latino

What is your age?

[ ]

How many hours do you spend using the Web (via computer or mobile device) per day?

[ ]

Before today's experiment, how familiar were you with the Web site you just viewed?

Not at All Familiar								Very Familiar
○	○	○	○	○	○	○	○	○

How experienced are you with Web design?

Not at All Experienced								Very Experienced
○	○	○	○	○	○	○	○	○

Representatives from WorldGreen International are supposed to visit UNC-CH for a week in April to recruit student volunteers for their organization. They are looking for a select group of students to donate some time while the organization is here on campus.

Please fill in how many hours (in 1-hour increments) you might be willing to spend helping them in their efforts.

In the future, how likely would you be to donate money to WorldGreen International?

1 Very Unlikely	2	3	4	5	6	7	8	9 Very Likely
○	○	○	○	○	○	○	○	○

In the future, how likely would you be to volunteer with one of WorldGreen International's programs?

1 Very Unlikely	2	3	4	5	6	7	8	9 Very Likely
○	○	○	○	○	○	○	○	○

Appendix C: Main Experiment Debriefing Form

CHARACTERISTICS OF WEB SITES AND THEIR EFFECTS

Information for IRB #11-0011
ORIGINATING FROM: School of Journalism & Mass Communication
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Thank you for participating in this session. We'd like to share some information about the research design and questions we were seeking to answer.

- Research begins with a compelling question. In this session, we wanted to learn
  - How two different design characteristics of Web sites, the level of interactivity and the level of navigability, influence attitudes towards and recall of site content.

- In the case of this study we also wanted to test several specific hypotheses, or predictions made on the basis of previous research. The hypotheses included
  - That navigability and interactivity would each uniquely affect attitudes toward the site and its content
  - That the influence of interactivity on attitudes and recall would depend on the level of navigability.
- In order to answer the research question and test these hypotheses, a research design was developed:
  - First, we created six different versions of a Web site that differed with regard to those two characteristics.
  - Then we asked participants like you to spend time viewing one version of the Web site, and to answer a number of questions based on your experience.
  - Once we have collected all the data, we will use statistical procedures to analyze whether individuals' attitudes and recall varied based on which site they viewed.

If you would like to learn more about this topic, you may be interested in reading the following:

Tabbers, H. K., & de Koeijer, B. (2010). Learner control in animated multimedia instructions. *Instructional Science*, *38*, 441-453.

Teo, H.H., Oh, L.B., Liu, C., & Wei, K.K. (2003). An empirical study of the effects of interactivity on Web user attitude. *International Journal of Human Computer Studies*, *58*, 281-305.

Thank you for your participation! We appreciate your help! Please, if you can, do not talk about this study with any of your friends before next Wednesday.

PLEASE NOTE:

WorldGreen International is a fictitious organization created for the purposes of this study. For more information on why this was necessary for today's study, please go to worldgreenintl.org/study.html

If you are interested in any of the programs or issues discussed on this site, please visit organizations such as The Nature Conservancy, Greenpeace, EcoHealth Alliance, or Conservation International.

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