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ABSTRACT

The purpose of this study was: (1) to look at the design, aesthetics, and functionality of educational and noneducational Web pages from the perspective of visual literacy; and (2) to evaluate printed and online materials that are used as resources by professionals and nonprofessionals to create these Web pages. These "how to" manuals were evaluated for their discussion of good screen design, the use of graphics and icons as communication, backgrounds, hypertext, linking, and overall understanding of publishing on the World Wide Web. The Web pages were divided into major categories and subcategories. The educational categories included K-12 schools and colleges/universities, and the noneducation categories included commercial, publications and communications, informational and cultural, and personal Web pages. Two evaluation instruments were developed: one contained 21 questions for evaluating online and printed resource materials; a second evaluation instrument contained 57 questions that were embedded in the categories of design, graphics, text, and color. These categories were divided into aesthetics and functionality. Initial data analysis indicates a wide range of quality in all the sites. The commercial sites developed by professionals contained animations and sophisticated graphics which met the evaluation criteria, but tended to target a narrow group of people; some of the Web pages were well designed and met the needs of the general user. Evaluation of the printed and online materials indicates a strong agreement in the use of how to create in HTML language and the technical aspects of using specific image formats for World Wide Web publishing. (Contains 22 references.) (AEF)

Creating Web Pages: Is Anyone Considering Visual Literacy?

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Abstract

This study examines educational and non-educational WWW web pages that exhibit an understanding of visual literacy principles. The study also examines on-line and printed materials that show how to construct web pages. It uses this paradigm to analyze these web pages and printed materials, for qualities that exhibits good design elements from pages that exhibit weak design. It concludes with a recommendation for further research to quantify the qualities that were found.

Introduction

A revolution is taking place -- a digital revolution and the "most crucial task before us is not putting in place the digital plumbing of broadband communications links... but rather one of imagining and creating digitally mediated environments for the kinds of lives we want to lead and the sorts of communities we want to have." (Mitchell, 1996, p. 5). One alteration of this revolution is the digital environment of the graphical user interface (GUI). This environment, once static and linear, has changed. Users relate mutually to screens that are visual, interactive and non-linear (Jones, 1995). Another transformation is the manipulation of images. Electronic tools allow the user to capture, display, distort, enhance, store and print images. These "developing technologies... blur distinctions between actual and represented reality..." (Stieglitz, 1995, p 22).

The Internet, a global network linking millions of people world wide, is a digitally-mediated environment. The Internet is made easily accessible through World Wide Web (WWW) browsers. These interactive browsers, i.e., Netscape, Internet Explorer, Mosaic, include informational displays and access tools presented to users in the form of web pages. These pages, created in a computer language called HTML (Hypertext Markup Language) contain hyperlinks -- graphics, buttons, icons, images, colored text, animation, video -- that allow the users to browse the contents of the page, search and retrieve information, and link to other web pages around the world. Recent developments in on-line communication tools provide the ordinary user the ability to create interactive pages and offer course delivery on the WWW. "The technology to transfer and transmit graphic and other forms of visual communication instantaneously around the globe has made available for communication, a large audience, which is often visually illiterate" (Saunders, 1994, p 186).

Purpose

The purpose of the study was twofold: (1) to look at the design, aesthetics, and functionality of educational and non-educational web pages from the perspective of visual literacy and, (2) to evaluate printed and on-line materials that are used as resources by professionals and nonprofessionals to create these web pages. These "how to" manuals were evaluated for their discussion of good screen design, the use of graphics and icons as communication, backgrounds, hypertext, linking, and overall understanding of publishing on the WWW.

The web pages were divided into major categories and sub-categories. The educational categories included K-12 schools and colleges/universities. The non-educational categories included commercial, publications and communications, informational and cultural, and personal web pages.

The subject of images, graphics, and icons is critical. From a technical aspect, if an image is memory intensive and being viewed with a low speed modem or limited machine capacity, the images load slowly. In creating web pages, the designer must convey to the user ways to access hyperlinks. This is sometimes done through icons, images, or text that act as interactive buttons. When the user clicks on these hyperlinks they are connected to new information, other web sites, or further resources. To be interactive the buttons

must be properly coded in HTML, thus, guiding the user.

The "business of creating web sites" is rampant. Many services, both on-line and printed references offer "how to" construction of web pages. However, little thought is given to the overall image of the page. Usually the focus is on the HTML language.

Background

The explosion of the WWW as an informational tool on the Internet (Descy, 1994) provides students and teachers, at all levels of education, with up-to-date information and continuous access to resources world wide. In effect, the Internet is a virtual library of information (Doyle, June, 1994).

Most recently, the development of electronic utilities provided through WWW links, growth of software that contains HTML readers, and publishing of on-line and printed technical manuals have provided ordinary computer users with the ability to easily access, create, and publish web pages. In particular, K-12 educators have begun to create web pages as a way to provide information about their schools and classrooms, display student work, provide links for student-generated research, and link with other schools to allow students to collaborate with one another in learning activities i.e., creative writing and problem solving.

Colleges and universities also use web pages as marketing strategies to provide information about the programs and courses they offer, as a way for students to apply to these programs or to register for courses. In addition, web pages are being created by college and university professors to offer courses via the WWW.

The increased ability to create web pages that use graphics, icons, and images to communicate a problem comes at a time when "our educational systems have reduced the number of courses in art education and.... the availability of courses in visual literacy that would advance seeing and interpreting what is seen are only recently finding support in the educational system" (Saunders, 1994, p 187). Thus, many educators and students creating web pages have had little guidance concerning the visual design elements. The myriad of technical manuals provide information about how to create web pages but they don't specifically address the necessary design elements that will help the web page communicate clearly and appear aesthetically pleasing.

Visual design is a significant factor in the development of web pages. The "...visual medium is...superior because it offers structural equivalents to....objects, events, relations and visual elements that can be "organized according to readily definable patterns." (Arnheim, 1969, p. 232) Visual representations in the form of icons, graphics, and images are defined in two- and three-dimensional space as compared to the one-dimensional space of text (1969). According to Saunders (1994, p. 186-187), these visual representations (graphics) function as a communication tool because they are:

- based on things that are seen
- appeal to our emotions as well as intellect
- convey a single overwhelming meaning or message
- communicate information
- comprise a language and grammar of which most of us are ignorant
- are not designed to encourage feedback from the audience

Effective web pages contain good screen design, graphics, icons, background images, image maps, and hypertext. The construction of web pages involves an understanding of the use of these elements. This understanding is inherent in the aesthetic and technical function of informational and form design as well as graphical user interfaces.

"Good screen design uses the visual to portray the message to the reader." Text with white space, the position of graphics, mixture of text and graphics, consistent placement of navigational buttons, standard icons, and borders act as visual aids to the user (Knupfer, 1994, p. 216).

Graphics are used to make visual statements -- to communicate visually. Visual statements are "an object or collection of objects created or assembled for the purpose of being seen and experienced" (Curtiss, 1987, p. 4). Visual statements contain visual symbols that include shape, color, dot, line, and style. (Such statements also include form -- the expressed ideas and conveyed meanings behind the elements that give support to the communication of the visual statement (Seels, 1994). To effectively communicate

with visuals, creators of web pages must consider the simplicity and clarity of the images, balance, harmony and organization of the text and images, aspects of framing, and emphasis color, texture, and space. (Thompson, 1994).

Icons to serve as "reference points....for searching and retrieving information" (Ma, 1995, p. 33). Icons also can be used as signs. Signs are "...organized into systems of meanings or codes" (Muffoletto, 1994). Signs can also be influenced by social and cultural meanings. Ma (1994) studied the meanings of icons on the WWW pages of 150 United States libraries. A sample of icons Ma found included an icon depicting a web overlaid with a magnifying glass to depict Internet resources, book-shaped icons that represent on-line catalogs, periodicals, etc., and icons that portray a highway to catalog Internet resources. Semiotic analysis of icons indicated that familiar icons used to index traditional library resources were being used to index resources indicative to the resources on the WWW

Backgrounds and background images are important design components. Used appropriately, background images can enhance the foreground icons, graphics, and text. Many novice designers include these images to "add a theme...or because they fill up unused space" (Siegel, 1996, p. 131).

Image maps (complex images that produce multiple hyperlinks) contain visual, navigational, and practical characteristics. Visual characteristics are clues that are recognized by the viewer and meet the viewer's expectations pertinent to the information. Navigational characteristics include the viewer recognition and initiation of linked information being used to index resources indicative to the resources on the WWW.

Practical characteristics include technical aspects such as image load time, background and special effects not cluttering the vision of the viewer, and whether graphics fit the target audience (Cochenour, Lee, and Wilkins, 1995). Cochenour and others (1995) evaluated nine WWW sites that contained image maps for visual, navigational, and practical characteristics. Nine viewers evaluated the sites and "they seemed to judge the degree of appeal by how easily they could get to information" (p. 170). The web sites receiving the highest ranks contained simple images and a well-ordered layout with clearly defined hot spots and a limited number of choices. Hypertext links are critical to web page design. These links are words or phrases that are underlined and colored to denote a link to more information or other web sites. The conventional use of color displays the "unvisited" links as blue and the "visited" links as purple.

This study investigated the use of these design elements in software and printed materials that tell how to create web pages and in the web pages created by students and teachers in elementary, middle, and high schools as well as those in colleges and universities.

Methodology

For this research the web sites were categorized into two main groups, educational and noneducational. Then each of those larger categories were further subdivided. Figure 1 shows the organization of the educational web page site categories and Figure 2 shows the organization of the non-educational web page site categories.

Development of Evaluation Instrument

Considering there is no previous research about designing web pages from the perspective of visual literacy, the researchers began by examining the literature for checklists that related to the basic elements of visual statements, GUI design, hypermedia design, and publishing on the WWW (Curtiss, 1987; Lucas, 1991; Schwier, 1991; Cates, 1992; Tolhurst, 1992; Wiggins, 1995). From these checklists two evaluation instruments were

Figure 1
Educational Web Site Categories

Elemenentary School
Student, Teacher, School
Middle School
Student, Teacher, School
High School
Student, Teacher, School
College or University
Student, Teacher, School

Figure 2
Non-Educational Web Site Categories

Commercial
- **Company Information about Products**
- **Product Instruction -- how to Use**
- **Advertising**

Publications / Communications
- **Newspapers /Magazines**
- **Radio / TV**
- **Journals / Books**

Informational / Cultural
- **Museum / Library**
- **Community**
- **Special Interest**

Personal
- **Professional**
- **Family**
- **Introduction**

developed and refined based upon a six-point Likert-type scale. One instrument contained 21 questions for evaluating on-line and printed resource materials. Examples of the evaluation criteria in this instrument are:

- Contains introductory information about the general WWW environment
- Use of browsers
- Explanations of image formats (tiff, pict, jpeg, gif, etc.)
- Use of color
- Links
- Publishing on the WWW
- Examples provided
- Emerging trends

A second evaluation instrument contained 57 questions that were embedded in the categories: design, graphics, text, and color. These categories were divided into aesthetics and functionality. These questions were used for evaluating K-12 schools, and college/university web sites. This instrument was also used to evaluate informational and cultural as well as personal pages. A sample of the evaluation criteria include:

Design -- aesthetics
- Design elements are aesthetically consistent (consistent headers, background, font sizes, etc.).
- The page has appropriate white space.
- The background contributes to the overall design.

Design -- functionality
- The design appears to be created for lay computer users not experts.
- The message is clear.
- The message is concise.
- The site appears to be current.
- A text only option is available when large graphics load slowly.
- The links function properly.
- Graphics load with reasonable speed.

Graphics -- aesthetics
- The graphics do not distract the user from the main message of the page.
- The graphics that are intended to be buttons look like buttons (easily recognizable as buttons)
- The graphics that are not intended to be buttons do not look like buttons (you do not do false clicks hoping to go somewhere).
- Graphics are easily interpreted.

Graphics -- functionality
- The site uses appropriate thumbnail graphics (user doesn't need to use time and memory loading in memory intensive graphics).
- Graphics enhance the message of the page.

Text -- aesthetics
- The properties of the text (font, style, size, color, pattern, etc.) are aesthetically appealing.
- The color of the text is aesthetically compatible with other design elements on the page.
- The layout of the text is aesthetically pleasing.

Text -- functionality
- The color of the text does not distract the user from the main message of the page.
- The layout of the text does not distract the user from the main message of the page.

Color -- aesthetics
- Color changes are used to convey a message (visited links, happy-sad, day-night, timed elapsed, etc.)

- The design makes use of warm (red, orange, yellow) and cool (purple, blue, green) colors.

Color -- functionality

- The design of colors considers the age of the final user.
- The color scheme is appropriate for color-blind users.
- The background color is aesthetically pleasing.

WWW Site Selection

Sites were randomly selected from the web. Various descriptors, such as, creating web pages, HTML, web page design, and so on, were used in various search engines to illicit web sites containing resources about how to create web pages.

An initial list of publishers who produce information about how to design and create web pages was constructed based upon a search of on-line, bookstore, and library materials. Over 100 electronic sites and 25 printed manuals were evaluated. The web page sampling source for schools and colleges/universities was gathered from the Yahoo search engine using the education category. Twenty sites were randomly selected for each elementary, middle school, high school, college and university (n = 160). The K-12 web sites included both public and private United States schools. Higher education sites included public/private colleges and universities in the United States and four countries around the world.

Independent Evaluators

Four graduate students majoring in educational technology at a major mid-western university evaluated the commercial, informational, cultural, on-line and printed materials, and personal web sites. K-12 school and college/university web sites were evaluated by an associate and an assistant professor of educational technology. Both professors teach the use of the Internet and the WWW to graduate students.

Results

Initial data analysis of graphics, text, color, and design characteristics within the components of aesthetics and functionality indicates a wide range of quality in all the sites. The commercial sites developed by professionals contained animations and sophisticated graphics which met the criteria for evaluation but they tended to target a narrow group of people. For example, product information sites can be very technical and difficult for the common user to understand. An example is the *About Abbey Camera* (http://abbeycamera.com/) web page. This site is targeted for general audiences but the navigational icons are not consistent and tend to mislead the user as to their use.

Some of the web pages are well designed and meet the needs of the general user. Examples of such sites are the *JC Penney's* and the *Ben and Jerry's Ice Cream* sites (see the sites at http://www.jcpenney.com/ and http://www.benjerry.com). The meaning and the matching of the text and the images are consistent and appropriate for general adult users. *Federal Express* (http://fedex.com/), *Land's End* (http://www.landsend.com/ are examples of sites that target specific users. These sites contain icons and links that guide users who want to find shipping information, ship parcels or order items. The icons are understandable and link to pertinent information about shipping parcels and other aspects of the each companies' business.

Evaluation of the printed and on-line materials indicates a strong agreement in the use of how to create in HTML language and the technical aspects of using specific image formats (gif, tiff, jpeg, mpeg) for WWW publishing. Examples of these printed and on-line publications include:

Fry, A. and Paul, D. (1995). *How to publish on the internet.* New York, NY: Warner Books;

Danesh, A. (1996). *Teach yourself web page design.* Indianapolis, IN: Sams.net Publishing

Home page creator [On-line]. www.angelfire.com/freepages/create.html

Netamorphix [On-line]. http://trace.wisc.edu/TEXT/GUIDELNS/HTMLGIDE/htmlfull.html

Lynch, P. (1995). *Yale C/AIM WWW style manual* [On-line]. http: //info.med. yale. edu/ caim/ printinfo. html

Niederst, J. & Freedman, E. (1996). *Designing for the web: Getting started in a new medium*. Sabastopol, CA : O'Riley 7 Associates, Inc..

Rogers, S. & Wise, A. (1996). *Home page beautiful*. Radiant Productions. [On-line]. http://click.com.av/click/v03/deconstruction/index.html

Wilson, S. (1995). World wide web design guide: Learn to design professional web pages . Indianapolis, IN: Hayden Books.

However, there is little agreement on the inclusion of elements of good screen design, appropriate size of graphics, use of icons for navigational purposes, and designing the screen as a portrait. (That is, the message is the object and the portrait is the screen.) Still, there are exceptions in both print and on-line publications. The authors discussed the use and aesthetics of images, backgrounds, text, graphics functionality and emerging trends. The user is provided with examples in the printed publication that correlate to examples in the on-line publications. These include:

Horton, W., Taylor, L., Ianacio, A. & Hoft, N. (1996). *The web page design cookbook: All the ingredients you need to create 5 star web pages*. New York, NY: John Wiley & Sons, Inc.

Horton, W. (1966). *Illustrating computer documentation*. New York, NY: John Wiley & Sons, Inc.

Siegel, D. (1996). *Creating Killer Web Sites*. Indianapolis, IN: Hayden Books. [On-line] http://www.killersites.com.

Evaluation of school sites indicates a strong use of backgrounds that tend to distract from the overall message. School sites tend to use text rather than images to present information. They use text whose properties (color, font, style, size) are difficult to read because the background interferes. Also, they use text that is targeted for adult users rather than the age of students attending these schools. Examples of these sites include:

Bethesda-Chevy Chase High School [On-line]. www.mcps.k12.md.us/schools/bcchs/

Chaffee Elementary School [On-line]. www.traveller.com/~lpearce/Chaffee/Chaffee.html

Fall Brook Union High School [On-line]. sd.znet.com/~schester/FUHS/index.html

Hardyston Township Elementary School [On-line]. www.garden.net/users/hardyston/non-enhanced.html

Longfellow Elementary School [On-line] www.nothinbut.net/~dhannah/xlongfel.html

Orange Grove Elementary School [On-line] www. awod. com/ gallery/ rwav/ oge/

Quail Run Elementary School [On-line] www. sped. ukans. edu/ ~scottk/ qr/

Examples of K-12 schools whose web sites contain good screen design, graphics that are aesthetically and functionally appropriate include:

Brookfield Central High School [On-line]. www. axisnet. net/ ~bchs/

Burke, Harry A. High School [On-line]. www. esu19. k12. ne. us/burke/BHS.html

Kyerene Akimel A-Al Middle School [On-line]. 204.17.16.101/Akimel/ams.html

Robinson, Andrew Elementary School [On-line]. www. rockets. org/

A further analysis of school sites indicates that the functions of graphics are not always apparent. Graphics which were not intended to be buttons looked like buttons, thus confusing the user.

Whereas K-12 schools use web sites as a way of introducing themselves to the WWW and promoting their school community, colleges and universities use their web sites for a variety of purposes, i.e., new student application, on-line registration, promotion, on-line courses, announcements, faculty and student homepages. Data for colleges and universities indicates a strong agreement in the areas of good screen design, use of color, white space, and icons that are effective navigational tools. Examples include:

Arizona State University [On-line]. www.asu.edu/asuweb/

College of the Menominee Nation[On-line] www.menominee.com/

Design functionality data regarding the updating of information, clues that reflect the information size, or provide a text only option when memory-intensive graphics are present indicates strong disagreement among all many K-12 schools and colleges and university web sites. However, many commercial, personal, and educational web pages contain indications of last update, informational size or provide a text option.

Conclusions

1. Preliminary data analysis indicates that the majority of the web pages use a simple design, with the standard blue and purple colors used for unvisited and visited sites.
2. Few web pages contained clues that would indicate the size of the files in the site.
3. The majority of web page backgrounds used distracting patterns and/or color.
4. In many cases the designers seemed to forget to maintain message of the page.
5. There was a tendency in most of the personal pages not to indicate the path the user is following. The user should be able to tell where he or she came from, how to go back and find his or her way around.
6. Many sites did not indicate whether the site had been updated. This may lead the user to loose interest in the site.
7. In many cases, graphics that looked like buttons were not.
8. The use of thumbnail graphics was minimal.

Recommendaations

The next phase of this study is to perform an in-depth data analysis. Following that, a formal evaluation of the data should be completed. From a preliminary analysis, the following considerations merit investigation:

1. Should the elements of the visual arts, dot, line, color, text that have been standard for decades apply to the medium of on-line publications?
2. Which literary publicatioon conventions should or should not be applied to the unique environment of web pages?
3. In what ways do the questions of interactivity, connection and interconnections, user control, and expeditious information gathering contribute to new publishing conventions?
4. How does the relationship of not knowing how a publication is structured impact the ability to communicate?

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