Visualizing *the* Web

EVALUATING ONLINE DESIGN FROM A
VISUAL COMMUNICATION PERSPECTIVE

EDITED BY Sheree Josephson,
Susan B. Barnes, & Mark Lipton

Introduction

Visualizing the Web

Sheree Josephson
Susan B. Barnes
Mark Lipton

We all see Web sites—and there are a lot to see. In July 2008 Google search engineers gazed in awe at statistics showing the number of unique URLs on the Web—1 trillion, as in 1,000,000,000,000 (Alpert & Hajaj, 2008), and they reported that the number of Web pages grows by several billion each day. The average U.S.-based Internet user visits more than 80 domains each month, logs about 2,600 page views, and spends just 56 seconds on each Web page (NielsenWire, December 2009). During approximately 64 hours online every month (NielsenWire, December 2009), Web users see a visual landscape filled with eye-popping color, animation, video, photographs, illustrations, graphics, logos, advertising, navigation, headlines, text, hyperlinks, search boxes, and more.

Over the years, a great deal has been learned about how to create, navigate, and map this visual landscape. For example, if you want to learn how to make the number of URLs a trillion-and-one, you will find a wealth of information on the technical and functional aspects of Web site design. If you need advice on navigating or surfing the Web, you can ask almost any teacher, librarian, or even elementary school–age child. As for mapping all this digital information, Google is now on its way to following links for a quadrillion URLs. However, there is a relative lack of literature emphasizing how to analyze the visual and aesthetic aspects of Web page design.

This introduction reviews some of the recent scholarly literature evaluating various visual aspects of Web page design. These studies use a variety of research methodologies and come from varied fields of interest, including graphic design, marketing, journalism, human-computer interaction, information technology, visual perception, and cognition.

The next eight chapters show how Web page design can be analyzed specifically from a *visual communication* perspective. *Visual communication* is an emerging field, which has its roots in and makes its connections to numerous disciplines

concerned with the creation, perception, and interpretation of visual messages. The scholars featured in this volume describe research methodologies in this new transdisciplinary field of *visual communication*. Their work allows us to see the sites from new visual vantage points—metaphorical, cultural, and rhetorical; cognitive, perceptive, and evaluative; and as socially constructed, by the visually literate. Following these eight chapters by visual communication scholars is an interview with Hillman Curtis, one of the foremost Web page designers in the world. His innovative and award-winning work has led critics to confer upon him the moniker of the "Michael Jordan" of Web page design (Handler, 2003). Curtis provides insight into the process of creating Web sites that are both visually pleasing and usable.

Visual Appeal and Aesthetics

Due to the trillion URLs currently found on the Internet, Web page designers have to work hard to grab attention, to stand out. "Attention Web designers: You have 50 milliseconds to make a good first impression!" exclaims the title of a 2006 study (Lindgaard et al., 2006) designed to ascertain how quickly people form an opinion about a Web page's visual appeal. Some researchers (Tractinsky et al., 2006) argue that there may be even less time—as little as 10 milliseconds. These studies suggest that visual appeal and aesthetics factors are detected first when someone opens a Web page. And extreme attractiveness ratings—both positive and negative—appear to be formed faster than moderate evaluations (Tractinsky et al., 2006).

This almost-instantaneous first impression of the visual appeal of Web pages appears to persist, to remain consistent over time. Fernandes (2003) showed participants 100 Web pages for half a second (500 milliseconds), asking them to rate visual appeal on a scale of "very attractive" to "very unattractive." To evaluate the reliability of the ratings, participants repeated the procedure with the same pages in a different random order. Ratings of visual appeal for both viewings were extremely highly reliable.

The opinion that a Web page is extremely appealing may persist even after the user encounters usability problems. One study (Lindgaard & Dudek, 2002) found that participants continued to highly value a Web page that they found to be "extremely" visually pleasing even after they were unable to successfully complete a task. Apparently, the visual enjoyment of a Web page may be strong enough to overcome subsequent experience with that page.

Hartmann, Sutcliffe and de Angeli (2007) suggest how expressive aesthetics can override a user's poor usability experience, determine user satisfaction, and even positively influence content (p. 26). Kim and Fesenmaier (2008) discover "that visually appealing stimuli are the most important tool for converting Web site lookers to users and/or making them stay longer on the Web site" (p. 10). These researchers boldly demonstrate that visually appealing design-related features are primarily what drive people's first impressions of a Web site. Their research findings also clearly identify usability as "the second-most-important driver of first-impression formation, followed by credibility" (p.10).

Research shows that credibility is itself impacted by visual appeal with Web sites possessing higher aesthetic treatment also judged as having higher credibility (Robins & Holmes, 2008). Karvonen (2000) similarly found that beauty and simplicity in Web page design affect viewers' feelings of online trust, concluding that a discussion about Web page quality or even usability is actually a discussion of aesthetics.

However, visual appeal and aesthetics—like beauty—are concepts difficult to define. In the early days of the World Wide Web, Foss (1993) took on this challenge. She said visual appeal is simply what attracts viewers to visual messages, emphasizing that something novel or interesting is required to draw their interest. On a practical level then, Web designers must create pages that move past the ordinary or their work won't get noticed on the Internet with more than a trillion sites to be seen.

A number of researchers are striving to identify some general visual characteristics that may affect the immediate impression of visual appeal. Other researchers are concentrating their efforts to study particular visual practices widely accepted to be aesthetically pleasing or appealing to Web users.

Visual Characteristics and Usability

Lindgaard et al. (2006) asked Web page viewers to offer their opinion on seven general Web design characteristics: simple-complex, interesting-boring, clear-confusing, well designed-poorly designed, good use of color-bad use of color, good layout-bad layout, and imaginative-unimaginative. Only two of the seven characteristics—complexity and clarity—were not highly correlated with visual appeal. Furthermore, Lindgaard et al. found that those five visual characteristics highly correlated with visual appeal were also highly correlated with each other. This line

of research provides a valuable look at the overall characteristics that contribute individually and collectively to make a Web page visually appealing.

More commonly, researchers study what may be termed visual practices. In particular, they investigate how best to use animation, navigation, layout, white space, fonts, and visuals of various kinds. A variety of research methodologies are used in these studies.

Animation has been studied using electrocardiograms and eye trackers. Fang-fang and Shyam (2004) investigated the effects of pop-up windows and animation in banner ads on online users' orienting responses using an electrocardiogram to measure heartbeats per second. They found that pop-up ads elicited stronger orienting responses than banner ads but noted no difference in orienting responses for animated versus static banner ads. Using a paper-and-pencil recall questionnaire, they found that ad recall was higher for pop-ups than banners. In an eye-tracking study, Josephson (2004) concluded that location was more important than animation in determining whether or not Web users look at banner advertisements. Placing an ad on the top of the page as opposed to the bottom dramatically increased the chances that a viewer would pay attention to it. Movement in the banner advertisement only slightly increased the chances it was noticed. Faraday and Sutcliffe (1999) compared four designs of animation in their eye-tracking study. Based on their results, they recommend that contact points or co-references between animation and text should be designed into Web pages.

Originally attributed to Euclid, the Golden Section has been used to achieve visual harmony in many contexts (Stuart, 2006). Now it is being applied to Web page design. The Golden Section helps to determine size, proportion and layout in design projects. It is frequently used to determine the screen ratio—32:68, for example—between the navigation and content areas. Using a computer-controlled experiment where participants completed an information-retrieval task, results showed that the effect of screen ratio (i.e., between the width of the menu area for navigation and the content area that displays information) on task performance and subjective outcomes was statistically significant (van Schaik & Ling, 2003). However, surprisingly, this research demonstrated that the Golden Section as a screen ratio resulted in poor task performance in terms of speed, accuracy, and display quality. Best ratios were 23:77 for speed; 23:77, 28:72 and 33:67 for efficiency; and 28:72 for display quality (van Schaik & Ling, p. 192). From this study, it appears that the most pleasing proportion depends on the purpose of the design.

White space, the empty area between elements in a graphic composition, is an important design tool used to separate and group the parts of a Web site. Howev-

er, most recommendations about white space on the Web do not distinguish the varied uses to which white space can be applied. One study (Zdralek, 2003) found that the amount of white space used in "gutters" did not affect the speed of in-page navigation.

The management of white space and clutter is important to the design of user interfaces and information visualizations, allowing improved usability and aesthetics. Yet, clutter is not a well-defined concept in the layout of Web pages. Rosenholtz et al. (2005) presented a "Feature Congestion" measure of display clutter. This measure is based upon extensive modeling of the saliency of elements of a display, and upon a new operational definition of clutter, emphasizing the two features of color and luminance contrast. Results showed good agreement between observers' rankings and this measure of clutter.

The readability and legibility of typefaces on the Web has been studied by a number of researchers by measuring reading speed and efficiency, by tracking eye movement, and by gauging opinion. Bernard et al. (2002) concluded that the sans serif typeface Verdana is the best choice for onscreen type because it is read fairly quickly, is perceived as being legible, and is the most preferred. Josephson's results (2008) concurred. The font designed specifically to be read onscreen was processed more quickly with fewer regressions or backward eye movements—and it was preferred by the most readers.

The power of pictures in all media, not just the Web, is widely accepted. In a study of use of pictures in an Internet news magazine, Knobloch, Zillmann and Callison (2003) found viewers were more likely to read articles associated with "threatening" rather than with "innocuous" images, and they were likely to spend more time with those articles. In addition, articles without images received the least amount of selective reading. In an eye-tracking study by the Poynter Institute (2007), researchers found that large photos and documentary photographs drew more eyes than small photos or staged pictures. Poynter's results also showed navigation was the first stop for online readers.

To study Web navigation, Sorrows (2006) asked participants to recall from memory possible navigation paths and URLs. Results validate a theory that three types of characteristics—visual, structural, and semantic—are important for effective landmarks on a Web site. Two measures of landmark quality were used to examine the characteristics of landmarks: one, an algorithm that incorporated objective measures of the visual, structural, and semantic characteristics of each Web page; and the second, a measure based on the experimental data regarding

subjects' knowledge and evaluation of the page. Significant positive correlations were found between the objective and subjective landmark measures.

Another study (Zimmerman & Walls, 2000) reported preliminary analyses of research designed to compare the navigational patterns users follow on Web pages organized in Web structure and Web pages organized in hierarchical structure. The results suggest no significant differences in participants' perceptions of the navigation of the sites and the sites' ease of use.

The evaluation of these various visual characteristics and the production of well-designed pages have become important discussion topics in the literature of Web page design. In the field of human-computer interaction, researchers (e.g., de Marsico & Levialdi, 2004; Strain & Berry, 1996) argue there is much to be gained by understanding users' expectations and experiences in navigating this digital world, an approach that might be termed user-empowered design. Singh, Dalal, and Spears (2005) concluded that to design aesthetically pleasing and effective Web pages, it is necessary to account for the fundamental drivers of users' perception of Web pages. They proposed a theoretical framework to measure the users' reactions to home pages, an approach they hope can serve as a guide to Web page design along with heuristic and intuitive approaches. Similarly, researchers such as Park, Choi, and Kim (2004) have compared users' needs and designers' desires, finding that users do not always experience the kinds of impressions that designers intend to convey through their Web pages.

In a related line of user-related research, Park (2007) seeks to define some fundamental characteristics of design for the online experience by looking to examples where online participation is both immersive and empowering for the Web viewer. Park's work draws on principles of co-creation from "Net art" and the capacity of users to create alternative identities and experimental modes of being. It seeks to identify those characteristics that make online experiences truly compelling, re-conceptualizing the relationship between user experience, interaction processes, and design elements. This research contributes to the field of Web design by offering a conceptualization of the user experience that escapes the current limitations of both graphic design, which is focused on the visual, and usability design, which is focused on functionality.

Visual Characteristics and Interactivity

An important characteristic of functionality is interactivity because the interaction between Web site and user is what makes a site successful. Steuer's (1992)

definition of interactivity is "the extent to which users can participate in modifying the form and content of a mediated environment in real time" (p. 84). Liu and Shrum (2002) explored the definition and influence of interactivity on advertising. They describe three aspects of interaction, which include user-machine, user-user, and user-message. Barnes (2003) agrees with these three aspects; however, she defines them as human-computer interaction, interpersonal interaction, and information interaction.

A number of communication scholars (Kiousis, 2002; Mcmillan, 2002; Richards, 2006; and Sundar, Kalyanaraman, & Brown, 2003) have researched the topic of interactivity. Mcmillan (2002) developed a four-part model of cyber-interactivity. The model includes feedback, mutual discourse, monologue, and responsive dialogues. These elements are designed as a heuristic device to help Web designers think about their creative process. One aspect of the method, for example, describes how designers might increase feedback opportunities by increasing participants' level of control over the communication process (p. 285). Feedback is also discussed by Kiousis (2002). He believes that feedback or the ability for receivers of messages to respond to senders is a major component of many interactivity conceptions, saying "Communication is seen as a dynamic, interdependent process between senders and receivers" (p. 359). In addition to sending and receiving messages, Richards (2006) examines the generation aspect of interactivity. Instead of viewing interactivity as a communication process, Richards explores the activity of interactivity and the production of interactive products, today called user-generated content.

Business scholars have researched many aspects of interactivity. Shaw (2001) examined the relationship between interactivity and stickiness in Web sites, saying "Stickiness involves retaining users and driving them into the site" (Shaw, 2001, p. 4). She analyzed the differences between .com and "not.com" Web sites. The relationship between the user and marketing Web sites (.com) is a topic of great interest to business scholars. Others who have done research in this area are Hoffman and Novak (1997); Ko, Cho, and Roberts (2005); Liu and Shrum (2002); and Sicilia, Ruiz and Munuera (2005). In marketing, interaction is researched to better understand how users are searching and retrieving information.

Visual Search and Information Retrieval

Various visual characteristics—especially color, layout, motion, and fonts—have been studied extensively in regard to visual search of Web pages. In addition, cha-

racteristics of the Web users—especially age differences—factor prominently into some studies on search behavior. Finally, usability research often focuses on how to make pages more "friendly" so that users can quickly accomplish their tasks or find the information they are seeking.

In a study that varied color combinations on six mock Web designs, the perceived attractiveness of the page as determined by users was found to have a statistically significant effect on their perseverance with the search task (Nakarada-Kordic & Lobb, 2005). In another study, pages with higher contrast between text and background color led to faster searching and were rated more favorably by visual searchers (Ling & van Schaik, 2002). Research (van Schaik & Ling, 2001) examining the effect of background contrast combined with frame layout showed an effect of layout both on accuracy and speed measures with frames located at the top left of the screen leading to better performance. While no main effect of contrast was found in this study, there was an interaction between layout and contrast in reaction time.

In an eye-tracking study using realistic Web pages (Grier, 2004), participants searched for specific targets, but neither motion nor position dominated target detection or gaze behavior. In another eye-movement study, this one evaluating specific design features for a prototype Web portal application (Goldberg et al., 2002), researchers found a preference for horizontal over vertical search and that header bars are not reliably visited or used for navigation cues.

Link colors and format have also been commonly studied in visual search studies. Ling and van Schaik (2004) investigated whether there is an effect of link format on speed and accuracy of visual search in both the navigation and content areas of Web pages. The format of links was found to affect the speed of visual search in both areas, but not accuracy. Participants expressed the highest preference for bold and underlined links, regardless of screen area. Pearson and van Schaik (2003) concluded that the design convention of blue links should be retained because responses for blue were found to be significantly quicker than red. An effect of presentation position was also found, with support for menus on the left or right with evidence that Web users might have formed automatic attention responses to specific Web page designs. Halverson and Hornof (2004) conducted a study offering empirical support for the design recommendation to differentiate visited and unvisited links by color.

Line length, alignment, and font have all been studied in regards to information retrieval in Web pages. Varying text presentation has been found to have a significant effect on task performance with wider line spacing and left alignment

leading to better accuracy and faster reaction times (Ling & van Schaik, 2007), longer line lengths facilitating better scanning, and shorter line lengths leading to better subjective outcomes (Ling & van Schaik, 2006).

The intersection of visual and semantic properties has been another popular topic for scholars studying visual search on Web pages. One study showed how the visual salience of items interacts with semantic cues about the usefulness of the distal sources of information (Tomborello & Byrne, 2005). Another showed that not only does visual discriminability play a role in target detection during search but also that the semantic relatedness between the target and distractor affects detection.

How the age of Internet users affects search on Web pages has been studied by several researchers. Reaction time, eye movements, and errors were measured during visual search of Web pages to determine age-related differences in performance as a function of link size, link number, link location, and clutter (Grahame, Laberge, & Scialfa, 2004). Increased link size from 10- to 12-point improved performance, whereas increased clutter and number of links hampered search, especially for older adults. Results also showed that links located in the left region of the page were found most easily. In another eye-movement study on the effects of age, Josephson and Holmes (2004) found preliminary evidence that older adults who are avid Internet users are able to rapidly and accurately find information, while children who have never known a world without the Web don't behave all that much differently from teens or adults who performed the task most efficiently.

Bing et al. (2004) used eye-movement measures to explore whether individual differences of subjects as well as Web site complexity and page order of viewing impacted ocular behavior. Results indicated gender differences and page-order differences. A scanpath analysis (simply put, the path our eyes follow when looking at an image) revealed that the complexity of Web page design influences the degree of scanpath variation among different subjects on the same Web page.

Search is often used to determine the usability of a Web site, but other tasks may be used as well. Russell (2005) measured users' eye movements while they completed a series of tasks on one of three e-commerce Web sites. This study found a high level of agreement in eye-tracking measures and traditional usability performance measures. For example, the number of fixations correlated to time spent on task.

The usability of Web sites displayed and viewed on smaller and smaller screens is becoming an increasingly important issue. With the increase in personal digital assistants (PDAs) and cell phone ownership and a rise of wireless services,

Web users are increasingly browsing the Internet on palm-sized screens. However, the tiny screens of mobile devices limit the usability of information browsing and searching. Researchers (e.g., Ahmadi & Kong, 2008) are working on methods to adapt a desktop presentation of visual information to a mobile presentation. Ahmadi and Kong's work analyzes both the document object model (DOM) structure and the visual layout to divide original Web pages into several subpages, each of which includes closely related content and is suitable for display on small screens.

Visual Information Processing

It's one thing to find information on a Web page, but another to visually process it. Visual information processing is the ability to recognize, interpret, understand, and recall what is seen in order to integrate that information with other sensory information and past experience in order to act appropriately on the environment—in this case, the Web. Visual information processing is impacted by a person's ability to distinguish visual similarities and differences and figure from ground, to fill in partially complete visual information, to realize visual form constancy when objects are shown in various orientations, to perceive spatial relationships and visual sequence, among other things.

Some authors (e.g., Marks & Dulaney, 1998) present a number of principles of visual information processing relevant to the design of Web pages in the hopes that such principles will aid designers in developing Web pages that are easy to search and browse and that promote interaction. Some of the topics discussed are distal and proximal stimuli, data-driven processing and conceptually driven processing in perception, sensory constraints on perception (contrast sensitivity and spatial frequency, perceiving and depicting depth and distance), and organizational principles in visual information processing (pattern recognition, the role of scene context in object recognition, the role of context in word recognition, perceptual processes in reading, attention and visual search processes).

The phrase to describe the "organizational principles in visual information processing" mentioned above is the Gestalt effect. The Gestalt effect has to do with the form-forming capability of the visual sense such that figures and wholes are perceived, instead of simple lines and curves. Hsiao and Chou's (2006) work specifically looked at this theory. After experimental research, they proposed a perceptual measure combining Gestalt grouping principles and "fuzzy entropy" to determine the Gestalt-like perceptual degrees for home-page design.

On the Web, problems with visual information processing can interfere with visual performance, the ability to sustain visual attention, and the ability to comprehend and manipulate visual information.

Visual Attention

Visual attention is the orienting of attention to specific kinds of Web content on a page. Eye-tracking studies are a popular way to study what Web page viewers look at as they make their way through visual imagery on the Internet.

Faraday (2000) proposed a model of how users search for information on Web pages that emphasizes Salient Visual Elements (SVEs), which capture attention and draw the eyes to them. The six SVEs most likely to determine the first fixation on a Web page in hierarchical order of importance are motion, size, image, color, text style, and position. Once Web viewers select an entry point, Faraday asserts, they employ Gestalt grouping principles to define the boundaries of the area surrounding the entry point and then scan that area in the normal reading order of the native language. In a later eye-tracking study, Faraday (2001) explored how visual information is viewed on a Web page. He found that larger text was dominant over small, bold and hypertext links were looked at longer than normal text, and when text and images were of similar size that text was more likely to be an entry point.

To track how attention is shifted as viewers look at a Web page, Josephson and Holmes (2002) tested the somewhat controversial and often-discussed theory of visual perception—that of scanpaths. In 1971, Noton and Stark (1971) defined "scanpaths" as repetitive sequences of fixations and saccades that occur upon re-exposure to a visual stimulus, facilitating recognition of that stimulus. Support was found for this theory. Josephson and Holmes (2002) found a statistically significant main effect for cross-viewing comparisons, reflecting a linear trend in which eye paths across a visual stimulus became more alike over time as the same Web user repeatedly viewed the image.

Visual Rhetoric

In addition to visual aesthetics, usability, and the interactivity of Web pages, many designers and scholars are considering the rhetorical effectiveness of Web designs. They are realizing how important it is to effectively communicate the intended message of the designer to the viewer. Ingram (2006), who focused her research on

evaluating the rhetorical effectiveness of higher education Web-page design, claimed that the challenge in creating rhetorically effective Web pages emerged because of the rapid lateral diffusion of HTML, which left a void in theoretical knowledge of Web-page design based on principles of human communication.

Zimmerman (1999) argued that the addition of the rhetorical perspective is critical to the understanding of visual images, including Web pages. She said this perspective should be added to Lester's (2005) six analytical perspectives—personal, historical, technical, ethical, cultural, and critical—essential to an understanding of visual images. In her opinion, only by adding this additional perspective—the rhetorical perspective—can we better analyze and understand Web pages. Sullivan (2001) called for "safe visual rhetoric" to be practiced on the World Wide Web. She discussed the differing concerns and aims that arise from visual design traditions that focus on "prose graphics" versus those that focus on "theatrical graphics," those that really persuade.

Welch (1999) examined the study of rhetoric in terms of electronic media. She identifies nine oral features of electronic rhetoric that can be applied to the Web. The features are: (1) the Web is additive rather than subordinate; (2) the Web is aggregative instead of analytic; (3) the Web is redundant; (4) the Web is conservative; (5) the Web is close to the human lifeworld; (6) the Web is agonistically toned, (7) the Web is participatory instead of objectively distanced; (8) the Web is homeostatic; (9) and the Web is situational rather than abstract. Training in electronic rhetoric involves both visual and verbal abilities. Barnes (2003) said, "By exploring both the content and visual design, Web users can begin to identify the persuasive techniques used by website creators" (p. 111). Welch's electronic rhetoric attempts to make users aware of the persuasive process used in Web sites. One persuasive technique often used in Web sites is visual metaphor.

Visual Metaphor

Kaplan (1990) contends, "In addition to fostering understanding, metaphors serve a rhetorical function by directing attention to some aspects and qualities of objects and minimizing or masking other features" (p. 44). One of the ways pictures, graphics, icons, and other visual images communicate and summarize information is through known visual symbolic connections. Willis (1999) explained that pictures can be used in Web design to present the main content of the Web message in condensed quick-reference visual shorthand, which offers visual metaphors to help cue general references in the viewer's memory. This cueing gives the viewer

help with immediate understanding of the presented information and memory storage for retrieval when the viewer wants to search the Web for this information again. Techniques for generating, recognizing, and visualizing structure that could be used to help ease the complexity in the design of Web sites was proposed by Joyce et al. (1996).

Techniques of visual metaphor are integrated into the computer-mediated experience. Since the first use of the desktop metaphor by Xerox Parc and Apple (Barnes, 2002), metaphors have been part of the user experience. First through human-computer interaction and later in computer-mediated communication, metaphors have helped users to conceptualize computer and Internet spaces. For example, the use of the room metaphor in chat rooms helps to make people think they are talking to someone, rather than writing. Other metaphors include e-mail to conceptualize sending a written letter or message, and the discussion list to foster the idea of sharing ideas with others. Metaphors support the visual thinking process and help people to perceive cyberspace.

Visual Thinking and Mental Models

Complexity of design in Web sites raises the issue of visual thinking. In 1954 Arnheim wrote the book *Art and Visual Perception*. Since that time, a number of scholars have conducted research on visual reasoning and visual cognition. Two examples are Gardner's (1982) *Art Mind and Brain: A Cognitive Approach to Creativity* and Barry's (1997) *Visual Intelligence*. Both of these authors utilize a cognitive approach to explore visual thinking skills.

Similarly, Glenberg (2002) uses a cognitive approach to explore text and images on computers. He relates the abstract symbols of words to the "perceptual symbols" of objects that we see. Comprehending symbols is often "based on perceptual details relevant to forming the symbolic form of experience" (p. 33). Mental images in this context are perceptual images that add meaning to the symbols, often words, being presented. His theory helps designers mesh text and images together. In contrast, Marsh and White (2003) developed a taxonomy of relationships between words and images for Web designers, saying, "The taxonomy develops a common, standardized language for expressing relationships between images and text" (p. 662). Understanding how to present image and text together is an important aspect of Web design.

In a marketing context, Stern, Zinkhan, and Holbrook (2002) created the Netvertising Image Communication Model (NICM), which "reflects the transi-

tional process by which organized stimulus imagery leads to perceiver construction of mental images" (p. 16). The model modified attributes from historical sources to fit the Internet environment. These include "(1) media representation; (2) number of message elements, multiple sensory inputs (words, pictures, movement, sound); (3) nature of message elements, vividness (concrete expressions); (4) format, 'edutainment' (information and entertainment); (5) consumer response, mental picture, and (6) behavioral responses in the marketplace" (p. 19). Their goal is to better understand how stimulus imagery leads to the construction of mental imagery.

In addition to mental imagery, designers also need to be aware of mental models when designing Web pages. Licklider and Taylor introduced the concept of mental models in 1968. They argued that mental models were necessary in computer-mediated communication for people to understand the communication task they were performing. Barnes (2003) explained, "Mental models are the models that people have of themselves, others, the environment, and objects, with which they interact" (p. 15). We use mental models in computer-based communication to better understand the context of the communication. In Web design, mental models are constructed by the designer when he or she frames the Web site as a game, newspaper, or entertainment site. The overall concept for the site helps to establish the mental model.

However, understanding these models can change based on the cultural background of individuals.

Visual and Cultural

As the Internet continues to expand, its content becomes increasingly diverse. A 2002 survey of Web pages ("Internet statistics," n.d.) determined that by far most content was in English (56.4%). The next most popular content was in German (7.7%), French (5.6%), and Japanese (4.9%). A more recent study documented Web searches were being done in 75 languages (Gulli & Signorini, 2005). As Web pages have appeared in more and more languages, studies about cultural and language differences have emerged.

One study (Rau, Qin, & Jie, 2007) investigated the effect of visually rich Chinese Web portals and floating animations on visual search between Chinese users and German users. Results indicated that participants using simple Web portals searched faster, made fewer errors and were more satisfied than participants using the portals filled with a huge amount of information and excessive visual stimuli.

People searching pages with randomly floating animations were found to use significantly more time compared with those searching pages with no animations. Noiwana and Norciob (2006) investigated, in an experimental study, the effects of animated graphic colors on attention and perceived usability of users. Participants searched for target words from text on Web pages containing three animated banner graphics. The results from this study suggested that there are possible cultural differences in interacting with a computer interface.

In a study evaluating the differences in visual components of the design of 900 university Web sites from 45 countries and regions, Callahan (2007) asked this question: Does the design of user interfaces vary across cultures? And if differences in interface design exist across cultures, could they be measured using Hofstede's (2001) five dimensions of culture: power distance, individualism/collectivism, masculinity/femininity, uncertainty avoidance, and long-/short-time orientation. Using content analysis on page layout, directionality, symmetry, length, and color scheme, as well as the presence of news and search engines, results showed significant differences across countries with the exception of page symmetry and centralization. In terms of Hofstede's dimensions, significant correlations were found for the dimensions of power distance and individualism/collectivism.

A cross-language study (Parush et al., 2005) investigated interactions among four visual layout factors in Web page design—quantity of links, alignment, grouping indications, and density—in two experiments, one with pages in Hebrew, entailing right-to-left reading, and the other with English pages, entailing left-to-right reading. Some performance patterns measured by search times and eye movements were similar between languages. Overall, performance was poor in pages with many links and variable densities.

Visual Remediation and Evolution

Another new and rich area of Web-page design research centers on the concepts of visual remediation and the evolution of the Web. Bolter and Grusin (2000) offer a theory of mediation for the digital age that challenges the assumption that digital technologies such as the World Wide Web must divorce themselves from earlier media for a new set of aesthetic and cultural principles. They argue that new visual media achieve their cultural significance by paying homage to and by rivaling and refashioning earlier media, and call this refashioning "remediation." In the case of the Web, Bolter (2000) says it refashions almost every previous visual and textual medium.

Cooke (2001, 2005) conducted several studies using the theory of remediation as a framework. In one study (2001), she analyzed the visual dimensions of news by tracing the interaction of its formal design qualities in print, television, and the Web. Design trends that emerged from this study demonstrate that each medium not only adapts the basic structural navigation and graphical elements of earlier document design, but also influences the visual rhetoric of the other media. The implications for design on the Web include using the modular structure that the news media favors in order to enhance the visual relationship between text and graphic elements, providing more "windows of entry" for users to ease non-linear approaches to documentation, using hypertext-like navigation design elements to help users locate related information, and including graphic elements to aid users who scan for information. In her more recent study, Cooke (2005) explored the longitudinal visual development of five major newspapers, seven networks and cable news programs, and 12 Web sites, finding that a visual convergence of media has become more pronounced over the decades as the acceleration of information has increased over time.

In another longitudinal study of the evolution of Web site design patterns, Ivory and Megraw (2005) analyzed more than150 quantitative measures of interface aspects for 22,000 pages and more than 1,500 sites that received ratings from Internet professionals. They demonstrated that Web site design is a "moving target" (p. 493). Since 2000 many Web pages contradict heuristics from the literature with greater numbers and types of links, more graphical ads, changes in color usage, and in other design practices.

Visual Automated Analysis

The above-mentioned study by Ivory and Megraw (2005) is one in recent years utilizing automated analysis tools to analyze visual aspects of Web pages. Their tool—WebTango—uses quantitative measures, empirical data to develop guidelines, and profiles as a comparison basis. Their approach makes it possible to conduct "context-sensitive analysis" such as the site's genre or the page's style. Sheffield Hallam University has also developed a graphical identity support tool (GIST), which works like robots or spiders used by search engines such as Google, but instead of crawling sites for text content, it takes a thumbnail grab of each Web page and analyzes the visual content (Harwood, 2005). This tool is being used to analyze the visual appearance of Web sites to ensure brand and design consistency. Faraday (2000) has automated the process of visually critiquing Web

pages via visual hierarchy rules to gain a greater understanding of what "good Web page design" means.

Visual Prediction

Some researchers have used quantitative analyses to make predictions about how viewers will look at and rate Web pages. Ivory, Sinha, and Hearst (2001) reported that page-level metrics, including overall page characteristics, predicted whether experts would highly or poorly rate a site, with accuracies ranging from 67 to 80 percent. A year later, they (Ivory & Hearst, 2002) extended this work with a much larger set of measures (157 versus 11), over a much larger collection of pages (5,300 versus 1,900), achieving much higher overall accuracy (94 percent on average) when contrasting good, average, and poor pages. They also created statistical profiles of good sites, and applied them to an existing design, showing how that design could be changed to better match high-quality designs.

Some of the same researchers involved in the studies described above (i.e., Sinha et al., 2001) were involved in an empirical analysis of criteria for award-winning Web sites. They examined the Webby Awards 2000 database to understand which factors distinguish highly rated Web sites from those that receive poor ratings. For the 2000 awards, the Web sites were categorized into 27 topical categories, and experts were recruited for each of these topic areas. The 3,000 Web sites were rated according to visual design, content, structure and navigation, functionality, interactivity, and overall experience. The authors found that the content criterion was by far the best predictor of the overall experience criterion, while the visual criterion was the worst predictor of the overall experience.

Researchers have developed many criteria to determine whether or not a Web site uses "good" or "bad" design. This volume adds to the many research studies discussed above by focusing on the *visual communication* perspective. It describes many different *visual communication* approaches to the study of Web design.

This Volume

The volume contains eight chapters each outlining a separate methodology for evaluating imagery on the Internet from a visual communication perspective as well as an interview with Hillman Curtis, one of the premier Web page designers. Rhetoric, remediation, eye tracking, visual culture, visual literacy, cognition, and usability are all discussed to demonstrate the multidisciplinary nature of *visual*

communication. These diverse research styles use both qualitative and quantitative approaches to their studies.

Sally Gill (Chapter One) uses concepts of remediation to conduct a metaphorical analysis of the Web. She opens this volume with an argument that the Web has evolved from a textual medium to a visual and spatial one. She states that the page metaphor is no longer applicable to the Internet, stating that "Web pages"—text-heavy, vertical scrolling electronic documents—have been replaced by "Web spaces"—media-rich screens where people interact with each other and engage in a variety of activities. Prompted by the desire to create onscreen Web *spaces* rather than Web *pages*, communication designers with backgrounds in art and design draw upon visual and spatial metaphors borrowed from architecture and CD-ROM design. Their terminology—portal, site, site map, image map, information architecture, navigation, browser window—is now part of the Web lexicon. Gill argues that as we observe shifts in creative practice, it is important and appropriate to re-examine the language we use to guide, describe, and analyze that practice. She concludes that Web pages will continue to have a place on the Web, but the page as dominant metaphor no longer provides an accurate conceptual model for either users or designers.

Susanna Paasonen (Chapter Two) situates her discussion of Web sites in the framework of visual media culture—specifically in the histories of the visual practices that precede and run parallel to the development of the Web as a visual medium. She points out that while Web design is a young profession and Web aesthetics have only a brief history, Web graphics appear less novel when considered in the context of earlier visual practices such as print graphics, cartoons, photographs, digital imaging, animation, cinematography, and television. Situating Web visuals in a graphic continuum, Paasonen argues, need not lead to the aesthetic, technological, or historical reduction of Web aesthetics to visual conventions already introduced and circulated in other media. Rather, Paasonen sees historical frames of interpretation as essential to a contextual understanding of how Web visuals develop, how they are used, and how they become situated within broader visual media culture. This contextual understanding of Web aesthetics and visual rhetoric is necessary to understand the development of the Web as a visual communication medium.

Valerie V. Peterson (Chapter Three) makes an argument for using a rhetorical approach—specifically an elemental rhetorical schema—to analyze the visual and spatial medium of the Web. However, while visual rhetorical analysis usually begins the task of visual criticism by identifying *the image,* Peterson's schema begins

the critical task by assessing visual *elements*. She believes this shift in approach avoids many pitfalls—primarily the complexity of perception where vision is not a simple matter of image identification but a matter of piecing together various visual elements. Furthermore, Peterson believes the elemental rhetorical approach appropriately recognizes the postmodern characteristics of Web visuals—fragmented, polymorphous (shape-shifting), polyvocal (many-voiced), and often without explicit or identifiable authors or purposes, or with multiple authors or purposes. According to Peterson, postmodern characteristics are typically overlooked in more traditional rhetorical analysis of Web site visuals.

Craig Baehr (Chapter Four) says the cognitive aspect—how readers think both visually and spatially—has largely been ignored in Web-based environments. His use of the term Web environment (not unlike Gill's Web space metaphor) is purposeful, as he maintains that viewers respond in similar ways to visual stimuli on the Web and visual stimuli in the environment, as suggested by both Gestalt theory and visual thinking. One thing Baehr recommends is that designers realize the user's interpretation goes beyond the perception of the individual visual objects and extends to their spatial configurations on the screen. He also encourages designers to visualize the paths viewers will take as they navigate through Web space. Baehr argues that heuristics for Web site analysis and design require a more complex understanding of user perception and thought than most Web designers are currently employing. A proper understanding of Web sites involves how users think both visually and spatially in solving problems, interacting, and forming concepts about how visual and textual content relate in a site. According to Baehr, only when heuristics are applied that consider these approaches in Web design, will the visual and spatial thinking needs of users be met.

Sheree Josephson (Chapter Five) discusses eye-tracking research as a means of measuring what *elements* are viewed and what *path* is followed as the eyes navigate the Web environment. The eyes are always on the move, making two to five brief stops every second. These quick eye movements, which largely go unnoticed in everyday experience, are necessary for a physiological reason. Detailed visual information can only be obtained through the fovea, the small central area of the retina that has the highest number of photoreceptors. During a fixation, only a small area of the available visual information is selected at any time for intensive processing essential to perception of detail. Josephson discusses how eye-movement apparatuses can record eye-fixation location and duration, as well as scanpath information. She also describes a number of data analysis techniques used to analyze eye-movement data in order to give researchers a glimpse into what

is happening in the brain as a viewer perceives and processes visual imagery on the Web.

While eye-tracking research could be used to evaluate the usability of a Web site, it is just one approach that could be used to look at the visual landscape. Roxanne O'Connell (Chapter Six) proposes a number of usability evaluation methods, including those designed to analyze prototypes and functions throughout the design process, and those used to analyze existing Web sites for improvement and/or socio-technical study. However, O'Connell points out that since the mid-1990s millions of Web sites have launched, largely without any user testing. As a result, she says the Webscape has become littered with confusing and unusable interfaces. According to O'Connell, "Until now, the Web has been a rapidly growing metropolis with no city planning, ordinances, or zoning. The result is often bad or inadequate signage, traffic jams at every intersection, time wasted, mounting frustration, and an overall lack of enthusiasm for making the trip into town." O'Connell's usability evaluation methods help to ensure the trip is worth it. Her step-by-step suggestions are helpful for either design or research, but many are useful for both.

Ulla Bunz and Juliann Cortese (Chapter Seven) discuss in detail one particular usability study with a method designed to elicit terminology, descriptions, and factors from people's use of Web sites—in their own words. Bunz and Cortese believe usability is socially constructed when users interact with a Web site and meaning is created. Specifically, the study asked two research questions: What personal criteria do Web users apply to assess a Web site? and Do Web site criteria perceived positively by subjects match those criteria advocated by the usability literature? Results showed that many of the criteria identified by the Web users were similar to the ones defined in the literature although Web users did not seem aware that they were using formal criteria but instead relying on personal opinions. However, differences emerged when Web users ranked sites based on their experience and then evaluated the same sites based on a usability scale. Results showed that as long as a Web site reaches a certain level of usability, people can make do with it—and may actually enjoy the experience.

Finally, Susan B. Barnes (Chapter Eight) argues that Web users must become visually literate in the new languages—for example, hypertext—introduced into the communicative process by this new medium. Since few visual or verbal symbolic codes, including those used on the Web, have meaning in themselves, users must learn meaning through formal education, exposure to media messages, and interaction with others. Barnes presents a number of critical questions—about

design, usability, and navigation—for Web users to consider when conducting a visual analysis of a Web site. Barnes believes that an awareness of the visual design issues illuminated by these questions combined with some common sense will enable people to better understand how Web sites convey visual messages to users. As the Web becomes a more mainstream medium, users need to develop a set of critical visual skills to understand how Web images can be used to facilitate navigation, manipulate feelings, and persuade viewers to think and feel in certain ways. In Barnes' words, users must become visually literate.

These chapters provide diverse approaches to the examination of visual imagery on Web sites—from the qualitative approach used to understand visual literacy to the quantitative use of eye-tracking equipment. *Visual communication* is a diverse field of study, and we hope that these examples will broaden the discipline and inspire new research to analyze the 1 trillion-plus Web pages. This visual landscape filled with eye-popping color, animation, video, photographs, illustrations, graphics, logos, advertising, navigation, headlines, text, hyperlinks, search boxes, and more is ready to be analyzed from a *visual communication* perspective.

References

Ahmadi, H., & Kong, J. (2008). Efficient Web browsing on small screens. *Proceedings of the Working Conference on Advanced Visual Interfaces*, (pp. 23-30). Italy: Napoli.

Alpert, J., & Hajaj, N. (2008, July 25). We knew the web was big. Retrieved May 6, 2009, from http://googleblog.blogspot.com/2008/07/we-knew-web-was-big.html

Arnheim, R. (1954). *Art and visual perception*. Berkeley, CA: University of California Press.

Barry, A. S. (1997). *Visual intelligence*. Albany, NY: State University of New York Press.

Barnes, S. B. (2002). The development of graphical user interfaces and their influence on the future of human-computer interaction. *Explorations in Media Ecology*, 1(2), 81-95.

Barnes, S. B. (2003). *Computer-mediated communication: Human-to-human communication across the Internet*. Boston, MA: Allyn & Bacon.

Bernard, M. L., Lida, B., Riley, S., Hackler, T., & Janzen, K. (2002). A comparison of popular online fonts: Which size and type is best? *Usability News*, January, 4(1).

Bing, P., Hembrooke, H. A., Gay, G. K., Granka, L. A., Feusner, M. K., & Newman, J. K. (2004). The determinants of Web page viewing behavior: An eye-tracking study. *Proceedings of ETRA 2004: Eye Tracking Research & Applications Symposium 2004*, (pp. 147-154). Texas: San Antonio.

Bolter, J. D. (2000). Remediation and the desire for immediacy. *Convergence*, 6(1), 62-71.

Bolter, J. D., & Grusin, R. (2000). *Remediation: Understanding new media*. Boston: MIT Press.

Callahan, E. (2007). Cultural differences in the design of human-computer interfaces: A multinational study of university Web sites. *Dissertation Abstracts International*, 68(07A), 2703.