Guidelines for Designing and Evaluating the Display of Information on the Web

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INTRODUCTION TO WEB SITE DISPLAY ISSUES

The utility of a Web site can be enhanced significantly by a thoughtful display of the information it contains. Screen elements, whether text, pictures, or icons, become much more meaningful when they—and the relationships among them—can be readily apprehended and unambiguously interpreted by the user. The following guidelines are intended to assist Web designers, authors, and editors in their efforts to create Web pages that effectively reveal—rather than obscure or confuse—the information they are trying to present. These guidelines are also intended to be used to assist in the evaluation of existing Web sites.

Of course, the design of a Web site, to some degree, can be modified by the user or by the characteristics of the browser or monitor enlisted to display it. Commonly, for example, type sizes and colors can be changed, as can the sizes of windows; different monitor resolutions also may inspire differences in the visual characteristics of a display. The guidelines that follow, consequently, acknowledge that in a very real sense, users may also assume the role of designer. The guidelines, therefore, are also intended to help users make informed decisions about how to make a display easier to use.

1 MAKING DISPLAY ELEMENTS LEGIBLE

Before any element on a screen can contribute to a Web site’s message, it must first, of course, be seen. Legibility, therefore, should be a primary consideration in the evaluation of any graphic element in a display, whether that element is a dot, line, banner, letterform, word, icon, or picture. Although a considerable amount of research has been conducted during the last century and a half on what is required to make an element in a visual field both visible and visually distinguishable from other elements, the results remain difficult to distill into a simple set of practical guidelines for Web designers, largely because there are so many factors that affect both "detection" and "discrimination." Nor is it always safe for designers to trust their own judgment about what is easy and what is difficult to see on a screen. What designers "see" is often influenced by their own knowledge about what is actually there. Thus, designers should test their impressions of the legibility of a Web site with a second set of critical eyes—those of a coworker, perhaps. Can they effortlessly decipher all the elements in the display? If not, those elements are likely either too small or too similar to their backgrounds. The following guidelines specifically address the issues of size and contrast.

1.1 Make sure that the visual elements in your display are large enough to be seen and interpreted.

In general, elements that contrast greatly with their backgrounds (black on white—or white on black—shows the most contrast) are relatively easy to see even when they are very small. Small colored elements, however, because they lack the high contrast of black and white, are both more difficult to see and more difficult to distinguish from other colors. In fact, it is almost impossible for the human eye to identify the color of a line whose thickness is smaller than 1.5 mm (0.06 inch). Colors at the blue end of the visible light spectrum (blues and violets) are especially susceptible.
LEAD SOLDIER COLLECTION

American history aficionados will appreciate the quality and detail of these figures, handsomely cast in a broad range of poses. The first in an expandable series, this scene includes 19 realistic pieces and accessories. Height of figures approx. 2-1/4".

178764 $495.00  Add To Cart  Add to Wish List

Figure 1. The ad copy asks the visitor to "appreciate the quality and detail" of these items, yet the picture of them is so small that it's difficult even to tell what they are (http://www.fao.com/178764.html).

to this problem. If a display must consist of very small colored elements, however, the detectability and discrim

inability of those elements can be improved to a limited degree by displaying them on a black, rather than white, background. (Thorell and Smith 1990).

Perhaps an even more practical consideration is whether or not an object on the screen can be interpreted once it's noticed. In Figure 1, the elements are large enough to be seen, but the critical details of the figures—the characteristics likely to be of most interest to the site visitor—are so small that the picture is virtually useless.

1.2 Avoid "busy" or distracting backgrounds.

Any display of information, whether on a screen or on a page, should assist viewers in their efforts to distinguish objects from their backgrounds (that is, to distinguish "figure" from "ground") and from each other (that is, to discriminate). In fact, these are among the first perceptual tasks addressed by the human visual system in its attempts to make sense out of the scene or page or screen it is viewing. It begins this process by locating discontinuities in the visual field, which typically result, for example, from changes in lightness, color, texture, and orientation. These changes are interpreted by the brain as edges or boundaries. In a very simple sense, the brain does the equivalent of drawing a line where boundaries exist between dissimilar areas and, subsequently, of combining those lines to form figures (Bruce and Green 1990; Goldstein 1996; Wade and Swanston 1991). "Busy" or heavily patterned backgrounds (see Figure 2) tempt the visual system to "draw a line" or see a figure where there isn't one. Backgrounds, consequently, should be, as far as possible, devoid of pattern or, if esthetic considerations demand that they be patterned, be very subtle or muted (Lynch and Horton 1999).

When boundaries between elements in a display and their backgrounds are created through the use of color, it is also important that those colors differ in luminance (brightness). Human vision has difficulty resolving boundaries between equiluminant colors even when those colors differ in hue (color), but the eye usually can resolve boundaries that vary in luminance without much difficulty (Murch 1984).

1.3 Use a white background, or select short-wavelength colors such as blue—particularly light blue.

White backgrounds provide the greatest contrast and, unlike colored backgrounds, are not susceptible to browser or monitor-induced change. If, however, a colored background is necessary, consider short-wavelength colors such as blue. Because of a phenomenon called "chromostereopsis" (sometimes called the "false stereo effect"), lines or objects constructed of shorter wavelengths (for example, blue, violet) appear to be more distant than longer (for example, red, orange) wavelengths of light, and vice versa (Thorell and Smith 1990).

Blue is an acceptable background color for other reasons, as well. First, while only about four percent of the color-sensitive photoreceptors (cones) lining the inside surface of the eye (the retina) are sensitive to short-wavelength light, they are nevertheless distributed farther into the periphery (60 degrees) than are those cones sensitive to medium and long wavelengths. The cones we have that can process blue color, consequently, are relatively far apart, making it difficult for the eye to see distracting patterns (to find boundaries, in other words) in a blue background. (Lansdale and Ormerod 1994; Sekuler and Blake 1990; Thorell and Smith 1990).

2 DESIGNING (ARRANGING) DISPLAY ELEMENTS

Understanding how ideas or elements in a body of information relate to each other—how they are organized—is predictive of how well information is understood, how well it's remembered, and how quickly and accurately the body of information a Web site contains can be searched. Viewers seem intuitively to understand this and, consequently, invest considerable effort in trying to discern the organizational structure of information they need to process before they actually begin to process it. Thoughtful design can help viewers in their efforts to apprehend that structure. Design, in its most simple sense, is an attempt to convey visually the logical, functional, or natural relationships that
exist among the elements in an information display. (This is true, by the way, regardless of the medium.)

Good design reveals structure when it visually mimics the logical relationships that exist among elements in a display. The human visual system attempts to find the structure of information—whether in a scene, on a page, or on a screen—very early in its efforts to process it, and it does so by looking for visual patterns. Importantly, the processing that occurs in this first stage of perception—a stage that takes only a few fractions of a second—occurs automatically and in such a way that interpretation of the display is dictated largely by the characteristics of the display itself rather than by the viewer’s prior knowledge or expectations (Bruce and Green 1990; Goldstein 1996; Wade and Swanston 1991). The practical implication of this fact is that those relationships inferred at this “pre-attentive” perceptual level set the stage for all subsequent conscious processing by predisposing the viewer to interpret a display in a particular way (Winn 1993). A viewer, in other words, will initially assign logical relationships among elements in a display on the basis of the display’s visual characteristics.

The designer, then, can purposefully create visual patterns on a screen that will reveal to the viewer how the information on a screen is structured. Simply, elements that are logically coordinate ought to be treated graphically in the same way. Subordinate elements ought to appear less prominent than superordinate elements, and elements that are closely tied to one another logically ought either to be grouped spatially or share some other perceptual attribute such as color. Lansdale and Ormerod (1994, pp. 60–61) caution that “... if it is possible to infer an apparent structure from the layout of information on the screen, then the user will undoubtedly perceive it. The designer’s job is therefore to ensure that the structure that is inferred is the one intended, and that misconceptions are not encouraged by spurious clues in the layout.” What they are saying, in essence, is that viewers will assume that the placement of any element on a screen is intentional and purposeful and, consequently, will try to assign meaning to it. “Spurious clues” to be avoided might include, for example, the accidental spatial grouping of logically unrelated elements (see Figure 3).

Finally, it’s important to acknowledge in the design of information to be displayed on a screen that screens differ from pages in some very fundamental ways. Screens, for example, may be smaller than pages, at least in the sense that they often display fewer lines of type than a typical paper page. Screens are also customarily oriented differently than paper—they are typically wider than they are tall. The images displayed on screens are also often more crude than those printed on paper, and, unlike paper, screens transmit light rather than reflect it. Issues of screen resolution and luminance are addressed in a later section on typography. Screen size and orientation, though, affect the designer's decisions about the arrangement of visual elements on a screen and so are considered in the context of our discussion of design.

The good news is that despite conventional wisdom, there is actually little evidence that display size or orientation has much effect on viewers—at least in terms of their ability to read text from a screen (Dillon 1994). Screen size and orientation, however, may affect how the designer breaks up or “chunks” content, both logically and visually, to reveal to the viewer how the content in the Web site is structured. The display problem is not qualitatively different from that confronted by the designer of a paper document, but certainly the parameters within which the designer of a screen must work may well be narrower simply because the typical monitor can display less content (for
most exclusively on the basis of a viewer’s ability to rapidly find information, so the degree to which the findings can be generalized to screens containing non-text elements or to user tasks other than searching is questionable. Tullis (1988) concluded from his own review of text density studies that factors such as the arrangement and grouping of elements on a screen strongly mediate the effects of the amount of information it contains.

2.1 Visually group ("chunk") related elements through the use of space, graphical boundaries, or similarities in lightness, color, texture, or orientation.

Spatial arrangement, lightness, color, texture, and orientation (Bruce and Green 1990) are all qualities that can be processed by our perceptual system at a pre-attentive level (Treisman 1990). Space is a particularly compelling tool for organizing a display because the visual system automatically attempts to group elements that are close together. In fact, elements that fall within five degrees of visual angle (an area that can be processed by the eyes in a single fixation, and one that roughly corresponds to an area equivalent to six or seven lines of single spaced type, 12–14 characters long at a viewing distance of about 18 to 20 inches [45.7 to 50.8 cm]) appear to be grouped automatically.

As Tullis notes, “Visual groupings have a significant effect on the semantic interpretations that users assign to the information” (1988, p. 390). Elements that are visually grouped (see Figure 4) will likely be perceived as “associated” with one another. Similarly, elements on a screen that share the same color or texture or orientation, even if spatially separated, are interpreted as being related in some meaningful way. Unrelated elements, of course, should be visually different or spatially separated from one another.

The use of graphical “rules” (lines) in a display can help the viewer to group related items, even when those items are spatially separated (McNamara 1986). When used strictly for decoration, however, rules also may create unintended groupings of unrelated elements, or may visually separate related elements in a display and consequently confuse the user. Use rules sparingly and carefully.

2.2 Graphically reveal the relative levels of importance among elements or groups of elements in a display.

Of course, what is important in a display is often determined by the interests and needs of the viewer. Nevertheless, information designers can graphically suggest their own sense of the relative importance of elements in a display (Goldsmith 1987). In general, any element in a visual display that contrasts in its visual qualities with other display elements will attract the eye (Kosslyn 1994). The
following are some specific perceptual attributes that have been found to draw disproportionate attention (and consequently imply greater importance):

- **Color** Consider the use of color to call attention to those elements you believe to be most important (Goldsmith 1987). Color is thought to draw attention largely from the contrast it can provide; nevertheless, displaying an element in color will suggest to the viewer that it is more important than elements displayed in black and white.

- **Position** Consider placing the more important elements in the upper left-hand corner of the screen (Brandt 1945). Western readers typically fixate (look at) visual elements placed in the upper left-hand quadrant early in the processing of a visual display. Sequence, in this context, implies importance.

- **Size** Make important elements larger than less important display elements (Edwards and Goaldkarian 1974). Larger elements are more easily discernible in peripheral vision, which guides subsequent foveal (central vision) fixations. People also typically fixate longer on larger elements in a display (see Figure 5).

- **Isolation** Surround important elements with lots of white space. Elements surrounded by generous white space are thought to be accorded greater attention. As a result, isolating an element in a display implies that it is more important (Goldsmith 1987).

- **Complexity** The eye naturally seeks out the most “informative” areas of a visual display; consequently, it spends little time processing predictable contours. In fact, informative areas are typically found and fixated in less than two seconds (Mackworth and Morandi 1967).

- **Tonal contrast** Important information resides at boundaries demarked by contrasts in tone (darkness or lightness). We use those differences to identify forms and to infer their relative distances; we are consequently conditioned to attend to them psychologically and are, it could be argued, “hard wired” to attend to them physiologically. Neurons in our visual system are fundamentally “difference detectors,” so our eyes are naturally attracted to areas where visual stimuli change. The perceptual principle of “salience” asserts that we are consequently compelled to attend to those areas (Kosslyn 1994).
2.3 Ensure that the graphical treatment of elements in a display is consistent and predictable (unified).

Unity is a very basic design principle. Much like cohesion in writing, unity refers to the degree to which elements in an information display address a single purpose and avoid things irrelevant to that purpose (Anderson and Armbruster 1985). From the perspective of the designer, unity implies consistency; from the perspective of the viewer, unity implies predictability. If the same or similar elements are treated in similar ways, logical or functional relationships are easier to process because they are conveyed and reinforced at a perceptual level, greatly decreasing the burden on short-term memory. Consistencies should manifest themselves in the pattern or arrangement imposed on the elements on a screen, in the selection and use of typetyles, and in the selection and use of color, to name but a few.

Consistency has some other advantages for the user, as well. A consistent format speeds searching—it sets up expectations about where certain kinds of information or elements such as menus, navigation aids, or site maps can be found (Tullis 1988). Consistency, then, should exist not just within individual screens but among all screens in a Web site; therefore, secondary screens should be logically, visually, and structurally derivative of home or primary pages.

Conversely, arbitrary changes in a display are usually misconstrued as intentional and purposeful. The psychological principal of “informative changes” asserts that any change in a visual field is interpreted by the brain as being meaningful (Kosslyn 1994). Any arbitrary change in the visual characteristics of a display—a change in typetyle, a change in column measure, a change in color, a change in the pattern or grid used to arrange visual elements, for example—is very likely to be misinterpreted by the viewer as signaling something meaningful. Lack of consistency and cluttered screens not only degrade users’ performance but have actually been found to provoke anger (Shneiderman 1992).

2.4 Reveal to the user the intended sequence (if any) in which information is to be processed.

Of course, one of the significant potential advantages of conveying information on the Web (or any other hypermedia environment) is that the sequence in which information is processed need not be constrained by conventional discourse structures. Yet while the medium may free the viewer from strict linear constraints, the logic of the relationships among the elements of a message sometimes may not. Procedures, for example, often must be performed in a particular order. It is sometimes necessary, consequently, to either compel or to encourage the viewer to process the information in a Web site in a particular order. Sequence can be revealed to a viewer in a variety of ways (Winn 1993).

- Sequence can be constrained by the presentation medium in animated graphics and in auditory presentations.
- Sequences can be “coded” with letters or numbers.
- Graphic devices such as arrows can suggest the preferred sequence in which elements on a screen should be processed.
- Relative differences in “eye attraction” suggest sequence. Elements in a visual that attract the eye first typically are those that contrast most with their surroundings—either background or other elements.
- In the absence of other cues, viewers will often resort to those habits imposed by reading. Readers of English, for example, will “read” a page of visual information from left-to-right, top-to-bottom (Galitz 1985).

3 ENSURING THAT TEXT IS READABLE

Spool (1999), Nielsen (2000), and a number of other contemporary observers of Web user behavior argue that Web site visitors don’t actually read continuous text but simply skim a site’s content. Alternatively, Lynch and Horton (1999) contend that while skimming may have characterized the behavior of early “surfers,” most users today are seeking information and not a “free-form, associative” experience (p. 99). They argue that hypertext links to small chunks of separate but related pieces of information “cannot create or sustain an argument or deliver a collection of facts as efficiently or legibly as conventional linear prose. When there is no sustained narrative, readers are sent aimlessly wandering in their quest for information” (p. 99). Who’s right in this debate most probably hinges on what is meant by terms such as “continuous text,” “extended discourse,” and “linear prose.” While there are certainly few Web sites providing book-length treatises, an increasing number of sites present the user with several screens-full of text. And that certainly is enough to present an unwelcome challenge to the reader should the type be difficult to read. The issue of the readability of type, then, deserves the Web designer’s attention.

In our efforts to ensure that text is readable, we can draw on knowledge gained from literally hundreds of years of practice in the art of typography as well as recent research that specifically addresses the special typographical challenges posed by the comparatively low resolution of today’s computer screens. As Dillen (1994) notes, the basic finding that people do, indeed, read more slowly from monitors appears to be disappearing as the quality of text displayed on screens improves. Gould and his colleagues (1987), in fact, have demonstrated that when screen “flicker” is eliminated, when letterforms are smoothed (“anti-aliased”), and when text consists of black characters on a white background (positive polarity), it is
This is an example of Georgia, a serif typeface designed especially for display on a monitor.

This is an example of Verdana, a sans serif typeface designed especially for display on a monitor.

Figure 6. Examples of Georgia and Verdana, two typefaces designed for ease of reading on screen.

possible to read as quickly and as accurately from a screen as it is from paper. As the "perceptual" differences between paper and screen lessen, then, we should be increasingly confident our ability to apply paper-based typographical principles to the screen. Some specific guidelines follow, but the reader is also encouraged to consult the following excellent reviews on the display of type, both on screen and on paper: Dillon 1994; Gould and others 1987; Hartley 1996; Lynch and Horton 1999; Sanders and McCormick 1987; Tinker 1963; Tullis 1988.

3.1 Use sans serif typefaces for display on screen.

Conventional wisdom notwithstanding, there is no compelling evidence that, for normal reading, serif typefaces are easier to read than sans serif typefaces (Gould and others 1987). On screen, in fact, serifs present the reader with several problems. First, serifs may display irregularly when they fall on the boundaries between pixels; this is especially problematic when using smaller type sizes. Serifs also must occupy, at the minimum, one pixel. This fact can make them appear blocky and disproportionately large, especially when displayed in small type sizes or on low-resolution screens. If, however, serif faces are chosen, they should be chosen from among members of the Egyptian (slab or block serif) group, and they should be displayed at relatively large sizes (see below).

Also consider choosing typefaces from among the growing number of faces that are being designed specifically for display on screen (see Figure 6), such as Verdana, a sans serif typeface, and Georgia, a serif face.

3.2 Use 12- to 14-point type for continuous text.

Because the size of the image projected on the retina is a function of both the size of the letterform and the distance of the eye from the screen, type sizes are often characterized in terms of visual angle. Visual angles of between .35 and .40 degrees (equivalent to 8 to 10 point type) are capable of presenting a legible image to the viewer who has perfect vision and is viewing under optimal conditions (Smith 1979). Unfortunately, a screen seldom provides those "optimal conditions," and few of us have perfect vision. Moreover, anti-aliasing, or character smoothing, works best on larger typefaces whose characters are at least 14 pixels high (Gillespie 1998). Most readers with normal vision do find 12- to 14-point type easy to read. Designers of Web sites likely to be frequented by people with visual deficits or by the elderly ought to consider even larger type sizes (Schrive 1997).

Because the visual impression of size is conveyed as much by a typeface's x-height (the height of the lower-case "x" in any face) as it is by its nominal point size (Rehe 1974), larger type sizes should be used with typefaces with smaller x-heights; smaller sizes may be used with typefaces with larger x-heights. Again, it's worth noting that readers, browsers, and computer operating systems can and sometimes do override a designer's decisions about the visual characteristics of a display.

3.3 Avoid the overuse of bold and italics.

Both bold and italic typefaces are used for emphasis and, consequently, should be used sparingly. Bold and italic letterforms also are often poorly formed on a screen—bold because the algorithm that creates them may simply add pixels to a letterform designed for and intended to be displayed at normal stroke widths; and italic because the oblique orientation of the letterforms doesn't mesh well with the constraints of a vertically and horizontally oriented pixel grid.

An exception in the use of bold applies to black text displayed on a highly luminous field. Because of a perceptual phenomenon called "irradiation," in which light areas appear to "bleed" or spread into darker areas, bold type is recommended. Due to the same phenomenon, "light" versions of a typeface may be more legible when reversed out of a black background (negative screen polarity). A final exception: bold type is also more legible than normally weighted typefaces when there is little luminance (brightness) contrast with the background (Sanders and McCormick 1987). In other words, use bold when there is little contrast in darkness between the type and its background.

3.4 Avoid setting type in all caps.

While setting type in all caps may sometimes be appropriate for headings or other short text segments, it should never be used for extended text. The shape of a word provides significant clues to the reader as to its identity. Setting in all caps destroys the shape (see Figure 7) because upper-case letterforms have no descenders or ascenders: each word assumes the shape of a simple rectangle. Tinker (1955) found that lowercase type is read about 13 percent faster than uppercase type.
WHILE SETTING TEXT IN ALL CAPS MAY SOMETIMES BE APPROPRIATE FOR HEADINGS OR OTHER SHORT TEXT SEGMENTS, IT SHOULD NEVER BE USED FOR EXTENDED TEXT. THE SHAPE OF A WORD PROVIDES SIGNIFICANT CLUES TO THE READER AS TO ITS IDENTITY.

Figure 7. Type set in all caps is quite difficult to read.

3.5 Arrange type intended for extended reading flush left, ragged right.

Lines of type are justified (aligned both flush left and right) by varying the spacing between words. Non-uniform spacing between words decreases reading speed by as much as 11 percent (Trollip and Sales 1986). Text that starts irregularly (any ragged-left setting, including centered text) produces more regressive saccades (backward eye movements) than does regularly displayed text and, consequently, reduces readability.

3.6 Except, perhaps, for headings, avoid lines of type shorter than 40 characters and longer than 60 characters.

When lines of type are too long, they may make it difficult for the reader to accurately and consistently locate the next line of type following a return sweep (the eye's movement from the end of one line of type to the beginning of the next line). When lines of type are too short, they excessively, and somewhat arbitrarily and mechanically, break up syntactical structures the reader is trying to identify. In other words, while the reader is trying to find and process the meaningful boundaries between phrases and clauses, the display is adding meaningless and confusing physical boundaries to the text in the form of line breaks.

The research on optimum line length is by no means conclusive. Tullis (1988) summarizes much of it, however, by noting that lines of type containing as many as 132 characters have been found to be quite readable as long as there is adequate inter-line spacing (leading). He cautions, however, that lines of text should never contain fewer than 26 characters. Rehe (1974) recommends lines of between 40 to 60 characters, which would be both long enough to minimally impact readers' efforts to uncover a text's syntactical relations and short enough to help readers keep track of their place in the text when they finish reading one line and have to visually locate the beginning of the following line. Rehe's recommen-

dation is also consistent with most traditional recommendations for text on paper (40 to 65 characters). Longer lines of type demand more leading.

3.7 Provide extra space (leading) between lines of type.

Lines of type with adequate leading require fewer fixations per line than do lines spaced too closely (Kolers and others 1981). Researchers differ in their recommendations for how much space is ideal, but in general they agree that more inter-line spacing is needed on a screen than on a page. Although a variety of factors can influence what is optimum, typically leading that is equivalent to 25 percent of type size (for example, 3 points leading for 12-point type) is almost invariably adequate for the printed page. Recommendations for screen, however, in general fall between 50 and 100 percent—basically the equivalent of space-and-one-half or double-spacing (Kruk and Muter 1984; Snyder 1988; Schwier and Misanchuk 1993; Tullis 1988). Double-spacing, however, should probably be reserved for very long lines of type (over 60 characters) and for typefaces with large x-heights.

3.8 Mark the boundaries between paragraphs with blank lines rather than indentation.

Block style helps the reader see each paragraph as a "visual chunk," which is yet another way of reinforcing at a perceptual level the logical structure of a message.

3.9 Use headings and subheadings to help reveal visually the relationships among the text elements they label.

Because headings are used to label the text elements on a screen, they are well suited to visually reveal the logical relationships among the ideas conveyed by those text elements. Differences in the size, boldness, case, and position of headings and subheadings have been used traditionally to suggest different hierarchical levels. Major headings, for example, might be larger or bolder than subordinate headings, or might be centered or displayed in caps. It is best, however, to vary only one visual attribute at a time. While it may be easy to discern the relative importance of two headings that differ only in their relative sizes, it's much more difficult to determine hierarchical relations among headings when they differ in, say, both position and case. (For example, although a heading set flush left and displayed in caps may appear in some respects superordinate to a centered heading displayed in initial caps and lowercase, centered headings in many genres have traditionally been considered higher in the hierarchy than headings set flush left.)

4 USING PICTURES AND ILLUSTRATIONS

The Web is a highly visual medium. It is natural, then, that we should want to flood our pages with images. These
images, however, can do more harm than good if we fail to keep in mind the fact that the role of images on our screens should be communication. To ensure that images you choose to display do communicate something of value, consider the following guidelines for their use.

4.1 In general, avoid using pictures that are strictly decorative.

While “thematic” pictures may be acceptable when their relationship to the site and its contents can be easily inferred, pictures chosen only to decorate a site often confuse. At best such pictures provide no assistance to the viewer in acquiring information being conveyed by a site. At worst, because of the viewer’s likely assumption that the author’s selection and use of the picture was purposeful, irrelevant pictures can be misleading (Levin and others 1987). This is not, however, an argument against the occasional and considered use of “thematic” pictures. A Web site for a ski area that doesn’t contain a theme- or mood-inducing photo of a skier on a snow-covered ski slope will certainly seem strange to the site visitor.

4.2 Supplement visuals with explanatory text or text labels.

In most instances, pictures (unless the meaning is purely perceptual, such as “how objects are arranged” or “what something looks like”) are a much less precise medium for expressing ideas than are words. The bounds of the concepts they evoke are inherently “fuzzy” and are often unintentionally narrow because of the frequent need to use an exemplar of a concept to express the concept itself. (Imagine, for example, what kind of a picture you would use if you wanted to express the idea “pet.”) Moreover, as is the case with “figures of speech” used in text, pictures can express something other than what they literally depict. For example, a picture of a lion may express or denote the concepts “courage,” “strength,” or “carnivore,” to name but a few (Knowlton 1966; Salomon 1979). Consequently, use words—captions, cutlines, or explanations in accompanying text—to reveal to the viewer not just what a picture shows, but what it means.

4.3 Consider the use of visuals when it is necessary to reveal the structure or organization of things or ideas—particularly when their structure is nonlinear.

Pictures (or especially diagrams) are much more efficient than text (which is rigidly linear) in conveying nonlinear relationships. Diagrams can use two-dimensional space to mimic logical or functional relationships (see Figure 8), and as a result, can decrease the amount of time it takes the user to discover those relationships and also to locate needed information. That’s because information related logically is displayed together spatially. Logical or structural relationships, in other words, create a pattern, and the human visual system is extraordinarily adept at detecting and understanding visual patterns (Larkin and Simon 1987). Ensure, however, that diagrams are not too large or too complex to be displayed on a single screen; if viewers have to scroll to see the entire diagram, their ability to process the visual pattern of relationships it reveals (which, of course, is one of its principal strengths) is lost.

4.4 Use visuals (photos or illustrations) when necessary to show what something looks like or to depict a “perceptual quality” such as color, texture, pattern, shape, relative size, spatial location, orientation, arrangement, or appearance.

As Gombrich (1974) notes, text is a very powerful and flexible medium for the expression of certain kinds of ideas because, unlike pictures, it embodies the ability to convey conditional states (“if X then Y”) and logical connections such as those expressed by conjunctions (“nevertheless”). However, sometimes the “meaning” of an object resides in its perceptual qualities. A visual preserves perceptual information and conveys it in such a way that it can be apprehended directly. In other words, the communication of the meaning avoids the necessity of having to be translated into abstract, symbolic codes (such as words). Because the codes themselves are representational, the “articulatory distance”—the “distance” between the form of the codes and the ideas they mean to express—is very small. Con-

Figure 8. Visuals are much better suited than text to convey non-linear—especially hierarchical—relationships (http://www.ipd.anl.gov/anl_org_chart).
trast, for example, the difficulty most of us experience in trying to
describe a color to someone else with the ease of communicat-
ing that information with a color swatch.

5 USING ICONS
A number of assumptions are commonly made about the
efficacy of icons in graphical user interfaces. They include
the notion that icons, because they are pictorial, are almost
invariably easy to interpret. A corollary is that they are
universally interpretable because the key to meaning con-
veyed pictorially is not bound to any one language. These
assumptions, which are largely incorrect, stem in part from
a confusion between the notions of “identification” and
“interpretation.” While it may well be true that, at least for
concrete things and ideas, pictures facilitate rapid, and
sometimes universal, identification, it is certainly not al-
ways true that they efficiently or unambiguously convey
what we intend an object to mean (Salomon 1979; Sebeok
1994; Williams 1996). As noted earlier in the discussion of
pictorial communication, there may be a significant differ-
ce between what a visual sign literally depicts and what
it means. What a sign means is almost always socially
mediated and, again, unless the meaning is purely perceptu-
al, is almost always more precisely conveyed through
text. The claim that pictorial signs (in this case icons) are
“universal,” then, requires considerable qualification.

Further confusing the interpretation of iconic signs is the
simple fact that, even within a single culture or dis-
course community, the logic of the system by which a sign
is mapped onto a referent often differs from sign to sign—
even in the same icon set. In other words, some icons may
be representational, some analogical, some metaphorical,
and so on. Does a sign showing a knife, fork, and spoon
denote a shop selling silverware or a restaurant? Most icon
sets comprise a mix of mapping systems and seldom pro-
vide any clues to the user as to which logical relationship is
to be used for which icon.

Finally, icons are not particularly good at standing in for
verbs (predication). When they attempt to convey action, they
typically do so by showing the results of it. Many actions in a
digital environment, however, have no picturable results, and
icons then often become no more than little picture puzzles
that confuse rather than inform. Other claims include those
that icons increase search speed and that they are more
memorable than text. This section examines these claims and
offers guidelines for the use of icons.

5.1 Label all icons except, perhaps, for those that
are likely to be very familiar to all users.
Interpreting the meaning of a pictorial symbol is often
difficult and sometimes next to impossible. Text labels,
even if “pop up” or “balloon,” relieve the user of a difficult
and clumsy interpretation task.

5.2 When possible, use “conventional” icons.
Some pictorial symbols have become, over time, almost
universal—usually not because their meaning has been
uniformly and consistently interpreted, but because their
intended meaning has been learned. When possible, use
existing, widely understood icons. Avoid the temptation
to be novel. Memory for pictorial information is generally
considered to be significantly greater than that for text; it
consequently makes sense to capitalize on prior—perhaps
very durable—associations acquired through learning.

5.3 To ensure the speed and accuracy of visual
search for particular icons in a display, design
icons to differ in their “global” characteristics.
Searching for images in a visual field begins by targeting
their “global” characteristics such as overall shape (see
Figure 9) or color (Arend and others 1987; Scott 1993).
Icons used in a display as search targets, consequently,
should be designed to differ on those characteristics.

6 USING ANIMATION
By far the bulk of the research literature on motion (and
animation is an attempt to create the illusion of motion) has
focused primarily on possible learning effects. Anglin and
others (1996) conclude, however, following a review of 42
such studies, that we still know very little about the effects
of dynamic visual displays. Many of the studies reviewed,
they note, were methodologically flawed and ignored im-
portant variables such as differences in the nature of the
learning task and differences in the characteristics of the
learners. What does seem clear is that animation is often
used in such a way that the information it provides is
superfluous to the learning goal. For example, animation is
frequently used to increase the “realism” of an on-screen
presentation despite the fact that it’s unclear that increased
realism has any effect on learning. Nevertheless, some
tentative guidelines for the use of animation are offered.

6.1 Use animation to attract the viewer’s
attention.
Animation can be used to gain or to guide the viewer’s (or
learner’s) attention. Motion is an extraordinarily compelling
visual quality; much of our visual system, in fact, is dedi-
cated to processing information about motion. Consequently, we are almost forced to attend to something in our visual field that moves. Of course, that can be highly distracting in the event that the motion capturing our attention is actually unimportant. (Have you noticed how difficult it is to ignore a flickering fluorescent light? The reason it’s difficult to ignore is that our visual system interprets that flicker as movement.) Blinking or flashing elements on a screen will almost invariably—for good or for bad—attract the viewer’s attention (Brown and others 1983).

6.2 Use animation to convey actual temporal changes.
Reiber (1994) suggests that animated visuals are defensible only when they are used to visually convey changes to an object over time or changes in the direction an object is moving. Of course, animation is an acceptable—in some cases ideal—medium for conveying that kind of information. It’s worth noting, however, that humans are pretty adept at imagining motion. In other words, it is sometimes more expedient to let the viewer imagine, for example, the movement necessary to change the orientation of an object than it is to create animation to depict it.

QUICKLIST FOR DISPLAYING INFORMATION ON THE WEB
The way in which information is displayed on screen in a Web site has a considerable impact on its usability. If elements on the screen are difficult to see, if text is difficult to read, if the organizational structure of the information the site contains is difficult to discern, or if the visual elements are difficult to interpret, then the effectiveness of the site suffers. Following is a distillation of those principles elaborated on in this article that are intended to assist Web page designers in making decisions that will lead to the effective presentation of a Web site’s content.

Key points
* Before they can convey any meaning, elements in a display must first be legible.
  Important elements in a display can’t contribute to a Web site’s message unless they can be seen. That means that they must be large enough to convey necessary detail and different enough from their backgrounds to visually stand out from them.
* Visual patterns in the arrangement of site elements should reflect the logical organization of information in the site.
  People attach meaning to the visual patterns they detect in an information display. It is consequently important to create patterns in the arrangements of elements on a screen that mirror the logical patterns of relationships that exist among the elements or blocks of content displayed in the site.

* Text is not generally as readable on screen as on paper, so not all the normal “rules” of typographical design apply.
  Screens present some special problems for the display of text, primarily because of their lower resolutions. Using larger fonts, sans serif typefaces, and generous line spacing, however, goes a long way toward mitigating those problems.
* Pictures can convey some kinds of ideas much more efficiently than can text.
  Pictures should be used to communicate rather than decorate a Web site. They are especially efficient at conveying “perceptual” information such as what something looks like, or what color it is, or how it’s arranged.
* Icons can be very difficult to interpret and, consequently, often don’t simplify the visitor’s navigation through a site.
  Icons are pictures, and like other kinds of pictures, their meanings can be ambiguous (what they resemble isn’t always what they mean). If an icon’s meaning invites interpretation, then its use probably ought to be reconsidered.
* Animation should be used sparingly.
  Animation can attract and direct the site visitor’s attention and can effectively illustrate real changes over time. Animation that doesn’t serve either of those purposes, though, is usually an unpleasant distraction.

1 MAKING DISPLAY ELEMENTS LEGIBLE
1.1 Size
For an element on a screen to be legible—to be capable of being both apprehended and deciphered—it must be large enough to be seen. Can you decipher all the elements in the display easily? If not, consider making them larger.

1.2 Contrast
For an element on a screen to be legible, it must contrast sufficiently with its background. Consequently, avoid “busy” or distracting backgrounds as well as boundaries between elements and their backgrounds created through color contrast alone (for example, a blue rectangle within a purple rectangle without black ruling lines to mark the boundaries of the inner rectangle).

2 DESIGNING (ARRANGING) DISPLAY ELEMENTS
2.1 Information structure
Good design reveals to the reader the structure of an information display, whether a Web site, a screen, or a page. Select visual patterns that reflect the pattern of logical or functional relationships that exist between and among the things being symbolically represented in the display.
2.2 Grouping
Group related items through the use of space: graphical boundaries; or similarities in lightness, color, texture, or orientation. Unrelated elements should be visually different or spatially separated from one another.

2.3 Relative importance
Reveal the author's view of the relative levels of importance among elements or groups of elements in a display graphically. Among those perceptual attributes that have been found to draw disproportionate attention are color, position, size, isolation, complexity, and tonal contrast.

2.4 Consistency and predicatibility
Designs should be consistent and predictable (unified). Elements that are equivalent logically or functionally should be treated the same visually. Consistency should also be apparent in the pattern or arrangement imposed on the elements on a screen.

2.5 Sequence
The design of the display should reveal the intended sequence (if any) in which the reader is expected to process it.

3 Ensuring Text isReadable

3.1 Typeface choice
Choose sans serif typefaces or serif typefaces designed specifically for display on screen.

3.2 Type size
Use 12- to 14-point type for text intended for continuous reading.

3.3 Bold and italics
Avoid the overuse of bold and italics.

3.4 All caps
Avoid setting type in all caps; preserve word shape created by lower case letters. Word shapes provide significant clues to the reader as to their identity.

3.5 Alignment
Set type intended for extended reading flush left, and ragged right. Readability is decreased by non-uniform spacing between words and text that starts irregularly.

3.6 Line length
Avoid lines of type shorter than 40 characters and longer than 60 characters.

3.7 Leading
Provide extra space (leading) between lines of type, typically between 50 and 100 percent of the type size.

3.8 Paragraph boundaries
Mark the boundaries between paragraphs with blank lines rather than indentation to help the reader see each paragraph as a "visual chunk."

3.9 Headings
Use headings and subheadings to visually reveal the relationships among text elements they label. Use differences in size, boldness, case, and position of headings and subheadings to suggest different hierarchical levels.

4 Using Pictures and Illustrations
To ensure that images you choose to display do communicate something of value, consider the following guidelines for their use.

4.1 Decorative pictures
Avoid using pictures that are strictly decorative.

4.2 Supplemental text
Supplement all visuals with explanatory text or text labels to ensure that visuals are interpreted as intended.

4.3 Information structure
Use visuals to reveal the structure or organization of things or ideas—particularly when the structure is not linear.

4.4 Appearance and perceptual qualities
Use visuals (photos or illustrations) when it is necessary to show what something looks like or to depict a perceptual quality such as color, texture, pattern, shape, relative size, spatial location, orientation, arrangement, or appearance.

5 Using Icons
Icons, simply because they are pictorial, are neither necessarily easy to interpret nor interpreted uniformly. Consequently, consider the following strategies when using icons.

5.1 Labels
Label all icons.

5.2 Familiarity
When possible, use "conventional" icons—icons whose use and meaning the user is already likely to be familiar with.

5.3 "Global" differences
Design icons to differ in their "global" characteristics to ensure the speed and accuracy of visual search for particular icons in a display.

6 Using Animation

6.1 Viewer's attention
Use motion when necessary to attract the viewer's attention.
6.2 Change over time
Use motion when necessary to convey actual changes over time. TC

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