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Understanding Web home page perception

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Abstract

A home page is the gateway to an organization's Web site. To design effective Web home pages, it is necessary to understand the fundamental drivers of user's perception of Web pages. Not only do designers have to understand potential users' frame of mind, they also have at their choosing a stupefying array of attributes – including numerous font types, audio, video, and graphics – all of which can be arranged on a page in different ways, compounding the complexity of the design task. A theoretical model capable of explaining user reactions at a molar level should be invaluable to Web designers as a complement to prevalent intuitive and heuristic approaches. Such a model transcends piecemeal page attributes to focus on overall Web page perceptions of users. Reasoning that people perceive the cyberspace of Web pages in ways similar to their perception of physical places, we use Kaplan and Kaplan's informational model of place perception from the field of environmental psychology to predict that only two dimensions: understanding of information on a Web page, and the involvement potential of a Web page, should adequately capture Web page perception at a molar level. We empirically verify the existence of these dimensions and develop valid scales for measuring them. Using a home page as a stimulus in a lab experiment, we find that understanding and involvement together account for a significant amount of the variance in the attitude toward the Web page and in the intention to browse the underlying Web site. We show that the informational model is a parsimonious and powerful theoretical framework to measure users' perceptions of Web home pages and it could potentially serve as a guide to Web page design and testing efforts.
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Introduction

The Web has emerged as a powerful medium for worldwide information dissemination and electronic commerce. To fully utilize its potential though, one must design Web pages capable of providing rich user experience. Designing such pages on a consistent basis is a challenging task, in part because design decisions are usually based on designers' intuition and/or guidelines from other designers.

Intuition is not always reliable, and popular design guidelines, though useful, are usually based on opinions, personal experiences, or observations (Geissler *et al*., 2001), and as such, often tend to be incomplete, lack generalizability and, at times, could be even misleading (Shneiderman, 1997, p. 5). Furthermore, expert advice often fails to reflect actual users' perspectives. Consequently, each design could be considered as the 'designers' implicit theory about aspects of human perception and cognition' (Gillan & Bias 2001, p. 353).

To ensure consistently effective designs, designers' intuition ought to be informed by fundamental perceptual theories (Shneiderman, 1997). In this paper, therefore, our main goal is to develop a theory of Web page perception that will enhance our understanding of fundamental perceptual processes users employ to make sense of Web pages. This theoretical understanding should aid design decisions in a more scientific manner.

The unit of analysis in this paper is the Web page rather than the Web site. In particular, we chose to focus on home pages of Web sites, because academicians and practitioners alike agree that home pages deserve special attention. For example, Ha & James (1998) and Bucy *et al*. (1999) contend that the home page is the front door to the entire Web site and, therefore, deserves emphasis. Geissler *et al*. (2001) also argue that the home page has the potential to entice or drive away prospective visitors. Practitioners, too, caution that home pages need to be designed with utmost care. Usborne (2003, p. 2), for instance, remarks:

> *…you may want to think carefully about the role of the home page. Unless you run a highly unusual business, you will experience natural attrition among your existing customer base. So, you eventually need new customers. If new customers are a priority, then take a second look at your home page. Is it optimized for first-time visitors?*

In the same vein, Nielsen (2000, p. 17) emphasizes the fact that the home page design is the most immediately visible part of Web design, and users typically are looking at a single page at a time. Also, generally, most testing – especially in the early stages of a site's development – is done on individual Web pages, often independently (Fleming, 1998; Alexander & Tate, 1999).

Because a site's home page is usually designed first, its design features influence the design of subsequent pages (Zhang *et al*., 2000). More importantly, in the early stages of design, a Web site is frequently represented by mockups, or color screen dumps of page designs. At this stage, a site simply is not ready for usability testing, and most user input is gathered via qualitative research, for example, focus groups (Vaughan *et al*., 2001), which tends to be time-consuming and costly, in some cases consuming as much as one-third of project time and budget (Bear *et al*., 2001). Therefore, there is an urgent need to develop standardized scales for easily and rapidly eliciting input from large numbers of varied users in the early stages of a site's design process, when it is easier and cheaper to effect needed changes.

In order to answer the fundamental question of how people perceive Web pages, we rely on the premise that, at some level, cyberspace and physical space share certain common properties; therefore, it is reasonable to posit that there are similarities in the ways in which people perceive or experience cyberspace and physical space. We draw from environment psychology literature on place perception, specifically Kaplan and Kaplan's informational model (Kaplan, 1987, 1992; Kaplan & Kaplan, 1989). We propose that, theoretically, Web page perception should involve only two underlying, second-order latent perceptual dimensions: (1) understanding (or structure) of information on the Web page and (2) involvement or the extent to which the information/content can hold visitors' interest. Using home pages as stimuli, we then develop reliable instruments to measure Web page perception along the two proposed dimensions, relate perception to attitude toward the Web page and behavioral intentions towards the page.

By providing a framework for investigating the basic cognitive processes involved in the perception of Web pages, the study enhances our theoretical understanding of this important phenomenon. By aiding designers on practical issues, the study addresses the frequent complaint by information systems professionals that they are unable to use basic research on cognition and perception (Bias & Gillan 1998; Gillan & Bias 2001). Web page designers today have a dizzying array of attributes from which to choose (e.g., icons, animation, audio, video, etc.), and this increases the complexity of the design task. Since attitude toward the page is, in part, a function of how information is structured, our proposed molar framework should aid designers in their task of configuring the various elements on the page for maximum effectiveness. In the absence of such theory-guided effort, Web page design will continue to be intuitive and, at times, will result in brilliant designs. However, more often than not, the designs that are intuitive for designers are not intuitive for the end-users (Tullis, 1993).

We begin with a review of extant, scholarly literature relevant to this study. Next, we introduce our theoretical model, describe the steps followed in the development of appropriate measures needed to test it, and present the results of model tests. The paper concludes with a discussion of results and its implications.

Related Work

The unit of analysis of this study is a Web page. However, because Web pages are part of a larger context, which affects how they are perceived, we will start our review with related literature focused on issues of usability, design, and quality of Web sites, Web-based systems, Internet businesses, and the broader Web medium itself.

The usability and design of Web sites has received considerable attention by researchers in several areas of information systems (IS), human–computer interaction (HCI), and marketing. Usability in general and the usability of Web sites in particular is not easy to define. In practice, usability has been defined and measured in many different ways (Agarwal & Venkatesh, 2002). Most notions of usability with respect to the design of Web sites relate to site characteristics such as navigation, response time, credibility, and content (see, e.g., Nielsen, 2000 & Shneiderman, 1998). Drawing upon Nielsen & Shneiderman's work on usability and design as well as the constructs of media richness theory (Trevino *et al*., 1987), Palmer's (2002) study found that site design, usability, and media richness were closely associated with Web site success. Specifically, he found that site success measured in terms of user satisfaction, likelihood of return, and frequency of use was significantly linked to Web site download delay (speed of access and display rate within the Web site), navigation (organization, arrangement, layout, and sequencing), content (amount and variety of product information), interactivity (customization and interactivity), and responsiveness (feedback options and FAQs).

Closely linked to the notion of usability is the concept of quality of a Web site. Aladwani & Palvia (2002) developed an instrument that captures key characteristics of Web site quality from the user's perspective. The factors were: specific content, content quality, appearance and technical adequacy. Barnes & Vidgen (2002) have developed a Web quality index that rates e-commerce Web sites on five factors: usability, design, information, trust, and empathy. Using the theory of reasoned action and the technology acceptance model (Davis *et al*., 1989), they created a measure of Web quality, which included dimensions such as usefulness, ease-of-use, and entertainment.

Borrowing principles from building architecture, Kim *et al*. (2002) proposed structural, functional, and representational constructs to measure the architectural quality of Internet businesses. The dimensions of quality they developed include: internal stability, external security, information gathering, order processing, system interface, and communication interface.

Huizingh (2000) used the term *content* to refer to the information, features, and services offered by a Web site in contrast to the *design,* which he defined as 'the way the content is made available for Web visitors.' In his empirical study, he studied both content and design of commercial Web sites using several objective and perceptual measures. Perceptual measures included perceptions of content as well as perceptions of quality of structure, image, and presentation style. Based upon his study, Huizingh suggests that larger Web sites are richer in content and design.

Over the years, there have been several studies that have attempted to relate various features/characteristics of a Web site to one or more outcome variables. For example, Chen & her colleagues, in two studies – Chen & Wells (1999) and Chen *et al*. (2002) – demonstrated that the attitude toward a Web site depended on the entertainment value, informativeness, and organization of the Web site. In the context of Internet retail store designs, Lohse & Spiller (1999) found that the navigational features (e.g., the link between products, number of products on the end-product pages, number of buttons used to browse the store, and the type of checkout and order process) that reduced the time to purchase products online explained 61% of variance in the monthly retail sales. Another study in this genre is Winter *et al*. (2003), whose findings indicated that consumers' perception of Web sites was related to how they perceived its text, graphics, layout, links to other pages, fonts, use of advanced technology, strong marketing tactics, and use of color.

Zhang & von Dran (2002) related quality perception of Web sites to various clusters of Web site features. Their findings indicated that features such as navigation, completeness or comprehensiveness of information, and technical features were important determiners of a Web site's quality perception, although their importance varied depending upon the site domain (e.g., financial, e-commerce, etc.). In a similar study, Zhang *et al*. (2001) considered characteristics of a Web site that satisfy/dissatisfy users. The results showed certain features or family of features (e.g., navigation) are equally important across domains, whereas the importance of other features varies by the domain.

In addition to the above, Web and software design issues have been examined through the theoretical lenses of flow (Hoffman & Novak, 1996) as well as the technology acceptance model and its numerous variants (Venkatesh *et al*., 2003). For example, building upon notions of enjoyment and flow, Agarwal & Karahanna (2000) proposed a multidimensional construct called cognitive absorption, which they defined as a state of deep involvement with software. They identified five dimensions of absorption: temporal dissociation, focused immersion, heightened enjoyment, control, and curiosity. Childers *et al*. (2001), using the TAM framework, discovered that navigation, usefulness, ease-of-use, and enjoyment predicted online shopping attributes. Korzaan (2003) utilized both flow theory and the theory of reasoned action and found that flow was an important independent variable influencing both Web exploratory behavior and attitude toward purchasing online. In the context of computer-aided multimedia presentations, Webster & Ho (1997) proposed a construct called engagement, which they describe as being largely similar to the state of playfulness such as exists in a flow state.

We now turn our attention specifically to Web pages. It is reasonable to suppose that users' perception of a Web site is derived, at least in part, from their perceptions of the Web pages that make up the site. In our literature review concerning Web pages, we found two classes of articles: purely empirical studies and those grounded in theory. At least four purely empirical studies have attempted to correlate attributes of a Web page with some criterion variable(s). Dholakia & Rego (1998), for example, investigated the relation between increased site visits (as measured via daily hit rates) and such homepage features as number of links to other home pages, number of pictures on the home page, presence of sound files, and number of colors used to design the home page. Based on data from 272 homepages, Dholakia & Rego concluded that the 'information content of the Web pages, per se, does not appear to attract visitors to the Web sites.'

Zhang *et al*. (2000) clustered 197 homepages of Fortune 500 companies using 24 features of pages, which included presence of e-mail, presence of site index, number of colors, number of links, and presence of animation. Their study revealed five clusters that varied on Web home page characteristics. Ivory *et al*. (2001), too, focused on Web page attributes. Specifically, they developed an automated tool to compute 11, page-level (what they described as) 'simple,' 'superficial' attributes, such as page size, color count, font count, link count, word count, and body text percentage. The Web pages came from 163 different sites and from different levels in the site (e.g., the home page, pages directly accessible from the home page, etc.). Using the scores from the 2000 Webby Awards, where a panel of over 100 judges from the International Academy of Digital Arts and Sciences evaluates the Web sites for how good they are, Ivory *et al*. classified the pages as either good or not-good. Various statistical analyses, such as linear regression, and linear discriminant analysis revealed that the page-level metrics were indeed capable of discriminating between the good and the not-good pages. Good pages, for instance, had slightly more content, smaller page sizes, less graphics, and employed more font variations than not-good pages.

Like Dholakia & Rego (1998), Bucy *et al*. (1999) considered the relation between various home page features (e.g., presence or absence of banner, color changes, animation, blinking text or images, number of screens and frames, photos, etc.) and the page views received by the site. Utilizing a systematic random samplings scheme, 500 Web sites (from a pool of 5000 top-ranked sites), which included both commercial and non-commercial sites, were selected for the study. Their findings were mixed. For the commercial home pages, the correlation between page views and asynchronous interactive elements (e.g., text links, survey forms) was significant for commercial (.com) pages but not network (.net) pages. There was also a near significant relationship ($P<0.06$) between page views and an omnibus structure variable for commercial sites. The strongest results were obtained for the educational (.edu) sites, for which all correlations between page views and various page elements and composite variables were significant.

The four studies reviewed above have some limitations. First, they are not primarily guided by theory. Second, the four representative studies we reviewed exclusively focus on the physical features of the Web pages. However, despite the fact that physical features determine the value of a product to consumers, ample evidence from the marketing literature demonstrates that in forming preference or choice judgments, consumers care less about physical attributes – also known in literature as denotative, characteristic, or engineering characteristics – and much more about the benefit (connotative, instrumental, or customer) attributes. Consumers want a product for the benefits they derive from it and not for its physical characteristics (Haley, 1968; Ratchford, 1975). In other words, they are more concerned about whether the medicine cures what ails them than the physical attributes (ingredients) that constitute the medicine. The idea is famously summarized in Levitt's (1969, p. 2) dictum that consumers 'do not buy quarter-inch drills; they buy quarter-inch holes.'

The fact that consumers' care about benefit attributes more than they care about physical features may perhaps explain Bucy *et al*.'s (1999) weak correlations between various sets of physical features and page views. In that study, correlations between asynchronous interactive elements and page views ranged from $r=0.08$ (for the commercial sites) to $r=0.30$ (for non-commercial sites). This, too, may explain why Dholakia & Rego failed to find any significant relation between the physical features of the home pages and increased site visits. Ivory *et al*.'s superficial, page level metrics did predict Web site classifications into 'good' and 'not-good' groups; the classification, however, was based not on consumer ratings but that of Web design experts, who should find physical attributes more meaningful. (See Hauser & Clausing (1988), and Shocker & Srinivasan (1974), who argue that since, physical attributes can be objectively calibrated, they are deemed 'actionable' and are more meaningful to engineers (in this case Web designers) and managers (Lefkoff-Hagius & Mason 1993)).

While the foregoing studies were purely empirical, two representative studies are grounded in theory. Both Bruner & Kumar (2000), and Geissler *et al*. (2001) have relied on Berlyne's (1960) theory of stimulus complexity, which posits that as complexity of a stimulus increases, so does visitors' interest in it – up to a point. If the stimulus becomes too complex, though, the interest will decline. Bruner & Kumar (2000), who manipulated the complexity of a Web page by varying the number and dynamics of the page elements (e.g., animated graphics, background color, etc.), found that increasing Web page complexity contributed to the Web page being perceived as more interesting, which in turn influenced viewers' attitude toward the Web site. Further, at low levels, the Web page complexity had a positive effect on viewers' attitude toward the Web site, but at the highest level, the complexity had a negative effect on the attitude toward the Web site.

Geissler *et al*. (2001) study had two goals: (1) examine which design elements contributed to perceived home page complexity, and (2) how does the Web home page complexity influence attention to the home page? Their hypothesis was that a home page with moderate levels of complexity will be more effective than the ones with either low or high complexity. They found that the home page complexity was influenced by the size (or length) of the home page, the number of graphics (other than the company logo), the number of links, and the use of motion. Further, complexity of the home page and users' attention were inversely and curvilinearly related, such that attention levels were higher for home pages perceived to be in a range of moderate complexity than at the lower or higher range of complexity. While the efforts of Bruner & Kumar (2000), and Geissler *et al*.

(2001) are laudable, one has to realize that complexity as a construct has limited explanatory power. In this paper, we report a study of Web page perception that has its origin in the complexity construct. However, our model attempts to go beyond mere complexity to include other key factors that explain Web page perception.

Perception of cyberspace and informational framework

Under the assumption that perception of cyberspaces and physical spaces share some similarities (Lombard & Ditton, 1997; Tanney, 1997), it is important to ask how this perception can be theoretically characterized, and how it can be psychometrically measured to be useful in Web page design and testing. To answer these questions, we needed a theoretical framework capable of producing generalizable results across actual physical spaces as well as virtual spaces. And in the environmental aesthetics literature, which has a long and rich history of spatial perception research, we did find such a framework – the informational model (Kaplan & Kaplan 1982, 1989).

This framework seems uniquely suitable for our purposes for two reasons: (1) it has received wide empirical support and much attention in landscape research literature (Gimblett *et al.*, 1985); and (2) the concepts provided in the model are readily generalizable to any setting regardless of the nature of environment. Support for the informational framework comes from several landscape studies (see Kaplan (1992) for a review), and there is evidence of its generalizability. Leventhal (1988), for example, has used the informational model to study the aesthetics of computer programming. In fact, Kaplan (1992, p. 596) specifically suggests that the model could apply in the context of HCI.

The informational model conceives of environments broadly in terms of their functional characteristics (e.g., visual organization and variety). The model is interactional in nature; it posits a complex relationship between the observer and the environment, which cannot be captured directly in terms of attribute or feature analysis. Hence, the perceptual process is focused not on specific elements of the physical setting but on the organization of the space, because the way the space is organized is highly informative of how the perceiver would function in it. Perception in Kaplans' model is functional, purposive, and concerned with what a perceived object or scene has to offer to the individual perceiver.

If perception of things and spaces depends on people's purposes, 'then understanding preferences requires that we first understand what these purposes are.... [R]esearch on preference has over the years repeatedly pointed to two underlying purposes that people are concerned with throughout their waking hours.... We have come to call these persisting purposes 'making sense' and 'involvement' (Kaplan 1988, p. 47).' Attitude toward a setting, thus, is a function of these two cognitive processes: understanding and involvement. Understanding (making sense, structure of information) relates to the need to comprehend, maintain one's bearings, and make sense of what is going on in the setting. The involvement, or exploration potential, or richness of a setting refers to being held by a setting, being attracted by or pulled toward sources of information in the setting. In addition, attitude formation involves both immediate, directly perceived aspects and inferred, future aspects of the environment.

In perceiving a setting or scene, people not only consider its immediate qualities and imagine themselves in the scene but also make projections about how they would function in it if they were to enter it. In other words, people react to scenes in two ways – they perceive the environment in front of them as a visual array or a two-dimensional pattern, like a flat picture (e.g., the photograph of a given landscape), and as a three-dimensional pattern of the space that unfolds before them. The immediate (two-dimensional) and the inferred (three dimensional) perception, when crossed with the understanding or exploration properties, yield four constructs: coherence, legibility, complexity or diversity, and mystery. Table 1 presents the informational framework for predicting attitude.

A description of the four main constructs in the framework adapted from Kaplan (1987, 1988, 1992), and Kaplan *et al.* (1989) is given below.

Coherence: Understanding reflects *coherence*, 'the ease with which one can grasp the organization of the scene' (Kaplan, 1992, p. 588). It relates to immediate structure of a setting (Kaplan, 1987).

Legibility: Understanding from the perspective of an inferred structure, or a three-dimensional view, is related to *legibility* (Lynch, 1960). Legibility is the extent to which the perceiver can find his/her way within the depicted setting or maintain his/her bearings while moving deeper into the scene. Thus, whereas coherence concerns the immediate aspect of orientation within the picture plane, legibility relates to the inferred aspects of comprehension, or the ability to continue to comprehend the environment yet to come. A clear or legible mental image (map) of the setting enables a person to move about easily and quickly.

Diversity: Diversity (or complexity) refers to the degree to which a scene is engaging or the degree to which the information available in the two-dimensional, picture plane offers possibilities of immediate exploration.

Table 1 An informational framework for predicting attitude

	Understanding (Structure)	*Involvement (Richness)*
Perception of immediate aspects	Coherence	Diversity or complexity
Perception of inferred or future aspects	Legibility	Mystery

Involving settings are informationally rich. At the surface level (i.e., in a two-dimensional plane), immediate, as opposed to inferred, richness of a visual stimulus can be potentially gauged by the presence of various dissimilar or distinct elements, in short, by its *diversity*.

Mystery: When a space (scene, landscape) is viewed in three dimensions, the richness of information is based not only on the features that are actually present or what is happening at the surface level, but also on the promise of what is to come (i.e., the opportunity to gain new but related information in the context of an inferred space). Kaplan (1992, p. 588) calls this promise of information *mystery*.

The informational framework posits that rich settings are engaging and tend to 'draw people in' and encourage exploration not only of surface level features, but also of promised hidden information in the underlying dimension if people will 'move' deeper into the scene. This makes exploration of an informationally rich setting a compelling and nontrivial task (Leventhal, 1988).

Note the hierarchical nature of constructs in the framework. The two second-order constructs, understanding and richness, respectively, drive the two sets of first-order constructs: (a) coherence and legibility; and (b) diversity and mystery. As Figure 1 suggests, when evaluating environments (spaces, objects), people appraise what the environment has to offer to facilitate understanding and exploration. A preferred environment must be well structured (i.e., easy to make sense of), and it must offer rich exploration opportunities, whether actual or potential.

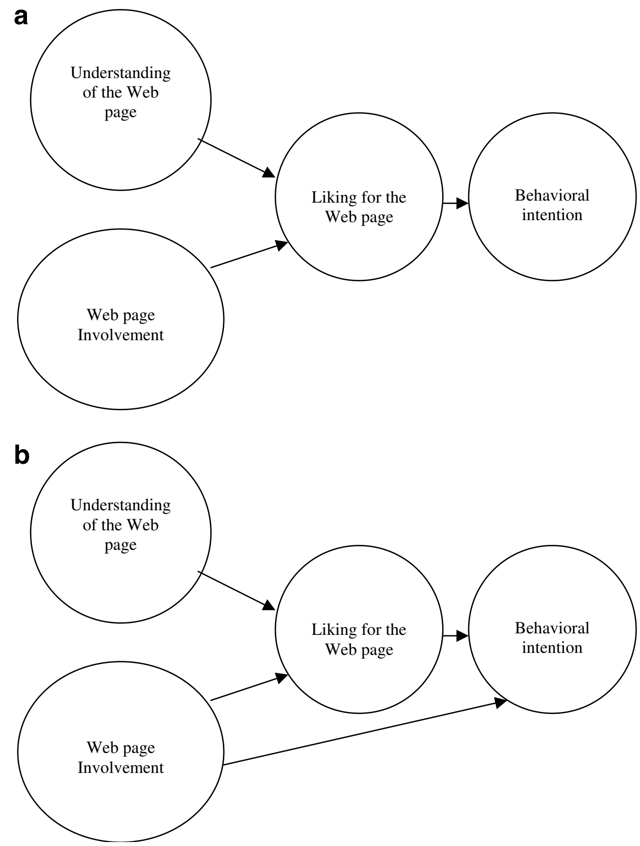

Figure 1 Hypothesized relationship between involvement, understanding, and behavioral intentions. (a) Full mediation model and (b) dual mediation model.

Informational framework and attitude toward the Web page

In most studies of environmental perception, settings are represented visually, via black and white photographs or color slides (Kaplan, 1992). This miniaturization of the setting necessarily results in loss of some detail, yet permits one to comprehend and explore the setting. Just as a picture of a landscape provides information about the immediate and inferred aspects of the landscape (i.e., about its structure and exploration possibilities), a home page, likewise, represents the underlying Web site. In terms of the informational framework, when a visitor looks at a home page, he/she makes a quick appraisal of the page in terms of its (1) usefulness and supportiveness for exploration and (2) its structure, understanding, or sense making capabilities, including the ease of home page comprehension, the perceived ease of navigating the underlying site, and the perceived likelihood of getting lost while exploring the site. The attitude toward the page should be a function of how involving and structured the page is. As Nielsen (2000, p. 166) contends, 'The first immediate goal of any home page is to answer the question, 'Where am I?' and 'What does this site do?' These two questions, which in our framework are analogous to understanding (sense-making/structure) and involvement (richness), respectively, determine the initial attitude toward the home page.

The framework is all the more valuable because it posits a clear relationship between attitude and behavioral intentions (Kaplan, 1992). Theoretically, there are two possible ways in which understanding and involvement can influence behavioral intentions. One possibility is that the entire influence of involvement and understanding on behavior occurs through the attitude toward the Web page alone. This 'full mediation of effect' possibility is depicted in Figure 1, Part A, and suggests that a visitor to the site would make an assessment of (a) how involving the home page and the underlying Web site are, and (b) an assessment of its navigation scheme (understanding or structure). This assessment results in the formation of overall attitude toward the Web page, which then becomes the sole driver of behavioral intention (and ultimately behavior).

A second possibility, however, is that the bulk of the influence of understanding and involvement on behavior is transmitted through attitude but that some of it has a direct effect. This dual mediation possibility is shown in Figure 1, Part B, in which a solid arrow from involvement to behavioral intentions suggests that, regardless of eventual level of attitude toward the Web page as a whole, a page rich in exploration possibilities will trigger an immediate behavioral response (e.g., bookmarking, clicking on a hyperlink) simply because the page aroused curiosity, or it was relevant to the visitor's other purposes. However, what about the effect of understanding on behavior? Can a well-organized, well-ordered page, although lacking in involvement, trigger a behavioral response? The answer is 'no.' As Nielsen (2000) notes, the most important question that a first-time visitor asks is: What does this site do for me? If the page is not engaging, no matter how well structured, it is unlikely to trigger behavior, that is, if the site is not rich for exploration purposes (it is perceived as non-involving) the organizational aspects of the site become moot. We therefore do not hypothesize a direct effect of understanding on behavioral intentions.

To test these models, we developed a number of scales for measuring various constructs. The relationship among constructs was explored using a nomological network tested through structural equation models. Unlike all prior operationalizations of the informational model, where the four cells of the matrix (see Table 1) have been treated as independent variables in their own right, the proposed model operationalized the two intervening higher-order latent constructs, involvement and understanding of information, with involvement comprised of diversity and mystery and understanding of coherence and legibility.

Method

Overview: The study setting was a computer lab in which student volunteers browsed the home page of an existing commercial Web site. After browsing the page, subjects provided written feedback by responding to several Likert and semantic differential items.

Stimuli: The home page of a Web site of a small manufacturer of handcrafted, earth-friendly greeting card gifts was selected for the study. The site sold greeting cards in which flower seeds were embedded in the handmade paper, which could be directly planted. The site was selected because it sold a product directly to consumers, and because greeting cards are relevant to student subjects. (Two researchers and a graduate student visited and pre-screened dozens of Web sites listed in the Yahoo! directory of companies and elsewhere, with a majority of them from the Yahoo! Shopping directory. As part of a pretest to select stimuli, an initial pool of 20 home pages was chosen and shown to pretest subjects to ensure that the sites were for products/services relevant to student subjects. The pages were downloaded from the actual Web sites of the companies, and represented a mix of pure Internet companies and those having a physical presence. We chose web sites of eight companies for use in various pilot tests. These companies were engaged in selling various products and services such as travel, entertainment, gifts, clothing, and magazines. The selection of companies was based primarily upon diversity of product and service offerings, diversity of look-and-feel of the home pages as determined by the subjective assessment of the researchers, and relevance of the product or service offered to the subjects. The Web site for the main study was selected at random from the prescreened sites.)

Subjects and procedures: A total of 540 undergraduate students (294 males, 246 females) at a major Midwestern U.S. university participated in the main study. They received course credit for their participation. The study was carried out in several 30-min sessions, and each employed between 10 and 45 subjects. Viewing differences due to machines were minimized by using computers with practically identical configurations, the same version of the browser, and 17″ monitors with identical settings of display resolution (800×600 pixels), color palette, font size, and refresh frequencies.

Upon arrival in the lab, subjects were told that they would be viewing and recording their impressions of a Web home page. The subjects were directed to read the instructions on their computer screens. In the instructions, the subjects were asked to browse the home page from the perspective of someone interested in buying a greeting card. They could scroll down the page but were told not to click on any of the blue hyperlinks shown on the page. We disabled active hyperlinks for two reasons: (1) Our goal was to ascertain the perception of the immediate aspects of the Web page as well as inferred aspects hidden beneath the home page, much like a person who is viewing a picture or a two-dimensional representation of a landscape but who has not actually explored any of the pathways, and (2) accidental clicking of the active hyperlinks would have taken our subjects to other pages or the home pages of other sites, which would affect their perception of the experimental home page. The subjects were told that after viewing the page, they could start filling out the questionnaire, which could be accessed by clicking on a link on the computer screen.

Measures

Involvement and understanding: To measure the informational properties (involvement and understanding) of Web pages, we developed a pool of Likert-type items (statements) that reflected the conceptual definitions of the coherence, legibility, diversity, and mystery constructs. The initial pool of items was generated using a focus group with five student subjects and subsequently refined with the help of three individuals familiar with the purposes of the study. In selecting the items, we took care to represent different shades of meaning (Churchill, 1979) and ensured that the items had a factorial composition commensurate with the constructs. To examine the face validity of the items, a colleague unfamiliar with the purpose of this study was given a description explaining the conceptual meaning of the constructs. He was asked to examine carefully the items and point out those that did not correspond to the respective conceptual definitions. All items were considered representative of the respective constructs. These items were subjected to a series of pilot tests including exploratory and confirmatory analyses. In the end, the legibility items did not coalesce as a construct, and 13 items were retained from the pilot studies to represent the remaining three constructs of coherence, diversity, and mystery (see Table 2).

Attitude measure: The attitude toward the Web home page was measured with four items with end points labeled 'appealing–unappealing', 'good–bad', 'worthwhile–worthless', 'favorable–unfavorable.'

Behavioral intention measure: After responding to the attitude question, the subjects' behavioral intention to return to the home page (and hence the underlying Web site) was measured as follows: 'If you were searching the Web to locate a greeting card site for buying greeting cards and you encountered this home page, what is the chance that you would further explore this home page by clicking on an icon/button?' (The three-item, seven-point semantic differential end points were labeled 'probable–improbable,' 'possible–impossible,' and 'likely–unlikely').

Results

Confirmatory analysis. Confirmatory factor analysis (LISREL VIII; Jöreskog & Sörbom 1993) was performed on the data ($n=540$) to assess the construct validity of all constructs (i.e., coherence, diversity, mystery, attitude toward the Web page, and BI) to be employed in the structural test (Anderson & Gerbing 1988). The test provides an assessment of the convergent and discriminant validity of the constructs used in the structural model (Campbell & Fiske 1959). The 13 items retained from the pilot studies were constrained to load on their three respective factors, as follows: four items on the coherence factor (X_1–X_4, Table 2), four on the diversity factor (X_5–X_8), five on the mystery factor (X_9–X_{13}), four on the attitude measure (X_{14}–X_{17}), and three on the behavioral intention measure (X_{18}–X_{20}). Following the suggestions of Anderson & Gerbing (1988) and Gerbing & Anderson (1988) as well as the examples set by Kohli *et al.* (1993) and Netemeyer *et al.* (1995), we deleted one problematic item from the attitude toward the Web home page scale (appealing–unappealing) after examining the

Table 2 Results for confirmatory analysis

Scale item[a]	*Completely standardized factor loading*	t-*Value*
Coherence (coefficient α = 0.83; confirmatory: composite reliability = 0.84, AVE = 0.77)		
X_1 This Web page is orderly.	0.66	17.09
X_2 It is easy to make sense of this Web page.	0.87	24.57
X_3 This Web page is easy to comprehend.	0.81	18.24
X_4 I can easily create a map of the page in my mind.	0.56	14.06
Diversity (coefficient α = 0.84; confirmatory: composite reliability = 0.84, AVE = 0.57)		
X_5 This Web page is stimulating.	0.66	19.00
X_6 I find this Web page very uninteresting. (R)	0.75	18.60
X_7 This Web page is engaging.	0.72	21.23
X_8 This Web page does not arouse my curiosity. (R)	0.83	18.62
Mystery (coefficient α = 0.84; confirmatory: composite reliability = 0.84, AVE = 0.51)		
X_9 The Web site that this home page represents promises a lot of information.	0.52	15.89
X_{10} I doubt that I will learn anything new by visiting the Web site beyond what I have learned from the home page. (R)	0.56	15.36
X_{11} Based on the home page, it appears there may be a lot more to see in the underlying Web site.	0.62	19.14
X_{12} There seems to be a lot to explore in the Web site represented by this home page.	0.65	20.24
X_{13} I believe there is not much to discover by visiting the underlying Web site. (R)	0.65	18.43
Attitude Toward the Web Page (coefficient α = 0.91; confirmatory: composite reliability = 0.91, AVE = 0.83)		
X_{14} Good–bad	0.86	24.85
X_{15} Worthwhile–worthless	0.84	23.82
X_{16} Favorable–unfavorable	0.94	28.59
Behavioral intentions (coefficient α = 0.97; confirmatory: composite reliability = 0.97, AVE = 0.93)		
X_{17} Probable–improbable	0.97	30.55
X_{18} Possible–impossible	0.94	28.77
X_{19} Likely–unlikely	0.95	29.68

Note: All items were scored on five-point Likert scales ranging from 1 ('strongly disagree') to 5 ('strongly agree').
[a](R) indicates reverse coding. AVE = average variance extracted.

pattern of residuals. The χ^2 test for the model was significant ($\chi^2_{(142)} = 420.04$, $P < 0.05$). Thus, other fit indices were examined. The model had a goodness-of-fit index (GFI) of 0.92, a confirmatory fit index (CFI) of 0.96, a Tucker–Lewis index (TLI) of 0.95, a root mean squared error of approximation (RMSEA) of 0.060, and standardized root mean square residual (SRMR) of 0.043. The combination of indices indicates a robust measurement model fit (Hu & Bentler, 1999; MacCollum *et al*., 1996).

Internal consistency was investigated by calculating the composite reliability and average variance extracted (AVE) for each factor (see Table 2). Composite reliability is an α equivalent, whereas AVE provides information about how much variance in the measured variables is captured in the latent constructs. Composite reliabilities were acceptable and AVE ranged from 0.51 to 0.93. Average variance extracted estimates of 0.50 or higher are considered evidence of internal consistency among the observed measures (Fornell & Larcker, 1981). Finally, all items had significant loadings on their respective factor ($P < 0.01$), which provides further evidence of internal consistency. In Table 2, we list the items, corresponding completely standardized factor loadings, and *t*-values.

Discriminant validity was evaluated several ways. First, we compared a five-factor model with a one-factor model, which produced a significant result for the χ^2 difference test ($\Delta\chi^2_{(6)} = 1728.83$, $P < 0.05$), indicating the superiority of the five-factor model. Second, all possible combinations of two-factor models were estimated and compared with the five-factor model. In all possible combinations, the χ^2 difference test was significant ($P < 0.05$ for each test), which indicates the superiority of the five-factor model and provides evidence of discriminant validity. Employing Anderson & Gerbing's (1988) complimentary test of discriminant validity, the confidence intervals ($\pm$two standard errors) around the ϕ estimates did not contain 1 for any pair of factors, which indicates that the factors are distinct. Finally, the squared correlation between two constructs was less than AVE, furnishing additional evidence of discriminant validity (Fornell & Larcker, 1981).

Structural test

To test the relationships hypothesized in Figure 1 and assess the nomological validity of the measures, a structural model (see Figure 2) was estimated using LISREL VIII ($n = 540$). In the model, mystery and diversity were first-order latent factors that were driven by the second-order latent factor, involvement. The second latent factor was directly measured by variables X_1 to X_4 representing coherence (see Table 2). Attitude toward the Web page was measured with three items having an α of 0.91 (good/bad, worthwhile/worthless, favorable/unfavorable). Three items (probable/improbable, possible/impossible, likely/unlikely; $\alpha = 0.96$) served as indicators of the behavioral intentions (BI) construct. Figure 2 presents this model, along with standardized LISREL estimates for each path and corresponding *t*-values. The variance–covariance matrix is shown in Table 3. The fit indices for the model were: $\chi^2_{(145)} = 426.00$, GFI = 0.92, adjusted GFI = 0.90, TLI = 0.95, CFI = 0.96, and RMSEA = 0.06, and SRMR of 0.042, indicating a close model fit (Hu & Bentler, 1999; MacCollum *et al*., 1996).

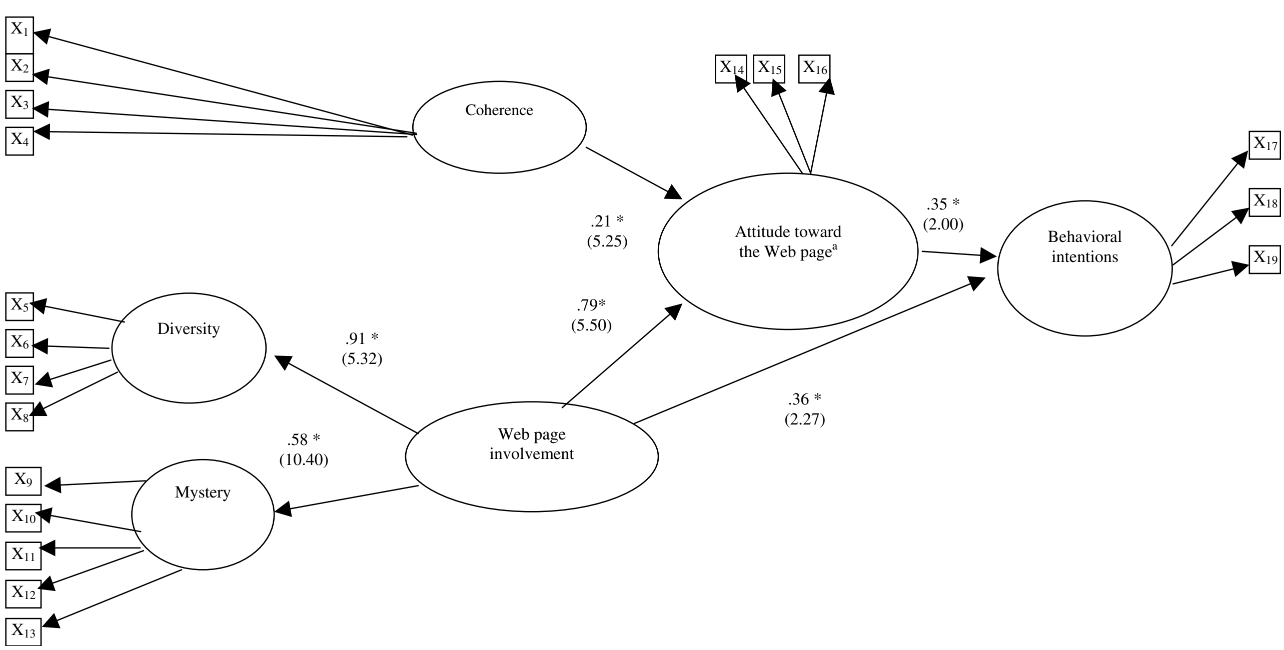

Figure 2 Structural model. (Completely standardized LISREL estimates with *t*-values in parentheses). $\chi^2 = 419.16$, df = 145, $P < 0.05$, GFI = 0.92, AGFI = 0.90, TLI = 0.95, CFI = 0.96, RMSEA = 0.060, SRMR = 0.042.

Table 3 Variance–covariance matrix

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}	X_{18}	X_{19}
X_1	0.79																		
X_2	0.26	0.95																	
X_3	0.47	0.33	1.04																
X_4	0.21	0.56	0.30	0.96															
X_5	0.20	0.41	0.27	0.49	0.93														
X_6	0.52	0.29	0.50	0.30	0.26	0.79													
X_7	0.21	0.53	0.30	0.72	0.43	0.27	0.92												
X_8	0.51	0.24	0.71	0.23	0.30	0.58	0.26	1.28											
X_9	0.20	0.16	0.23	0.12	0.12	0.23	0.09	0.25	0.64										
X_{10}	0.16	0.17	0.25	0.15	0.14	0.21	0.13	0.27	0.32	0.77									
X_{11}	0.19	0.20	0.22	0.11	0.10	0.23	0.10	0.25	0.31	0.34	0.67								
X_{12}	0.23	0.19	0.26	0.10	0.12	0.24	0.05	0.25	0.34	0.31	0.43	0.68							
X_{13}	0.20	0.14	0.28	0.09	0.12	0.22	0.07	0.34	0.32	0.42	0.38	0.42	0.79						
X_{14}	0.72	0.72	0.77	0.71	0.48	0.71	0.71	0.77	0.36	0.31	0.37	0.33	0.34	1.99					
X_{15}	0.59	0.50	0.72	0.50	0.43	0.63	0.48	0.80	0.40	0.39	0.41	0.40	0.38	1.34	1.81				
X_{16}	0.72	0.64	0.87	0.63	0.51	0.75	0.60	0.89	0.41	0.44	0.41	0.45	0.40	1.62	1.53	2.01			
X_{17}	0.72	0.59	0.83	0.59	0.48	0.75	0.60	0.99	0.42	0.43	0.46	0.37	0.45	1.49	1.40	1.59	3.57		
X_{18}	0.66	0.52	0.77	0.53	0.42	0.68	0.54	0.85	0.41	0.46	0.41	0.31	0.41	1.35	1.29	1.45	2.89	2.87	
X_{19}	0.69	0.56	0.92	0.57	0.45	0.74	0.52	0.94	0.41	0.46	0.46	0.44	0.45	1.42	1.36	1.60	3.28	2.83	3.54

Note: X_1, stimulating; X_2, uninteresting; X_3, engaging; X_4, does not arouse curiosity; X_5, orderly; X_6, make sense; X_7, comprehend; X_8, create a map; X_9, lot of information; X_{10}, doubt I will learn; X_{11}, more to see; X_{12}, lot to explore; X_{13}, not much to discover; X_{14}, good-bad; X_{15}, Worthwhile–worthless; X_{16}, favorable–unfavorable; X_{17}, BI probable–improbable; X_{18}, BI possible–impossible; X_{19}, BI likely–unlikely.

The hypothesized model was tested against several competing or alternative theoretical representations and found to be superior to those. Alternative models (more/less restricted) were tested using Anderson & Gerbing's (1988, p. 418) notion of testing a series of nested models that compare the '…next most likely *constrained and unconstrained alternatives* from a theoretical perspective to the substantive model of interest.' A model (M_1) is nested within M_2 when M_1 is obtained by restricting the estimation of parameters in M_2. Each of the specifications examines an alternative theoretical representation of the relationships. Sequential χ^2 difference tests are used to ascertain which model should be retained (Steiger *et al.*, 1985). If the χ^2 difference test is significant, the freer model (or the more complex model) should be retained. If the χ^2 difference test is not significant, then the more parsimonious model with fewer paths should be retained.

We analyzed four nested models that included the gamut of potential rival explanations: (1) a saturated structural model, which estimates both direct and indirect effects of the exogenous variables (M_1); (2) an indirect model, which posits only the indirect effects of involvement and coherence via attitude toward the Web page (M_2); (3) the hypothesized model with the direct path from coherence to BI constrained to zero but estimating both direct and indirect effects of involvement (M_3); and (4) a model with the direct path from involvement to BI constrained to zero but estimating both direct and indirect effects of coherence (M_4).

In concert, the nested model tests indicate the superiority of the hypothesized structural model (M_3) over a range of alternative explanations (see Table 4). That is, the significant χ^2 difference tests demonstrate the need to estimate the paths in the saturated structural model (M_1) when compared to models that eliminate paths such as the indirect model (M_2) and the model that does not estimate the direct path from involvement to BI (M_4). When the saturated structural model (M_1) is compared to the hypothesized model (M_3), the non-significant χ^2 difference indicates a need to retain the more parsimonious model, or the hypothesized one.

The hypothesized model estimates only the indirect effects of coherence on BI but both the direct and indirect effects of involvement on BI. The LISREL estimates of total, direct, and indirect effects are given in Table 5. (All non-zero effects are significant, $P<0.05$.) As Table 5 shows, attitude toward the Web page fully mediates the relationship between coherence and BI and partially mediates the relationship between involvement and BI. That is, attitude toward the Web page fully explains the impact of coherence on BI, whereas it partially explains the impact of involvement on BI.

The squared multiple correlations of the structural equations for attitude toward the Web page and BI were 0.84 and 0.48, respectively. The squared multiple correlations can be interpreted in the same manner as an R^2 value. That is, 84% of the variance in the attitude toward the Web page is attributable to coherence and involvement, and 48% of the variance in BI is explained by all the constructs in the model.

Discussion of results

To recapitulate, the main goal of this study was to understand, at a molar level (at the level of benefits as opposed to page characteristics), how people perceive home pages and the ways in which this perception affects

Table 4 Nested model results

Model	*Comparison*	χ^2_{diff}	df_{diff}	*Result*
M_1: Saturated	M_1 *vs* M_2	6.52	2	Retain M_1
Structural: estimates both direct/indirect effects	M_1 *vs* M_3	0.53	1	Retain M_3
	M_1 *vs* M_4	5.73	1	Retain M_1
M_2: Indirect effects only/no direct effects estimated				
M_3: Hypothesized model: Saturated structural with path from coherence to BI equal to 0				
M_4: Saturated structural With path from involvement to BI equal to 0				

Table 5 Direct and indirect effects

Exogenous constructs			*Standardized estimates (t-values)*		
	Total effect	=	*Direct effect*	+	*Indirect effect*
Coherence	0.07 (1.83)	=	0.0	+	0.07 (1.83)
Involvement	0.64 (9.44)	=	0.37 (2.27)	+	0.27 (2.48)

attitudes and behavioral intentions toward the home pages. Equating cyberspace with real places and based on Kaplan & Kaplan's (1982, 1989) informational model, we predicted that two properties of information – involvement and understanding – would explain adequately the perception of home pages and that a preferred home page would score reasonably well on both these dimensions. Our results are in line with these predictions. Understanding (measured via coherence) did not have a direct effect on behavioral intentions, but involvement did. Understanding influenced behavioral intentions solely through attitude. This is precisely what we expect in a Web context. A Web page, no matter how organized and well structured, is unlikely to trigger approach behavior – especially for a first-time visitor, it seems – unless it is involving, that is, rich in exploration possibilities. As Nielsen (2000) notes, for first-time users, substance of the page (in our study, involvement) is always going to be weighted more heavily than the site's navigational scheme (in our study, understanding) regardless of the nature of the site. Involvement and understanding together account for 84% of the variance in attitude toward Web page; the direct and indirect effects of richness and the indirect effects of understanding and attitude explain 48% of the variance in BI.

The best fitting model, shown in Figure 2, corresponds closely to the hierarchical structure predicted by the informational model, in which involvement and understanding are represented as second-order latent constructs, with involvement comprised of diversity and mystery and understanding comprised of coherence.

The fact that overall Web page attitude mediates the effect of perceptual variables on behavioral intention implies that focusing on individual elements of a page (e.g., icons, graphics, fonts) is not sufficient. No matter how impressive the individual elements of the page, a Web page that is not liked overall will be less effective. We must, therefore, secure user input on the Web page as a whole. Thus, even when a Web page is focused on providing factual information about a product or service, designers must consider the execution aspects of the page and strive to make it appealing, enjoyable, and likable.

Implications

Although we simulated the naturalistic experimental condition by using the home page of a Web site that was relevant to the student subjects, our results must be interpreted in light of limitations inherent in lab studies. These include the use of student subjects and the artificial nature of the experimental task, where subjects looked only at the home page of a site. Consistent with the focus and scope of our study, we examined perception only in the context of Web pages; we did not attempt to capture attributes or perceptions related to the entire Web site. (Note, however, that we used real commercial home pages and that in pretesting Web pages, securing input on individual pages – and even color screen dumps and page outlines – is not uncommon). Furthermore, we measured only the attitude toward the Web page and behavioral intentions to explore the site; we did not examine actual behaviors or shopping intentions. With the above limitations in mind, let us consider the theoretical and practical implication of our work.

Effective Web page design requires an understanding of how people perceive Web pages, for perception drives attitudinal and behavioral responses. A majority of past research (e.g., Dholakia & Rego, 1998; Bucy *et al.*, 1999; Zhang *et al.*, 2000; Ivory *et al.*, 2001) aimed at understanding Web page perception has been focused on page-level, physical features. However, as consumer behavior literature suggests, page-level attributes are likely more meaningful to site designers than they are to site visitors, who, presumably are more concerned with molar benefits, or denotative attributes. Hence, it is no surprise that results of these studies reveal either a null or a weak relationship between the physical attributes of the page and the page views.

The journey from physical attributes to behavioral intention/behavior may include several intermediate steps, such as perception of denotative aspects of the page and the underlying site and the overall attitude toward the page. Not accounting for these intermediate steps is a major weakness of physical attribute-focused studies. A second weakness is their purely empirical nature. Designing Webs without an underlying theory of Web perception is like building houses without using any guiding principles of construction theory. Theories provide foundations around which to organize and integrate findings (Jacoby, 1978). In other words, they play a stabilizing role, guiding the data collection and interpretation of results (Pfeffer, 1993). Failure to develop theories leads to reductionism and a loss of holistic perspective (Reidenbach & Oliva, 1981). In the case of Web design, the systematic development of theory in the long run will enable researchers to understand, explain, predict, and control users' online behavior.

Bruner & Kumar (2000) and Geissler *et al*. (2001) do use Berlyne's stimulus complexity theory. But, this theory has limited explanatory power. We used a model that, although fully compatible with Berlyne's theory, is more comprehensive and subsumes the complexity construct. For example, the definition of complexity used by Geissler *et al*. (2001), which they borrowed from Berlyne (1960, p. 30) – 'the amount of variety or diversity in a stimulus pattern,' is very similar to Kaplan's (1988) conceptualization of diversity, which is the presence of various dissimilar or distinct elements in a scene. It should not be surprising because Berlyne's complexity notion was a primary impetus for the informational model.

Kaplan (1988, p. 586) notes that he was intrigued by a study in environmental aesthetics, which found that 14 scenes of diverse settings showed highest preference at middle levels of complexity. Yet he felt uncomfortable by the study because 'it ignored the environmental content of the scenes and because it was hard to believe that preference could be explained that simply.' In 1972, Kaplan and his associates conducted a study, Kaplan *et al*. (1972), which showed that complexity was not a powerful predictor of environmental preference. This study generated some hypotheses, which with substantial future research, led to the development of informational model.

By including constructs such as diversity, mystery, and coherence in a nomological net and relating these to the attitude toward the Web page and behavioral intensions, the proposed model enhances our theoretical understanding of Web page perception. What's more, the scales used in operationalizing the model enable reliable and parsimonious measurement of the same. To the extent better measures are critical for theory development and validation (Anderson & Gerbing, 1988), the psychometrically valid measures of Web page perception presented in this study could help further evolution and validation of theories about Web browsing.

Our model has compelling practical implications. For example, to design user-friendly pages, it is essential that designers have a good understanding of users' mental maps. To do this, designers rely on either qualitative methods (e.g., depth interviews, focus groups, direct observation of subjects while they interact with Web pages), or on existing design principles, perhaps under the assumption that these principles are based on sound understanding of user perception. Unfortunately, qualitative methods rely on small sample sizes and are typically not guided by any theory, which leaves them open to potential researcher/moderator bias. Therefore, one is never quite sure about the validity and generalizability of their findings (Churchill, 1983).

Reliance on design principles could be dangerous too. Most Web page design principles are based on qualitative, personal experiences, and as Shneiderman (1997, p. 5) laments, they are often incomplete, lack generalizability, and some are even misleading. In contrast to qualitative methods, or personal experience-based guidelines, the framework used for this study is grounded in a theory of perception. Furthermore, because it explains attitude toward the Web page as a function of how virtual space on a Web page is organized in terms of understanding (how information is structured) and involvement (how rich is the information), not only does it offer a way to organize various elements on a Web page, it also provides a generalizable and scientific framework for incorporating user reactions in Web page design and testing. For example, using the scales presented here, a designer can determine whether and why a Web page is preferred (or not). To borrow a phrase from Kaplan (1992), the scales 'inform the intuition.' The quantitative scores on the overall understanding and involvement of a Web page can be supplemented with data on feature ratings and with focused, qualitative probing to determine which specific aspects of the page are driving the obtained scores. This strategy may be preferable to the many atheoretical approaches that directly manipulate individual page elements (e.g., font, animation, and so forth) without understanding the effects of these changes on the overall perception.

The home page of a Web site is usually designed first and its design features strongly influence the design of subsequent pages. Further, in the early stages of design, a home page is no more than a color screen dump or a storyboard. It is at this stage that user input is most valuable, when it is easier and cheaper to effect needed changes. And yet, at this early stage, to our knowledge, other than the Geissler *et al*.'s (2001) scale on home page complexity, there are no standardized, reliable, and valid measures to seek large-scale consumer input in home page design. At this early stage in the design process, usability tests – the typical method of gathering user input – are not even possible, as they require functional Web sites. The measures developed in the present study fill this void. Our pilot tests indicate that these measures are versatile and can be used in the paper-and-pen format, conducive to data collection in practical design situations with storyboards, screen dumps, and sketches. In fact, simpler methods, such as the one reported here, stand a better chance of being used and should encourage the multiple tests and design iterations so effective in developing effective Web pages (Fleming, 1998).

Future research

In this study, involvement played a more dominant role than understanding. This was expected because for the first-time visitor to a home page, evaluation task is dominated by content, and hence, higher weight is placed on involvement – to quote Nielsen (2000, p. 18), 'Navigation is a necessary evil that is not a goal in itself and should be minimized.' But what about repeat visitors? A repeat visitor comes to the home page of a site knowing that the site contains (or should contain, based on prior knowledge, experience, etc.) the information/product/service that is of value to the visitor. In this case then, the understanding (making-sense) or navigational scheme of the site ought to be weighted more heavily than the involvement. Nielsen (2000, pp. 166–167) concurs:

> *For the first time visitors, answering the question 'What does this site do?' may be the most important function of the home page, but for most other users, the most important function of a home page is to serve as the entry point to the site's navigational scheme.*

The notion of variable relative weights of involvement and understanding across situations is compatible with the finding that a dimension used in one environmental cognitive set (defined as a plan to select a specific type of information processing/mental operation) also will be used in other cognitive sets, although the salience of dimensions may vary (Ward & Russell, 1981).

In this study, we focused on home pages. The model and the methods developed here need to be extended to entire Web sites. Also, perception of places varies with personal characteristics, such as age, gender, and sociocultural factors (Ramadier & Moser, 1998). Analogously, we would expect person- and culture-based differences in the perception of Web pages. (e.g., Zhang *et al*. (2002) found that effectiveness of product information presentation in a Web-based e-commerce environment varies by online consumers' psychological types.) Such variables should be investigated in future research.

Some of the other constructs emerging from our theoretical development have intriguing parallels with broader work in the design of information systems in general and Web-based systems in particular. For example, involvement is a parsimonious construct that seems to capture elements of enjoyment (Venkatesh *et al*., 2003), usefulness (Davis, 1989), delight (Kim *et al*., 2002), interactivity (Palmer, 2002), engagement (Webster & Ho, 1997), playfulness and flow (Hoffman & Novak, 1996), cognitive absorption (Agarwal & Karahanna, 2000), and medium richness (Trevino *et al*., 1987). Our understanding construct seems related to Web site navigation (Palmer, 2002) and ease-of-use (Davis, 1989) as well as aspects of usability. Future research needs to study relationships between constructs emerging from different theoretical lenses to look for synergies and commonalities that may strengthen understanding of Web perception phenomena at the levels of Web page objects (such as banners or animations), Web pages, Web sites, Web-based systems, and Web communities.

Conclusions

Designing Web home pages is a challenging task. Not only do designers have to understand the potential users' frame of mind, they also have at their choosing a stupefying array of attributes – including numerous font types, audio, video, and graphics – all of which can be arranged on a page in different ways, compounding the complexity of the task. Our theoretically grounded approach, by mapping users' cognitive environment in terms of coherence, diversity, and mystery and their influence on attitude and behavioral intentions, should aid designers in understanding users' perceptions of the Web page at a molar level (in a relatively more holistic way) and, potentially in choosing and arranging various molecular attributes on a Web page. Versatile and reliable scales not only could be used in pre- and post-tests and complement extant behavioral and automated methods of Web page analysis, they should also help in advancement of further knowledge of Web browsing behavior. In the end, we believe our approach represents an attempt consistent with Shneiderman's (1997, p. 5) vision that 'foundational cognitive and perceptual theories will structure the discussion and guide designers' of Web environments.

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