ACCESS by Design

A Guide to Universal Usability for Web Designers

SARAH HORTON

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New Riders

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For my brother, Matt,
who always pushed me to reach
for the higher branch

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Foreword

THE FIRST PHOTOGRAPHERS had to design and build their own cameras. As photography caught on, the needs of professional photographers stimulated camera design innovations. Fifty years passed before George Eastman designed the Kodak camera for a much wider community of users. It took another century for camera designers to include high-tech universal usability features such as automatic aperture settings and autofocus. These features enabled most users to produce quality images reliably. This story has an amazingly successful outcome: cameras are used in 96% of American households today. And now, as digital cameras and cell phones with cameras have become popular, photos will become even more ubiquitous.

Similarly, the first Web site builders had to design their own programming tools. And as Web popularity soared, the needs of Web designers influenced the software tools. With 70% of American households now using the Web for health, travel, and shopping, it is clear that the transformation to public use of the Web is here. However, user experiences are often filled with frustration aggravated by confusing layouts and failure to find what they want. Improving the quality of Web experiences and broadening the audience is the next challenge for high-technology researchers and entrepreneurs.

Fortunately, Sarah Horton's book can accelerate the pace of Web site design improvement. With clarity and thoughtful authority, Sarah lays out the territory of good design, as inspired by universal usability. Her goal is to make Web sites accessible for everyone. By this she means to improve the Web experience for all users, including those who have physical disabilities and other limitations. She assumes knowledge

of HTML, CSS, and other technical issues, so she can concentrate on design. Her analysis is sophisticated but her advice is clear and easily applicable.

The chapters provide lucid examples of good and bad design for structure, text, images, tables, and forms. She guides designers through the presentation issues of links, color, audio, video, and interactivity with comprehensible guidelines and wise advice. Each guideline is nicely summarized in a section called *In a nutshell*. The advice guides designers to make sensible decisions that will benefit most users—by improving layouts, appropriately integrating images, and clarifying content. The family values of good design produce many happy children.

Sarah's book is among a growing set of efforts to improve Web design for all users. These strategies benefit users with visual, auditory, or mobility limitations and also bring gifts to older adults, users with cognitive limitations, users with low literacy, novice users, and others with particular needs. The good news is that these same strategies also benefit all users.

There is also good news from research and development workers who are increasingly mindful of clearly defined personas and audience segments. Refined evaluation methods, automated software evaluation of designs, and logging tools are providing the richer feedback needed to further improve designs. Controlled studies with selected user groups, observations of diverse users, and torrents of usage data give Web designers the evidence they need to make rational decisions for a wider range of users. As a computing professional this is satisfying to see, as I believe we will be remembered, in part, by how ambitiously we work to ensure that every Web user can successfully accomplish his or her goals.

Professionals like Sarah Horton, who address their social responsibilities to ensure broad access, are receiving recognition for their efforts. During 2005, the Association for Computing Machinery's (ACM) Special Interest Group on Computer Human Interaction (SIGCHI) established an award for social impact. The first recipient of this award was Gregg Vanderheiden of the University of Wisconsin's Trace Center.

Dr. Vanderheiden received the award for "his technical innovations and inspiring leadership in making information and communications technologies usable by more people. His contributions are especially beneficial to users with disabilities, but the techniques he developed will bring benefits to all users." He cochaired the Web Content Accessibility Guidelines Working Group, whose recommendations have had widespread international influence.

Conferences that address accessible designs are gaining strength. The ACM's Special Interest Group on Accessible Computing is actively promoting research with its Assets conferences on computers and accessibility. I am proud of organizing the ACM's Conference on Universal Usability, which generated a capacity crowd of researchers and industry leaders. The SIGCHI group has an extensive Web site devoted to accessibility as well.

In Europe, the newly formed Accessible Design in the Digital World Conference (www.accessinthedigitalworld.org) is led by the diligent and persistent efforts of Alan Newell. The event adds to the interest generated by the series of successful conferences on User Interfaces for All (UI4ALL) (http://ui4all.ics.forth.gr/) invigorated by the enthusiasm of Constantine Stephanidis, who also founded the journal, *Universal Access in the Information Society*.

Visionary leaders recognize the importance of broad participation by attending to the needs of diverse people. Thomas Jefferson wrote: "I feel… an ardent desire to see knowledge so disseminated through the mass of mankind that it may… reach even the extremes of society: beggars and kings." Similarly, two centuries later, World Wide Web creator Tim Berners-Lee emphasized the many dimensions of universality in his Japan Prize lecture: "The most important thing about the World Wide Web is that it is universal. By exploring this idea along its many axes we find a framework for considering its history, its role today, and guidance for future developments." He amplifies this idea to suggest a torrent of further innovations. Universality is a generative theme; it forces new requirements that lead to surprising benefits for many users.

The first wave of Web dissemination is spreading across the world as users learn about the possibilities and get connected. But fewer than one in six people in the world are Web users, so there will still be much turbulence as the first wave of information access rolls through. There remains much work to be done by designers in providing useful, usable, and universal content. Cross-cultural, multilingual, and multicultural designs are no longer just fashionably innovative; they are becoming required and expected. Serious attention to privacy and security is shifting from nice-to-have to need-to-have.

When 80% of humanity has access to information and is getting email, we'll need to celebrate with trumpets and fireworks. Of course, the second wave—in which users can create Web pages, produce content, and disseminate their ideas, music, photos, and products—has already begun rolling out among early-adopting users. The shift from information access to content generation is profound. eBay, wikis, and blogs are part of the second wave, which already claims several hundred million users—and that is just the beginning. The creative aspects of the second wave are enabling artists to produce animated and interactive visual and musical art projects while enabling scientists to collaborate in exploring the human genome or fighting HIV/AIDS. Open-source creativity is a potent force, especially when harnessed by the vision of universal usability. Online communities and social computing are spreading, enabling fruitful cooperation and democratic participation.

Universal usability will do more than stimulate entertainment, encourage conversation, and facilitate photo sharing. It has the potential to improve health care, enliven education, and accelerate economic development. Realizing these potentials is the goal for those who want to be heroes of the second wave.

But before we let this utopian optimism wash away our rational side, we should remember that there are serious risks. Good intentions are a fine starting point, but attention to real dangers is essential for happier outcomes. Universal usability in design is important, but economic, educational, and policy support to reduce digital divides are necessary as well. Public discussion about privacy protection, commu-

nity values, and appropriate regulation can help reduce the dangers. Unfortunately, we will also need capable enforcement to cope with the spammers, spyware distributors, and stalkers. We'll need to address the deceptive advertisers and malicious identify thieves, and we'll need to develop protections from racist or terrorist groups who seek to use the universality of the Web for harmful purposes.

And what about the third wave? Can we envision ways in which Web technologies will promote effective international development, hasten innovative education, and ensure safe neighborhoods? How can we use the Web to improve health care, accelerate environmental protection, and support conflict resolution? The key to the third wave will be the transformation from information to action. A Web page on world hunger is a good start, but it does not in itself solve the problem. Information without action is failure. Knowledge without responsibility is tragic.

It is difficult to envision the impacts of our efforts, but I have come to believe that open discussion and broad participation have profound benefits. Thomas Jefferson and Tim Berners-Lee had the right idea. Open systems enable a wider range of ideas that contributes to more successful solutions. Engaging more voices not only widens the range of policy options, but it also builds commitment to the community's decision and encourages refinements as the inevitable implementation problems emerge.

Mindless optimism is dangerous because it allows darker forces to emerge, but visionary thinking is needed to create new possibilities. A mature approach balances the enthusiastic and sober sides of our personalities. Each designer makes a contribution by creating new opportunities; each designer shares responsibility for the world he or she creates. There's much work to be done. Sarah Horton has done her job well. Now it is our turn. Let's get to work!

Ben Shneiderman
University of Maryland

WE BEAR IN MIND that the object being worked on is going to be ridden in, sat upon, looked at, talked into, activated, operated, or in some other way used by people individually or en masse.

When the point of contact between the product and the people becomes a point of friction, then the… designer has failed.

On the other hand if people are made safer, more comfortable, more eager to purchase, more efficient—or just plain happier—by contact with the product, then the designer has succeeded.

HENRY DREYFUSS, *Designing for People,* 1955

Preface

The web has democratized design—both the process of design and the attendant responsibilities. Knowingly or not, we have been engaging in design throughout our lives, but without such broad implications. When we choose whether to wear brown shoes or black, the effect of our choice is limited to the people we encounter throughout the day. When we design a Web site, we design for everyone. Our choices affect anyone who tries to use our site.

Making decisions—that is the task of the designer. Good decisions have a basis: a purpose to uphold and best practices for achieving that purpose. For example, the purpose of type is to be read, and best practices provide conventions for setting type size for optimal readability. The purpose of a light switch is to control illumination, and best practices dictate how to design a light switch for optimal usability.

The purpose of a Web site is… well… that depends. The Web is dynamic and its purpose evolves as the technology grows and changes. Defining purpose depends on whether we are talking about functionality—what makes the Web work; interface—how users interact with the Web; or content—what users do with the Web. Defining *best practices* depends greatly on how we define our users—are we talking about "typical" users, cell phone users, blind users, adult users, Google?

Given the complexity of the tool, its dynamic nature, and the diversity of its users, what do we use as a basis for making design decisions when designing Web sites? This book will attempt to answer that question, and will provide guidelines for making design decisions that work for the greatest number of users.

THE ORIGINS OF THIS BOOK

I've been doing print and interface design since the beginning of my professional career and without the benefit of a design education, I have relied on the knowledge of experts to guide me: Robert Bringhurst, Patrick Lynch, Donald Norman, Ben Shneiderman, and Edward Tufte, just to name a few. This approach has served reasonably well in areas where design is established, such as graphic and interface design. However, Web design was just new when I began designing Web sites, and I had no seasoned experts to turn to for guidance in that arena. Instead, I muddled along, trying to make sense of the medium and develop an appropriate design approach. These approaches and methods have passed through several phases leading up to the methods I employ today and that I advocate in this book.

Graphic design

In the early days of the Web, when users were "surfers" skimming along the surface of the Web, Web design was about looking good. Designers went to great lengths to design sites that were eye-catching and that incorporated established design methods. Unfortunately, the medium provided few tools for graphic design, which meant a large part of my efforts went to devising methods for controlling design and layout.

Information design

Once users became more goal-oriented, information design gained importance. Too often, Web users could not find what they were looking for. In response, designers began to pay more attention to the information structure of their sites. Information architecture became part of my practice, with a focus on solid organization, clear and effective navigation, and self-explanatory labels. I started developing content inventories and site diagrams to build sound site structure, and employed user research methods, such as card sorting and user testing, to design intuitive navigation.

User-centered design (a.k.a usability or user experience)

A major paradigm shift occurred with the introduction of "users" into the Web design process. Designers began consulting users early and often for insights that would inform the decision-making process. Until this time, I felt my role as a designer was to make decisions about the design of my pages on behalf of the user, based on what I knew about graphic, interface, and information design. Once I started working with users, I found I could derive design decisions by observing user behavior and feedback. At this point, user research and usability testing began to inform many of my design decisions.

Web accessibility

When the Web community began discussing Web access for people with disabilities, some of the fundamental attributes of Web pages came into focus—attributes that had been either neglected or suppressed because they interfered with visual design. The most basic of these is flexibility—Web pages adapt to the needs and preferences of users. In understanding the breadth of diversity among Web users, I came to appreciate that flexibility was a good thing rather than something to be overcome. I stopped trying to impose design and began optimizing my pages for graceful transformation.

Web standards

About the same time, and perhaps not coincidentally, the Web design community began demanding support for Web standards. In order to design consistent pages in an inconsistent environment, Web designers had adopted complex and sometimes unorthodox methods for implementing designs that would render consistently across browsers with poor support for standards. These methods often worked at cross-purposes with accessibility and universal access—for example, favoring images over text because image-based designs provided a measure of consistency. The call for Web standards brought about better browser support for good coding practices.

By focusing on Web accessibility and Web standards, I gained a better understanding of the purpose and fundamental character of Web sites. Rather than work at odds, I started to work *with* the constructs, and the constraints, of the medium.

Universal design

In the physical world, access is often achieved using a *universal design* approach, where accessibility features are integrated into a design. Common examples include curb cuts, access ramps, and elevators. But universal design principles can be applied to appliances, devices, Web sites, even instruction—such as education programs designed to work for all kinds of learners. The basic premise behind universal design is to provide for diversity through design rather than accommodation—for example, rather than providing handicapped access via a separate entry, one would integrate ramped access into the main entrance.

As a Web designer concerned with accessibility, I was attracted to the concept of providing a single point of access that would work for all users. I liked the idea of incorporating access requirements into my designs rather than considering them as an afterthought. By adopting a universal design approach, I could make access a deliberate part of my Web design process. I would address access requirements within the overall design of a Web page with the goal of optimizing page designs to work for all users. *Access by design* became my *modus operandi*.

However, the term *universal design* conjures images from the physical world, such as access ramps, curb cuts, and kitchen gadgets, more so than Web pages. So while I adopted a universal design approach, I had difficulty advocating the method because the term *universal design* has not found its way into the general discourse of Web design.

Universal usability

I was well into writing this book when I discovered that Ben Shneiderman was advocating a design concept that addressed universal design specifically for communications and information technologies. Shneiderman has long been a leader in user-centered interface design. His seminal

book, *Designing the User Interface*, first published in 1986, is required reading for fledgling computer scientists worldwide. He has been one of the most prominent advocates of the "human" in human-computer interaction.

In his most recent book, *Leonardo's Laptop,* Shneiderman defines *universal usability* as "enabling all citizens to succeed using communication and information technology in their tasks." For Shneiderman, citizens include users with "new or old computers, fast or slow network connections, and small or large screens, … young and old, novice and expert, able and disabled, … those yearning for literacy, overcoming insecurities, and coping with varied limitations." This broad and encompassing view of the user resonated with my universal design approach. I felt the Web could support this type of universality. I also liked his focus on usability over accessibility. As an interface designer, Shneiderman understands that access to content and functions is the basis of universality, but that access alone is not enough. Many Web sites that meet the standards and guidelines for accessibility are not usable. Having found a way to describe the design approach I had been seeking, I adopted the label *universal usability* as both a design methodology and the focus for this book.

THE FOCUS OF THIS BOOK

To achieve universal usability, Shneiderman identifies three challenges for designers: "to support a wide range of technologies, to accommodate diverse users, and to help users bridge the gap between what they know and what they need to know." In order to apply these general challenges specifically to Web design, we need to consider the layers of Web site design: function, interface, and content.

- Function: The things we design take their form from their functions. A coffee mug must have the right shape, capacity, and material to contain and dispense hot liquid. Part of designing for function is identifying the restrictions inherent in whatever we are designing: A coffee mug cannot leak and must be well insulated so the user does

not get burned. On the Web, the functional layer consists of the technical underpinnings that make a Web site work. When a Web site is functional, its content is accessible and its interactive components function properly.

- Interface: Well-designed objects are self-explanatory. One look at a coffee mug and we know it's for holding and drinking liquid. We know how to work it by the way it's shaped: The hollow is for filling, the lip is for drinking, the handle is for grasping. Having access to a Web site and its functions does not necessarily make it usable. A usable Web site tells the user what it's for and how it works. It offers an interface that clearly conveys purpose and provides self-explanatory controls.
- Content: If function and interface are the means, then content is the end. In many areas of design, the designer is not responsible for content. For example, it is the user who decides what kind of coffee goes inside the coffee mug. In the Web domain, content can be countless different things—information, entertainment, a conversation, a transaction. A Web designer *is* responsible for what goes in the cup, and whether it's instant or brewed is reflected on the design of the site.

In this book, we primarily address universal usability at the *functional* layer, focusing on the challenges of designing pages that are accessible and usable on different devices by diverse users. We concentrate on the functional layer because, without it, the other layers are irrelevant. An intuitive interface and informative content are useless if the basic functions of a site don't work. Like a car that doesn't start, a Web site that does not function is of no value to the user.

CONVENTIONS AND TERMS USED IN THIS BOOK

This book is organized around best-practice guidelines for universal usability. It begins with an introduction that lays the foundation for universal usability, and the remainder of the book is divided into chapters that address concerns as they relate to different elements of Web pages.

Each chapter begins with an overview and is followed by guidelines. The guidelines are broken into sections: first, basic principles covering the broad concerns associated with the element, and then more specific concerns relating to particular aspects of the element, such as markup, size, and color. Each guideline is summarized in a section marked "In a nutshell." Sections and guidelines are numbered for orientation and easy reference, and the Appendix contains a quick reference to all the guidelines and nutshells.

Before we begin, let's take a moment to define the terms used in this book.

Design

Design is a problematic label to assign to the process of making Web sites. The term feels too big—too much an assessment of worth. We think that things that are "designed" must look good. But design is, simply, the process of making decisions about how things are made—their size, shape, materials, and so on. There are many design fields—engineering, graphic design, industrial design, architecture—and many things created—safety pins, billboards, armchairs, towns. Although we often think of design purely in terms of its aesthetic aspects, design is what gives form to *all* aspects of our creations. Whenever we make a choice about how a thing is made—how it looks, how it operates, how it is put together—we are engaging in the process of design.

In this book, when we talk about design we are talking about the process of making the decisions that give form to a Web site.

Designers

The term *designers* is also difficult. We think of designers as well-clad people who make decisions about the buildings that we live in, the clothing that we wear, and the devices that we use. We may not feel qualified to think of ourselves as designers. However, any time a person makes something, the process involves some degree of design. Consequently, at some point in time, we are all designers, whether of sand castles, soup, or sonograms.

In this book, when we refer to designers we are not talking *only* about people who are educated in a design discipline. Professional designers design Web sites, but so do countless other people—educators, entrepreneurs, musicians, gamers, medical professionals, shopkeepers, architects, and so on. If design is the process of making choices about how things are made, then Web designers are people who make Web sites.

Users

Another source of conflict is in defining the audience. We design for "people," and when we design well, people become "users." When we refer to "people," we are not talking about your average José and Joséfa—we mean all people. Given the diversity of human needs, it may seem unrealistic to discuss design in such broad and inclusive terms. How could all people use a single Web site? We forget that we are designing Web sites, not T-shirts, and that, on the Web, one size *can* fit all.

Some people avoid the label *users* when referring to people who use Web sites. In this book we favor the label because it emphasizes the role of the designer. We build Web sites so people can *use* them. When we make a Web site that is usable, people become "users."

SO, WE HAVE ESTABLISHED that, as makers of Web sites, we are designers engaged in the process of design. We are interested in humanizing the Web by designing Web sites that people, in all their diversity, can use. To build sites that are universally usable, we must base our designs on a framework of solid functionality. Let's begin.

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Introduction

DESIGN IS A MEANS TO AN END. We design things for a purpose. We design beds to sleep in. We design clocks to keep track of time. Our success at these activities (the end) depends on the design of the tools (the means). With good design, the tool fits the task so neatly that it becomes part of the task. Instead of using a bed, we sleep. Instead of using a clock, we check the time.

We build Web sites for many reasons, but one reason trumps all others: We build Web sites so people can use them. They are to be looked at, watched, listened to, skimmed, read, printed, clicked, input into, and operated by different people using different access devices. If the result of design is that someone cannot load a page or activate a link or read a paragraph or interpret an image, then design is no longer a means to an end—design is an impediment.

A FUNCTIONAL BASIS FOR DESIGN

It wasn't by observing buildings that architect Louis H. Sullivan arrived at the formula "form follows function." It was by observing forms in nature.

> "Whether it be the sweeping eagle in his flight, or the open apple-blossom, the toiling work-horse, the blithe swan, the branching oak, the winding stream at its base, the drifting clouds, over all the coursing sun, *form ever follows function,* and this is the law. Where function does not change form does not change. The granite rocks, the ever-brooding hills, remain for ages; the lightning lives, comes into shape, and dies in a twinkling."

In his essay "The Tall Office Building Artistically Considered," Sullivan asserts that the pervading law of nature should be the law of all things, built by man or nature.

Of course, nature does not build Web sites—people do. Sullivan would ask that Web designers hold *as law* that form follows function. To follow this dictum, we must first define in plain detail what a Web site is for, and examine the functions that the Web provides. Only by defining the function of the Web can we make appropriate decisions about its form.

DEFINING FUNCTION

When thinking about function, we tend to focus on the function of the site we are designing—selling books, publishing texts, building community—rather than on the functions of the Web itself. Our decision making has more to do with information structure, visual design, and back-end technologies than with basic functionality. We might say we have this focus because our design methods ensure a working Web site. Unfortunately, basic functionality is not a given. We all have experienced Web sites that look good and are well organized but that are nonfunctional on some basic level: forms that don't submit, broken links, unreadable text. The fact is, the Web is broken at least part of the time for everyone who uses it. For people with special needs, the Web is broken much of the time. Our tendency to focus on the features of a site is part of the problem.

When we focus primarily on features, we risk making choices that impair basic functionality and lead to nonfunctional sites. To design functional sites, we must understand the purpose and functions of the Web, and the attributes that make it something that people can use.

To define function we must first identify our audience.

Who (or what) is the audience for Web pages?

In the most abstract sense, we build Web pages so that computers can read them. The software that people use to access Web pages is what "reads" the document. How the page is rendered depends on the type

of software being used. A visual browser, such as Netscape or Safari, will render pages with images and complex layouts. A text-only browser, such as Lynx, will render only the text and minimal formatting. A talking browser, such as Home Page Reader, speaks the contents of a Web page. There are other types of software that read Web pages: Email harvesting programs read Web pages to extract email addresses; search-engine software reads pages to place them in a Web page catalog. When considered in the broadest sense, our primary audience is computers. Our Web pages must be usable by computers.

Of course, *people* use computers, and as we work our way from the general to the specific we are concerned with two types of users: visual and nonvisual. Visual users are those who use the Web by viewing pages on some sort of display device; nonvisual users hear them read aloud or interface with the underlying code. According to this definition, nonvisual users include software applications—such as Google.

So our most general definition of audience includes the following:

- Visual users: look at visually rendered Web pages.
- Nonvisual users: hear pages read aloud or read the underlying code.

If we sharpen our focus, we see important subdivisions within these categories: *Software that reads what?* Email addresses? Page content? Structural information? *People who look at pages on what?* Paper? A cell phone? A large display monitor? *People who hear pages read aloud why?* Because they can't see? Because they understand the content better that way? Because they are occupied, for example, driving a car?

These subcategories are important, and we will discuss them as we delve into the specifics of Web page elements. For now, in the spirit of simplicity and clarity, these broad audience categories will serve us well as we turn to defining the functionality of Web sites.

FIGURE 1
The Smith & Hawken site is informative and interactive—users can learn about and purchase products. For universal usability, the information must be accessible and the interactive features must be functional and operable.

What are the functions of Web pages?

Web pages provide two basic functions: communication and interaction.

Communication: People consume information on Web pages. Some Web content is static and is meant to be ingested by the user. For example, a product page, containing a paragraph about the product and a product photo, is intended to communicate information about the product (**Figure 1**). When successful, the user ends up knowing more about the product—what it is and what it looks like.

The purpose of the description is to tell people about the product. Since the description is textual, the text must, above all, be perceivable by the user. It must be clear to the user that there is text on the page. For visual users, the text must be readable. For nonvisual users, text must be machine-friendly so it can be read well by software.

The purpose of the photo is to show people what the product looks like. For the photo to fulfill its purpose, it must be perceivable—people must know that there is a photo on the page, and that it is a photo of the product. However, the purpose of the image is to convey the visual properties of the product. To fulfill its purpose, the image must be interpretable. Visual users need to be able to view the image well enough to see its visual properties. Nonvisual users will not be able to see the image and will need the description of visual properties in a text format.

For content whose primary function is to be communicated to the user, the most important attribute is accessibility. For communication to occur, all elements must be available and accessible to the user.

Interaction: People work with Web pages. Other Web content is intended for interaction. Take, for example, a text link to a complete product description. The text of the link is both informative and functional. The link needs to be identified as a link, needs to communicate its destination, and, on activation, needs to move the user to the designated page. A functional link transports the user successfully from one page to another.

In addition to being accessible, interactive Web content must be functional. If a user does not recognize a link, cannot activate a link, or cannot reach the target page, the conditions of a link are not met.

So the basic functions of Web pages, in priority order, are

- Communication: Web pages communicate information. The important condition for communication is accessibility.
- Interaction: Web pages support user interaction. The important condition for interaction to occur is functionality.

What are the attributes of the Web?

Having defined the basic functions of the Web, we will consider the attributes that enable those functions.

Text-based: The Web is universal because it is powered by text. Text is the *lingua franca* of computer technologies because text can be read and "understood" by computers. In other words, software reads and performs actions based on text commands.

Web browser software performs certain actions based on the text it reads in Web documents. When reading text contained within a title tag, the software displays the text in the window title bar of the browser window. When reading text within the body tag, the software displays the text in the browser window. On encountering an image tag, the software retrieves the image file and displays the image in the appropriate location on the page.

With basic text, the computer can readily read and render a document. This rendering can vary depending on the environment. Browser software adapts its display to different display devices. Some browser software renders only the text in a document, ignoring visual elements and layout. Some browser software uses text-to-speech technology to read Web pages aloud. When people interact with browser software using spoken commands, the software converts spoken speech to text so the browser can respond appropriately.

When Web content is presented as text, *communication* can occur.

Structured: The Web is smart because of document structure. Software can read text but cannot attribute meaning without additional information. Document structure supplies meaning through tags that provide defining information for key document elements. Then, when reading, software can interpret certain aspects of a document. For example, if a phrase is tagged as the primary heading of an article, software can determine what the article is about.

When software has a way of deriving meaning, it can do far more than with text alone. Think about the functions of a search engine. If

search engine software could only read text, a search for pages about the "tufted titmouse" would return all pages that contain those words, at best listed in order of frequency. With structured text, the software can find documents that are *about* the tufted titmouse because those words appear in the `TITLE` and/or `H1` tag.

Standard browser software also makes use of structural codes, such as the document title. If a phrase is marked as `TITLE`, then software makes the assumption that the phrase identifies the document and should appear in the window title and the bookmarks list.

Software that reads Web pages aloud can communicate more information with structured text than with plain text. Many documents provide visual cues to communicate emphasis and document structure, such as italicized words and section headings. Screen reader software cannot know why a word or phrase is italicized or bold. Is it a heading? Is it emphasis? Is it a citation? Hence, these visual cues are not communicated by screen reader software. When reading a structured document, a screen reader can use audible emphasis to communicate structure to the user. Emphasis can be conveyed through a change in inflection, and document structure through sounds and inflection: for example, through a beep and slowed reading.

When Web content is structured, *meaningful communication* can occur.

Operable: The Web is interactive because it has working parts. Web pages are not merely for consumption. People operate Web pages. For the Web to be interactive, its functional parts must be in working order.

To work a Web page, we operate some sort of input device—either a pointing device like a mouse or a device that issues commands that are associated with the keyboard. Pointing devices are not usable by everyone. Some prefer to use the keyboard. Others find it difficult or impossible to work a mouse, or cannot see the screen to point and click.

On the other hand, keyboard commands can be issued using many different input devices. Commands can be input directly from the key-

board or by using spoken commands that activate keyboard actions. A variety of alternative input devices are available, and they all work by activating keyboard actions. Accordingly, all functional elements must be operable from the keyboard.

Clearly, operability is more than making sure all working parts are operable. They need to work properly and according to expectation. For instance, a link might be clickable, but if it leads to "Page not found," it cannot be considered functional. A link that is embedded in an image may be operable, but if it cannot be seen and does not include alt-text that describes the target, then people who can't see it won't know where it leads.

When Web pages are operable and function according to expectations, *interaction* can occur.

Flexible: The Web is usable because users can control their experience. In the physical world, we can't make a microwave easier to use by making the buttons larger, or shrink a book so it fits better in our handbag. Our experience of these objects is based on their design. On the other hand, some objects provide a measure of customization. As drivers, we can adjust the car seat and steering wheel to fit our size. Handbags and backpacks have adjustable straps. Since the marketplace is rife with goods, we can improve our experience by trying out different versions of the same thing. We might try several different styles of garden rakes, hiking boots, or toothbrushes, to find the one that suits us best. Or we might choose a style that has been designed to meet certain needs, such as large-print books.

When creating a fixed object, such as a book, the designer must make decisions about format—size, typeface, line length, etc. Since the aim is to create something that is usable by the largest number of people, these decisions must be based on what works best for the "average" person. In the case of a book, type size is generally set at a size that is comfortable for people with 20/20 vision.

Universal design is an approach to design that attempts to incorporate features that make things usable by more than just the "average"

person. By anticipating the needs of all people, things can be designed in a way that makes them universally usable. In a public restroom, for example, the hand dryer and paper towel dispenser need to be used by standing adults, small children, and people in wheelchairs. Locating these features at a lower height makes then reachable by all.

The physical world is not an easy place to achieve universal usability. Most of what we see around us is fixed in form. For universal access and usability, one solution must address the needs of many. However, without the possibility of customization, the notion of one-size-fits-all means that someone has to compromise. For example, tall people might have difficulty using a paper towel dispenser that is located low enough for a wheelchair user. A truly universal design would adapt to meet the needs of each user.

The Web is an ideal medium for universal design. The stuff of the Web can adapt to meet the needs of each user. Much of the Web's flexibility comes from its basic structure: Web content is flexible and device-independent. Because the Web is flexible and can be customized, the user is part of the design process and can make design decisions. For instance, although the Web designer makes decisions about format, the reader has the option to display text in whatever fashion he or she chooses. Printed text is generally read off a page; Web text can be read off a page, from a screen, by software, and so on.

Flexibility is also present in the way the Web functions. We can choose to interact with the Web's operable elements (links, forms, menus, media controllers) using different methods, such as pointing and clicking, using the keyboard, touching the screen, or issuing spoken commands.

By separating content from form, the Web is also device-independent. In other words, its form is not necessarily what defines the user experience. Users can define their own experience through the devices they use to interact with the Web.

When Web pages are flexible and device-independent, *communication* and *interaction* can occur *for more users.*

PROVIDING FUNCTION

For universal usability, make Web pages text-based, structured, operable, and flexible. Although this directive sounds simple, Web sites rarely provide this most basic functionality. For example, Web sites commonly use images as links. To be functional, these links need to be accessible, which means image links need alternate text for people who can't see them. Many Web sites do not provide alternate text for images. And even with alternate text, image links do not work for visual users who need large text for reading because images cannot be resized the way text can. Moreover, image links do not adapt as well as text to different window widths, which may affect people using small devices. Clearly, image links significantly impair functionality, yet they are a common element on many sites (**Figure 2**). How can this be? *Because decisions about form often take precedence over function.*

When it comes time to make design decisions about form, particularly with a device as complex as the Web, designers must compromise. In the example above, links should not appear as images because of functional considerations. However, we sometimes use images for links to enhance the appearance of a site: for example, to use a special typeface or type treatment that we cannot achieve using plain text. We might want to enforce a certain layout that people cannot resize or alter. In these cases, form and function are in conflict. If we use images as links, we get the form we are after but we sacrifice function. Some people will not be able to access and use our pages if we use image links.

Quality Web sites that are universally usable are not simple to design and build. But building quality sites is no more difficult than designing and building Web sites that are *not* good and *not* usable. Universal design is simply an approach to design, one that requires that we make intelligent decisions that honor and uphold the function of the Web.

Making informed decisions

We cannot build a Web site without making decisions about what colors to use, what fonts to use, how to lay out pages, how to label navigation. We may make decisions based on what we think works well in our

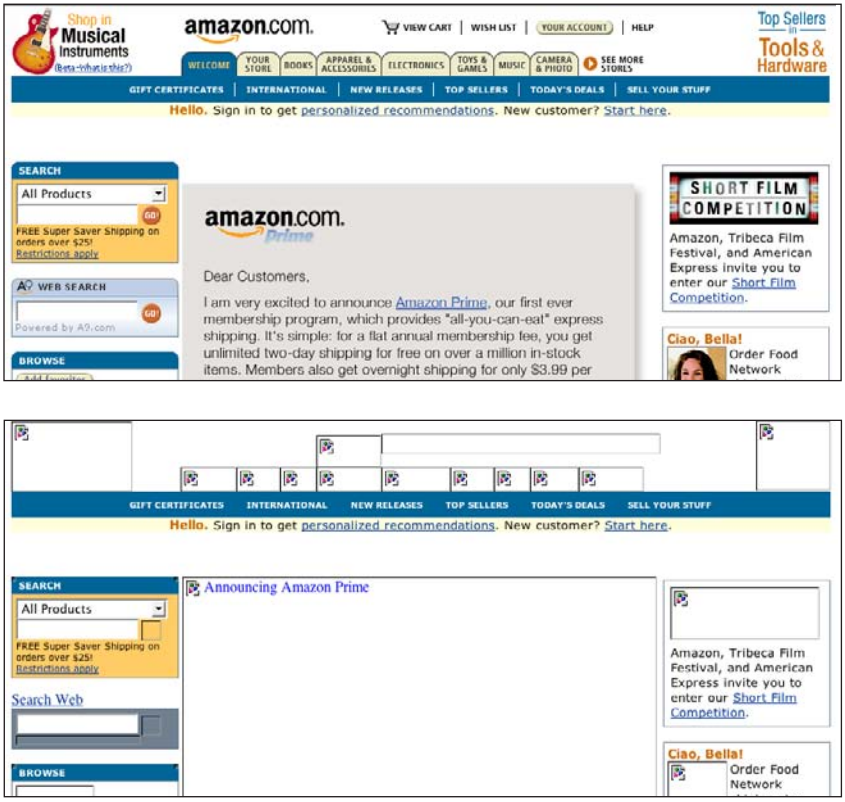


FIGURE 2
Amazon uses graphic text for links and content. Not all the graphic elements have alternate text; those that do have unhelpful alt-text. Users who cannot access image-based content and functionality may be unable to use the Amazon site.

experience of the Web. We may make decisions by emulating methods used on other sites. We may make decisions based on knowledge of best practices.

Regardless of method, somewhere along the way in the design process we will face a difficult decision, one whose effect ripples out to our other design choices. For example, we may decide to use a three-column fixed layout, even though it undermines the flexibility of our pages. When facing this type of decision, we need to determine whether the cost of a three-column layout is worth the benefit.

First, let's look at the benefits of both approaches. One benefit of a multicolumn layout is *visibility*: more content can appear "above the

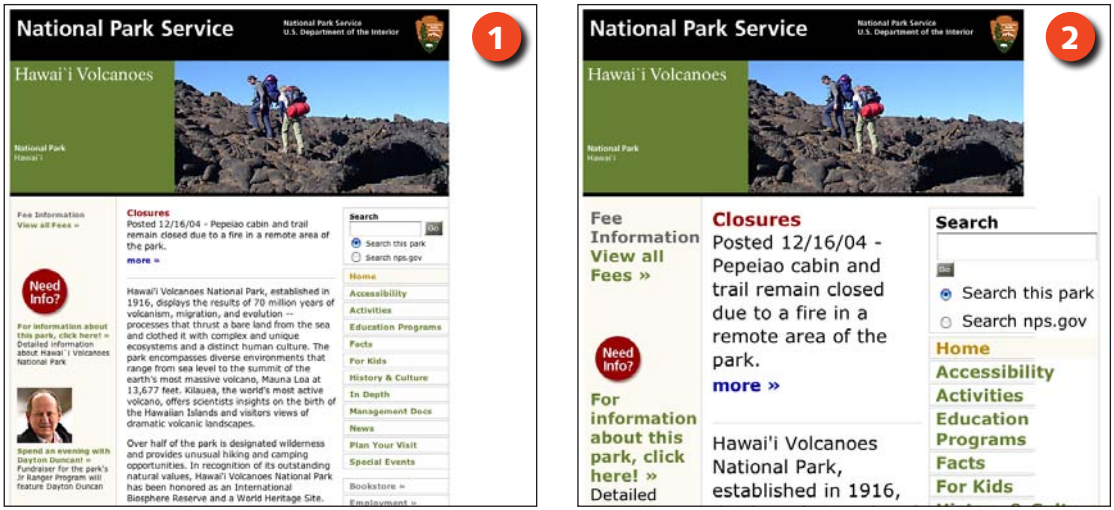


FIGURE 3
Fixed layouts, such as those used on the National Park Service site, do not adapt well to user modifications. The pages are attractive and usable when viewed on a standard display using a standard font size (1). However, the columns become narrow with enlarged text (2).

fold." Another benefit is *readability*, since fixed-width columns result in shorter lines of text. On the other hand, a flexible layout more gracefully accommodates modifications, such as enlarged type. Flexible pages also adapt to different display devices, from computer monitors to cell phones.

Now, let's look at costs. The cost of using a fixed, three-column layout is high because such a layout affects the basic accessibility and usability of a site. People who need large type for reading or who view the Web on a small device like a cell phone will either be unable to use the site or significantly hindered by the layout (**Figure 3**). The cost of *not* using a three-column fixed layout also affects usability, but in a less fundamental way. Some people might miss content if they do not scroll down to see what's below the fold. People who view Web pages on large monitors might object to long lines of text (**Figure 4**).

Now, we could make this decision based on intuition about what is important or according to personal preference. However, it is far better to make a deliberate decision that honors and upholds the basic functionality of the Web. And since we have joined hands and agreed that our primary goal for creating a Web site is so people can use it, we

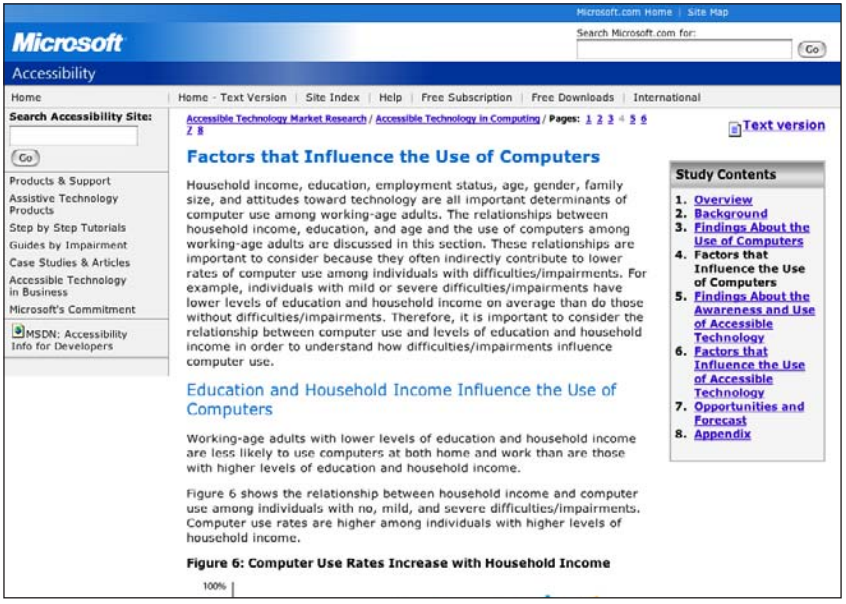
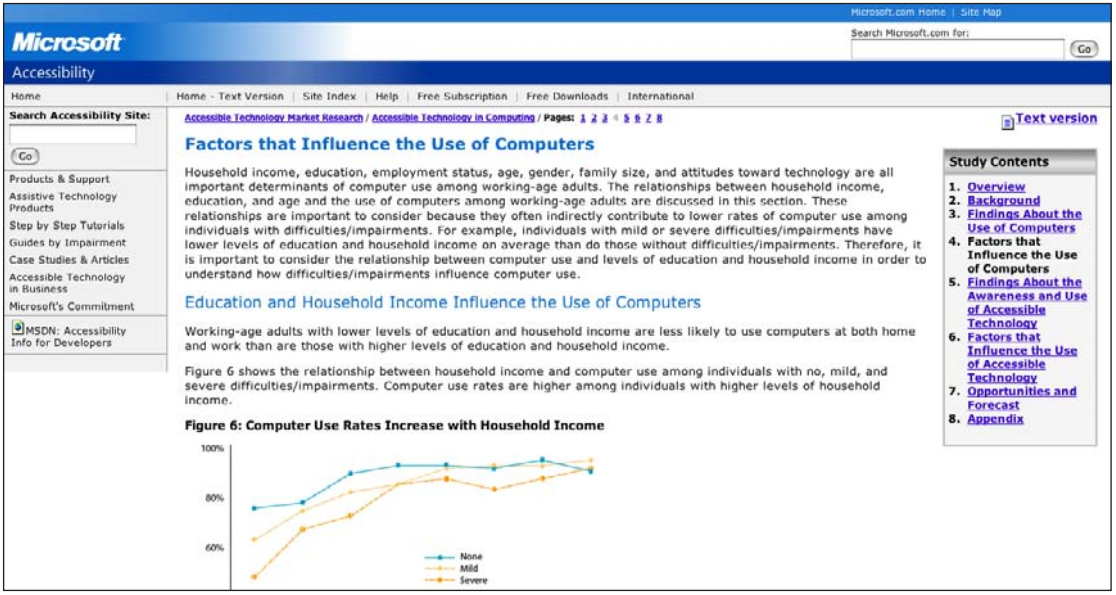


FIGURE 4

Flexible layouts, such as those on the Microsoft site, expand and collapse to fill the browser window. A flexible approach adapts well to different devices and to user modifications. However, users viewing flexible pages in a wide browser window may find the line length too long for comfortable reading.



will not compromise *flexibility* for *visibility* and *readability* because the benefit does not outweigh the cost.

Upholding the basic goals of access and usability simplifies the decision-making process significantly. Whenever the result of a design decision is that people cannot use our site, then other methods must be considered. In this case, a two-column flexible layout will meet our basic accessibility and usability goals while allowing more on-screen content and adjustable column widths.

Partnering with users

If we were to take a real-world approach to delivering a document to different users, we would provide a large-print version, an audio version, a high-contrast version, a text-only version—and still there would be people whose needs were not accommodated. In the physical world made of solid matter, it is impossible to create a thing, or even many versions of a thing, that works for everyone.

The Web provides a customizable interface to Web content. As long as the content is coded properly and designed to be flexible, users can change parameters, such as text size and color, and can use different software and devices to access Web pages. The result is that both designers and users are responsible for the design of Web pages. In a way, Web design is collaborative design. Designers send content to the user in a way that is flexible, operable, text-based, and structured; users, in turn, "redesign" the content to fit their needs and preferences.

Fixed design: Decisions based on rules and conventions. When graphic designers started working with the medium in the mid-1990s, we balked at the notion of collaboration. The rules and conventions of graphic design were established to enable effective communication. If users had the ability to change elements of a Web page, they might violate established conventions, and this was bad for communication. In response, our goal became to design pages that could *not* be customized by the user, to ensure design integrity and effective communication. We built pages with fixed elements—fixed-size text, graphic text, fixed column

FIGURE 5
User modifications are difficult to accommodate when layouts are as complex as those used on the ESPN site. This type of design relies on pixel-level precision and requires the use of graphic text and fixed-width columns to ensure the integrity of the design.

widths—that did not change size or reflow (**Figure 5**). With the advent of style sheets, we gained additional control over page elements: pixel-based sizing and positioning, leading, link formatting. Technologies such as Flash and PDF allowed us even more control over the look and feel of Web documents. Indeed, the Web gained popularity in part because it was more visually appealing than in its early, gawky days as a collection of hyperlinked text documents with scarcely any visual attributes. However, while gaining control of the user interface, we lost the active participation of the user.

In the physical world, whether we are designing razors, refrigerators, parks, or buildings, we must make decisions about how things look and how they operate. Generally, we make decisions based on a concept of what works best for the user. In user-centered design, users are consulted early and often in the design process. Established best practices are an effective source for determining what is in the best interests of the user. However, it's impossible to make design decisions that work for everyone. The way to meet the needs of a diverse population is to allow users to make their own decisions about how things look and operate.

Transitioning roles to fit the medium. When new technologies are invented, we often apply proven methods, particularly when we see the new technology as compatible with existing methods. Problems arise when this approach causes us to make inappropriate use of the new technology. While compatibility can lead us to adopt a new idea, it can also lead to misadoption if we incorrectly interpret the intended use.

Designers are accustomed to controlling design in other information and communication technologies, such as film, print, and product design. The Web is yet another communication medium, so our initial approach was to control design in the same way by applying established design conventions. This was an instance of misadoption.

The trouble with imposing established conventions on the Web is that they undermine the strengths of the medium. In the words of Tim Berners-Lee, the inventor of the Web, "The power of the Web is in its universality." When we impose a design on Web users and withhold their ability to control and customize their view, the Web becomes less universal because some people cannot use it.

For example, in order to support universal access, browsers display underlining as well as color to identify Web links. Underlining is essentially a fallback, so people who cannot distinguish color will still be able to identify links. However, underlining is considered vulgar in typographic design—a carryover from the days of the typewriter, when text styles such as italics were not readily available. There are good reasons to avoid underlines: they intersect text forms and clutter the page.

When graphic designers first started working with the Web, we objected to underlines because of their effect on legibility and readability. Asking people to read from the screen was bad enough without making them deal with underlines. However, we had little recourse since the user, not the designer, controlled the display of underlines. Though we could turn off underlining in our own browser preferences, we had to accept that our pages might or might not be displayed with links underlined. Then, with the adoption of style sheets, we gained the ability to remove link underlines, and there was much rejoicing. In today's designs, links are often displayed without underlines.

FIGURE 6
Flexible sites, such as the HubbleSite, are not designed with one page size in mind. Instead, the pages are designed to adapt to different dimensions.

The thing is, underlines are a rather useful method for identifying links, particularly for people who cannot see color. When underlining is turned off and there is no other method for identifying links, people who cannot distinguish link color from text color cannot easily identify links. A Web site without links is like a bicycle without wheels. When we impose conventions from print typography by removing link underlines, we take away one of the most essential Web functions—hyperlinks. And while users who object to link underlines have ready browser controls to remove them, users who need link underlines cannot easily put them back.

While misadoption can end in failure, it can also lead to movement away from old ways as the potential of the new medium is realized. In the early days of film, it took some time before filmmakers stopped filming staged action in the studio and began shooting live action in different locations. In recent years, we have started to reexamine our assessment of the purpose and use of the Web.

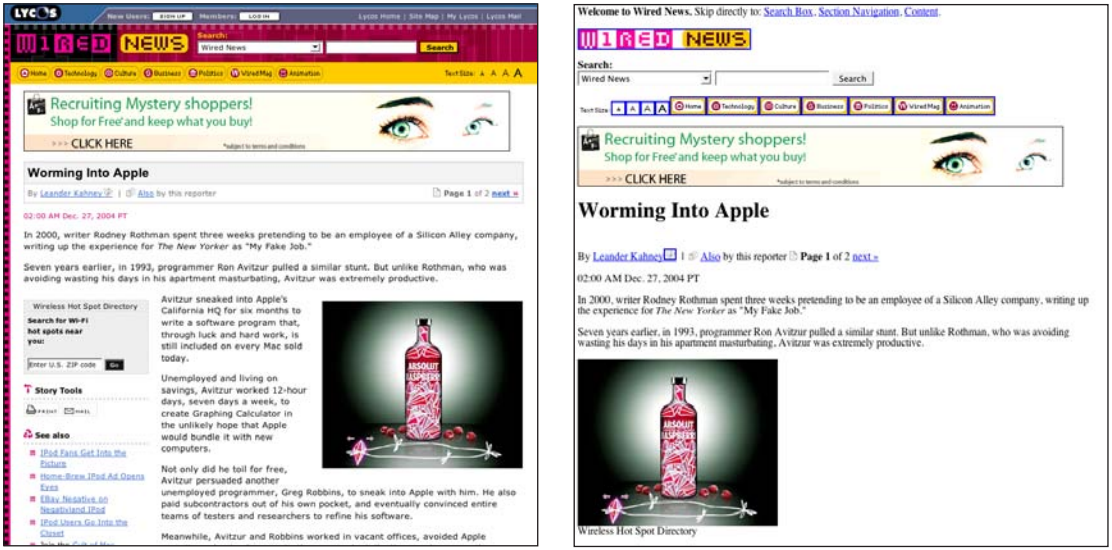
Initially, people accessed the Web using computers and standard display monitors, which allowed designers to predict to some degree how pages would be viewed. Today, with the proliferation of access devices and different "page" dimensions, we see the futility of trying to design a single page "view" (**Figure 6**).

Concerns about Web accessibility are being voiced through various channels. The Web presents opportunities for people with a great diversity of needs and preferences. Since Web content can be flexible and device-independent, the Web has great potential for people who have access or viewing requirements, use specialized software, possess old hardware and software, or have slow access to the Internet. Influential organizations like the World Wide Web Consortium are raising awareness about accessibility concerns through their Web Accessibility Initiative. Federal and local governments, organizations, and institutions are mandating Web accessibility.

All this focus on access and usability has given us the opportunity to reevaluate our role. We are accustomed to bearing responsibility for design decisions, but perhaps the Web asks something different of design. Should we continue to see ourselves as sole purveyors of design, and risk alienating users by our design decisions, or should we partner with users to build a Web that is accessible and usable by all?

Flexible design: A collaboration between design and user. Partnering with users requires two things: First, we have to design for transformation. Our pages must have flexible elements, and the overall design must hold up to change. Second, we need to recognize and respect the boundaries of the user domain.

Design for transformation means that designers must make decisions about the way Web pages are presented to the users while keeping those settings fluid so users have the ability to override settings and change elements without "breaking" the page. For example, users must be able to resize text without sending the layout into disarray. Users must be able to view pages on different display devices—large and small—and the layout must adapt gracefully. Pages must be designed using style sheets so users can override the designer settings with a custom style sheet. Pages must display well without visual formatting so users who do not use styles can still use the page (**Figure 7**). Content must be provided as text so users can suppress the display of images and still use the Web page.



Users have control over aspects of the Web environment. They control where the cursor is on the page, what links to click on, whether to reload a page, whether to use author-defined styles or their own, how to print pages, whether links open in a new window, whether images display, and so on. Web technology gives the designer control over some of these aspects. For example, we can move the cursor focus or force a page to reload. Sometimes we do enter the user domain in order to do something helpful, like place the cursor in the search field or update a page with dynamic information, like a stock quote. However, these helpful interventions can cause considerable confusion because they violate user expectations.

For example, designers often make links to external Web sites open in a new window. We do this for good purpose. One of the problems with hypertext is that, in clicking on link after link, people can easily get lost. The back button is commonly used to return to the originating site, but it has its flaws and does not always work according to expectation. To help users return to our site, we open links in a new window so users can easily close the ancillary window and return to our site.

FIGURE 7
Wired uses style sheets to control formatting and to position elements on the page. Since content and visual design are separate, users who view the pages without styles can still access the content and functionality of the site.

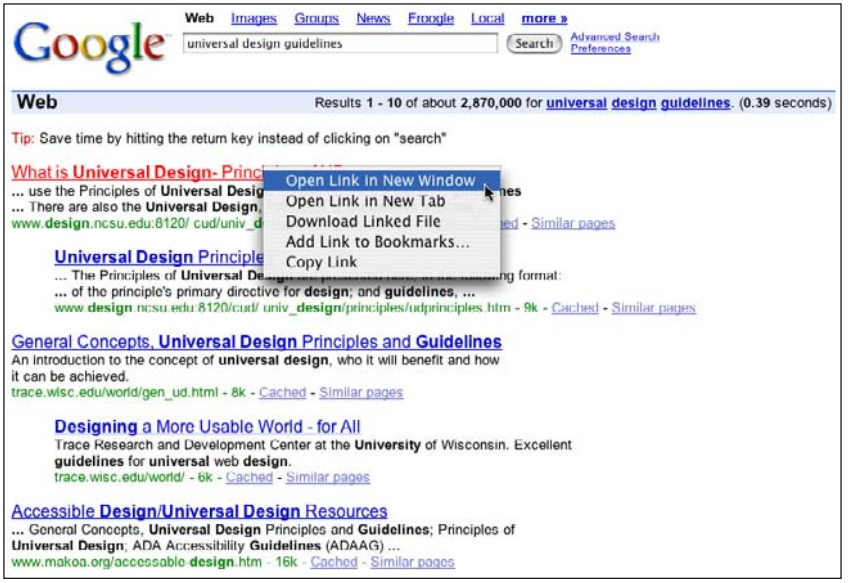


FIGURE 8
Browsers offer users the option of opening links in a new tab or window.

The trouble with this approach is that many Web users have a two-pronged strategy for navigating the Web. They set out by following page links, and then use the back button to retrace their steps. When a link opens in a new window, the browser establishes a new history for that window. When it comes time to head back, clicking on the back button does not work, since the originating site is not in the history for that window. A user with only those two navigation methods—following links and using the back button—is stuck and without options.

However, users have the option of opening links in a new window—this functionality is part of the user domain. Should a user find this strategy useful, she or he can easily implement this approach using built-in browser controls (**Figure 8**).

This scenario represents another instance where the user cannot override a designer's choice, but *can* implement it—an important distinction for collaborative design. If we remove link underlines so users don't have to deal with clutter, users who need underlines can't put them back. If we force links to open a new window, users who want to use the back button

can't make links open in the same window. If we refresh pages to display current content, users who want a static page can't override the refresh. But users can manage all these actions—removing links, opening pages in a new window, refreshing pages—through their browser interface. When considering design choices that may cause problems for some users, we should step back and let users make their own decisions.

SUMMARY

We design Web sites so people can use them. *People* doesn't mean "some people" or "certain people." With universal usability, our goal is to design Web sites that accommodate the diversity of people and the Web browsing devices that they use. To design Web sites that people can use, we must work within the flexible framework that the Web provides.

To this end, we must begin our process with a solid understanding of how the Web works. When we know its nature, we can make intelligent design decisions that uphold rather than impede its functionality. Whenever we face a decision that may impact function, we must look for other options.

No matter how well we uphold function, we cannot possibly design a Web site that meets the needs and preferences of every user. The only reason universal usability is a realistic goal for Web sites is because the Web is a flexible medium where designers and users *share* control of its design. With a working partnership, designers provide content that is well designed but flexible, and users adapt the design as necessary. To arrive at a successful collaboration, designers must assume less control and invite users to take more responsibility for their environment.

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CHAPTER 4

Images

Compared to printed images, Web images are easy to prepare and can be used without cost. However, there are drawbacks to using images on the Web. Image files are often larger than text files and take more time to download. Images command attention and can be distracting. When images are used to convey important information, people who cannot see them miss the message.

Images are not bad *per se*. Some concepts are easier to grasp when images are used to reinforce the text. For example, when assembly instructions include graphic depictions of each step, we have a way to visually confirm that we are on the right track. When product information includes a photograph, we know far more about the product than we would by simply reading a text description (**Figure 4.1**).

FIGURE 4.1
The Shopzilla site provides shoppers with a product image along with a text description. The image communicates information about the visual attributes of the product.

However, images affect accessibility when they are used as the sole means of conveying information. When content is presented as an image, people who cannot see images cannot access the content. People who have viewing requirements may not be able to modify images sufficiently to meet their needs. People with technical limitations—such as low bandwidth or older browser software—may not have access to images.

In some circumstances, images can be used without concern for those who cannot access them. Images are effective for establishing a visual site identity. Images and icons that reinforce text are not always essential to nonvisual users. To achieve universal usability, we do not have to abandon images—indeed, doing so would make the Web difficult for people who are helped by images. We simply need to use images appropriately, and in a way that does not result in the exclusion of some users.

4.1 BASIC PRINCIPLES

4.1.1 Use images purposefully

Some concepts require graphic representation: a chart depicting population growth on a census site, perhaps, or a photograph of a seascape on a travel site. A table of figures or a description of the scene can summarize, but cannot replace, the images. Other images are used to convey a sense of place or purpose, such as a photograph of a doctor with a patient on a hospital site. We sometimes use images as part of the user interface, such as arrows, icons, and buttons. We also use images to establish a visual identity for a site, so people know where they are. Though some of these examples are more compelling than others, in each of them the images have a purpose: providing information, establishing context, providing direction, or establishing a brand or identity.

In other cases, even though our content does not lend itself to visual representation, we feel compelled to include images because we know that "the Web is a visual medium," and we need to add images in order to "spice up our pages" (**Figure 4.2**).

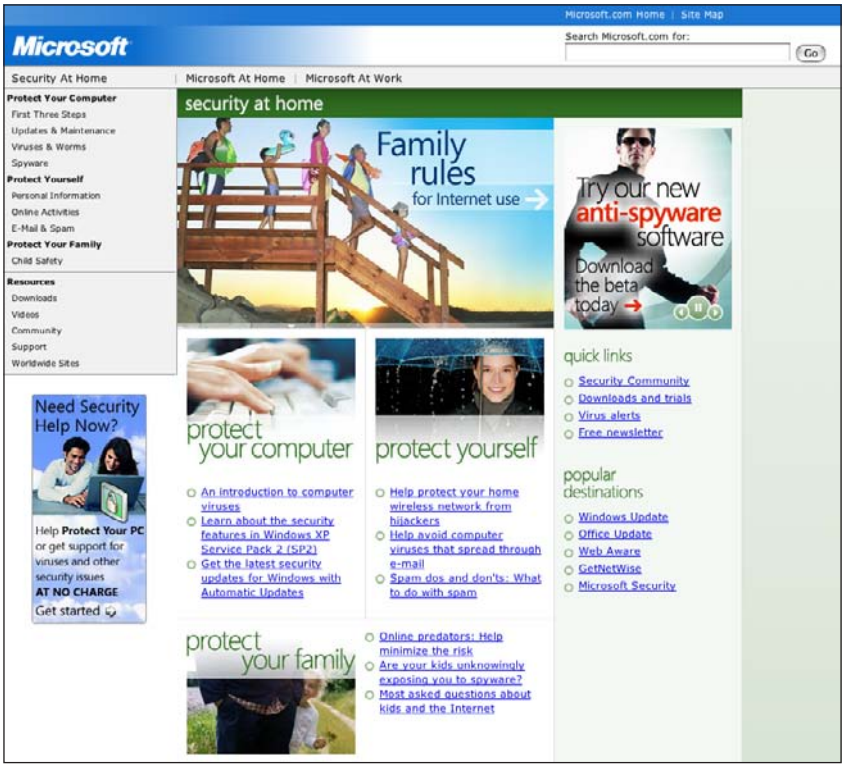


FIGURE 4.2
When images are used for visual impact, as on the Microsoft page shown here, their meaning can be unclear, as can their relationship to the content of the site.

This is a misuse of a powerful communication device. Images first draw the eye, then they invite interpretation. When presented with a page containing an image and text, our eye is drawn to the image. We then try to interpret why it's there and what it means. On a day-care center home page, we know that the photo of Susie and Sam on a swing is there to give us a sense of the spirit of the place, not to show us how to swing or to help us recognize Susie and Sam. When the meaning and purpose of an image is clear, images communicate extremely well. When images are unrelated, they foil all attempts at interpretation, which can lead to frustration. If the day-care center home page contained a photo of a duck, unless the center's name was something like Ducky Day Care, users might be baffled by the image.

FIGURE 4.3
Surprise.com includes images as an essential part of the user interface. The meaning of the images is unambiguous. The images may make features of the site more comprehensible to users who are helped by images.

Images are effective when they are used purposefully. If images are not part of the message, then don't use them. When using images, make sure they are appropriate to the context. A Web page that provides computer setup information should not be peppered with photos of happy people using computers. Instead, include useful images, such as photos or diagrams that demonstrate what is described in the setup instructions (**Figure 4.3**).

In a nutshell. Images come at a cost to usability—they take time to download and are inaccessible to users who cannot see them. Use images with a purpose, such as providing information or enhancing the user interface.

FIGURE 4.4
Some browsers, such as Opera, allow users to enlarge graphics as well as text. However, graphic text, such as the site links and logo (1) on the Network for Good site, becomes pixilated when enlarged and may be difficult to read, whereas regular text (2, 3) remains clear and legible.

4.1.2 Do not use graphic text

When it comes to advancing universal access on the Web, text is the best tool we have. Text is machine-friendly and can be read and modified by software. Text can go through many permutations and still convey its message.

Images, on the other hand, are not readable by machines and therefore are not amenable to change. From the browser's perspective, an image is a collection of colored pixels. Browser software cannot look at an image of a navigation link and recognize that the colored pixels are, in fact, text characters that make up the word *home* or *help*.As a result, software cannot make intelligent use of graphic text the way it can with plain text.

For example, the browser cannot enlarge an image gracefully; to do so intelligently, the browser would have to be able to make sense of the image. In order to make an image larger, all the browser can do is more of the same—add to the existing colored pixels—which is not an elegant solution. When a user enlarges graphic text, the result is pixilated text that is difficult to read (**Figure 4.4**).

Graphic text cannot accommodate other modifications that can be made to plain text. Users cannot change the color or style of graphic text. Applying a custom style sheet will have no effect. Moreover, people who cannot see will not have access to graphic text.

Ultimately, graphic text can be an insurmountable barrier to people who are attempting to use the Web. If images are used for navigation, people may not be able to access the information that is contained in the images. If people cannot use a site's navigation, they cannot use the site. Plain text is always better, particularly for something as essential as navigation.

Of course, sometimes graphic text is acceptable—when its purpose is visual, as in a banner graphic and logo. Here the primary function of the text is branding, not information. In these cases, the page structure (title tag, page heading) must describe the content and origins of the page, so the information conveyed in the graphic text is available to people who cannot see the image.

In a nutshell. Graphic text is not machine-readable, flexible, or customizable, and therefore is inaccessible to some users. Avoid using graphic text; use plain text instead.

4.1.3 Avoid animated images

If images are a powerful force in commanding the attention of the user, moving images are many times more commanding. It is nearly impossible to ignore a page element that is moving, particularly one that is blinking rapidly on and off.

Animations are generally seen as an annoyance on Web sites. They make it difficult to focus on the primary content of a page. For some people, animations are more than an annoyance. They cause discomfort or even medical consequences, such as migraines or seizures. Even static images that only *appear* to be animated can be a trigger—for example, images with closely spaced stripes that seem to vibrate (**Figure 4.5**).

Do not place an animation alongside primary content. An animation should appear on a page of its own so the decision to view it is an explicit user choice. Do not begin playing the animation right when the page loads. Instead, provide controls for starting and stopping the animation. Avoid images that include patterns that seem to animate, such as striped or patterned backgrounds.

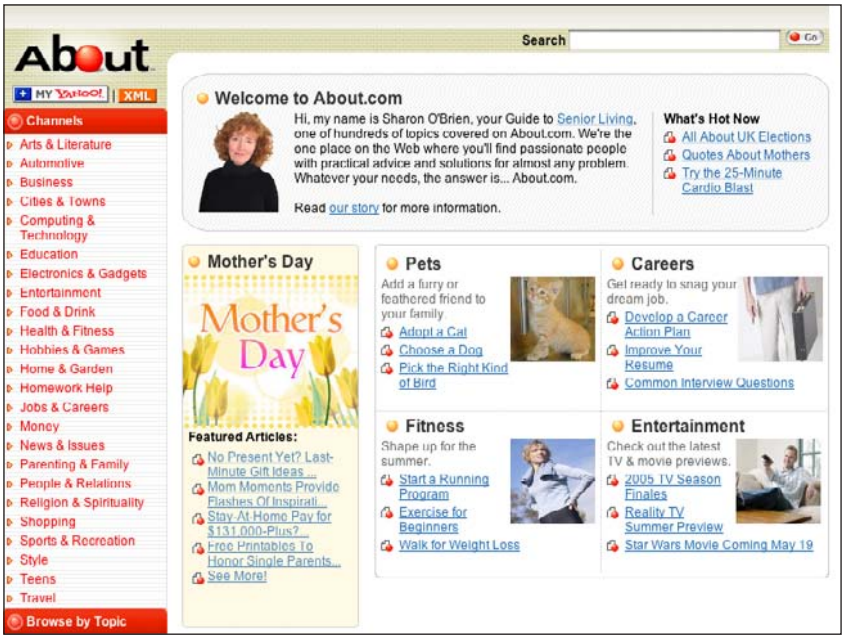


FIGURE 4.5
About.com uses a patterned background that appears to vibrate, which can cause discomfort and impair readability.

In a nutshell. Animations are distracting and can even be debilitating. Avoid using animations. When using animations, allow users to control playback: play, pause, and stop.

4.2 TEXT ALTERNATES

4.2.1 Provide alt-text for all relevant images

Many HTML structures allow designers to provide information in more than one format so users can access it using different methods. Link underlines are an alternate method for identifying links for people who cannot see color. Alternate text is an alternate method for supplying information to people who cannot see images.

When an image is essential to the content and functioning of the page, nonvisual users can read the text description provided in the `ALT` attribute of the `IMG` tag. Take a text graphic with alt-text that is the same

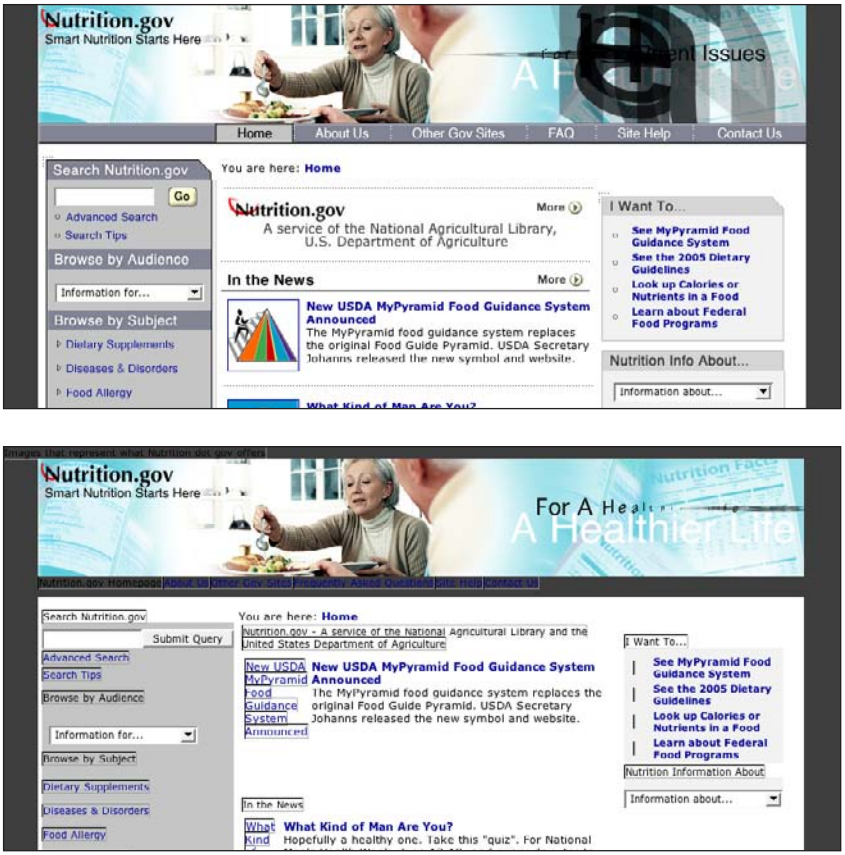


FIGURE 4.6
Nonvisual users can use sites with images as long as equivalent alternate text is provided. Nutrition.gov provides descriptive alt-text for its image links so users who do not have access to images can still use the site.

as the text that is displayed in the graphic: The visual user reads the text in the text graphic (as long as it is readable); the nonvisual user has software that reads the text in the `ALT` attribute (**Figure 4.6**).

When images do not contain alt-text, users who cannot access images are stuck. People who do not load images are unable to navigate a Web site that uses images for navigation if alt-text is not provided. Since screen reader software cannot interpret images, it relies on alt-text to communicate image information to the user. When an image is provided without alt-text—for example, `<img src="photo.jpg">`—the

only information the screen reader can relay is that there is an image on the page and that its file name is "photo.jpg" (**Figure 4.7**).

If a picture is worth a thousand words, then a short description in the ALT attribute is a poor substitute. In many cases, however, such a description can provide enough information to assure Web access to nonvisual users. For images that are part of the user interface, provide alternate text that provides the equivalent function. In other words, the alt-text for the *New York Times* masthead should be "The New York Times masthead"; the alt-text for a print icon should be "Print

FIGURE 4.7
The NextD site uses images for essential elements but, in some instances, provides unhelpful alt-text and, in others, provides no alt-text. Users who do not access images will have trouble using the site.

this page." When an image is part of the content of the page, the alt-text should describe the image: "Photograph of sunset," "Graph of net gains," "Painting of Venus by Botticelli."

Other types of image elements should have alt-text as well. For example, image maps should have alt-text for all the active areas. Form buttons should also have alt-text. Background images cannot contain alt-text, so make sure background images are not required content.

In a nutshell. Users who cannot access images can get the equivalent information via alt-text. For images that are part of the user interface, use alt-text to provide the functional equivalent, such as "Go to next page" or "Print this page." For content images, use alt-text to provide a brief image description.

4.2.2 Provide a full text description for content images

Generally, the best that alt-text can do for content images is provide a brief description of the format and subject of an image. To fully describe the information contained in an image to a nonvisual user, we need to use other methods.

HTML allows for a full description of image content by providing the `LONGDESC` attribute of the `IMG` tag. The content of `LONGDESC` is a file address pointing to a file that contains a text description of the image. When a nonvisual user encounters an image with a linked text description, he or she loads the linked file, reads the description, and then returns to the originating page.

Another way to provide a full image description is to provide image captions. This approach benefits both visual and nonvisual users because text may prove helpful in comprehending the image. For example, an image caption explaining the contents of a graph or chart allows nonvisual users to access the information via the caption, and helps visual users to better their understanding (**Figure 4.8**).

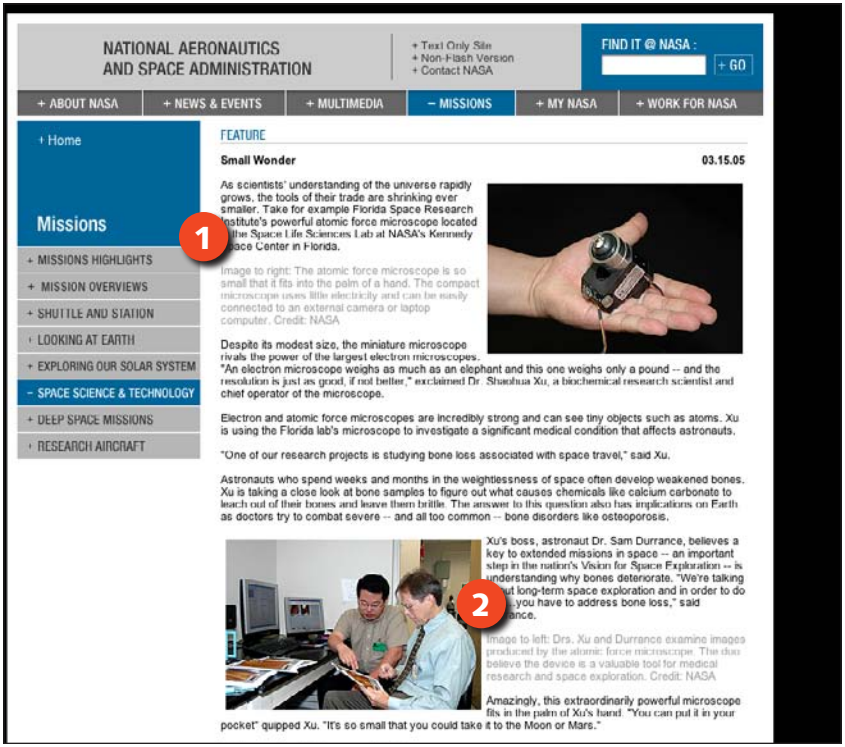


FIGURE 4.8
NASA includes captions (1, 2) for the images on its site. The captions provide information about images for both visual and nonvisual users.

In a nutshell. Content images may require more description than can be provided via alt-text. Provide a text description of the image information using a linked page or image caption.

4.2.3 Provide blank alt-text for irrelevant or redundant images

Alt-text is a way of communicating *relevant* information contained in images to people who cannot access images. However, not all images are relevant to nonvisual users. When images are relevant only in a visual context, provide blank alt-text (`alt=""`) so nonvisual users do not have to bother with irrelevant content. Software that reads Web pages understands that empty alt-text identifies an image that is irrelevant, and so it does not communicate any information about the image to the user.

For example, elements such as spacers, bullets, and arrows do not add anything beyond visual emphasis and do not need to be described. People using screen reader software do not need to know that red bullets mark list items. When blank alt-text is used for such images, the software will skip over the image.

FIGURE 4.9
When images are used to reinforce text links, such as the icons on the Creative Commons site (1), alt-text is redundant since its function is handled by the link text (2). In these cases, the best approach is to provide blank alt-text (alt="").

Also, images that appear alongside text to provide visual emphasis or clarification need not be communicated to nonvisual users. For example, text links are often paired with icons to help people quickly identify the link purpose, such as an arrow next to a "next page" link, or an email icon next to an "email this article" link. In these cases, the text link does a sufficient job of conveying the link function to nonvisual users. Generally, when images are used to reinforce text links, providing the functional equivalent via alt-text only results in redundancy (**Figure 4.9**).

In a nutshell. Not all images are relevant to nonvisual users. When images are not relevant outside of a visual context—such as spacer images or custom bullets—provide blank alt-text (`alt=""`).

4.2.4 Maintain a catalog of image content

Web designers have a lot to keep track of with respect to images. Publishing Web images involves both the visible properties of an image and its nonvisible properties—such as alt-text and long descriptions. In order to ensure quality and consistency, keep some sort of catalog of image content. When image cataloging is part of the Web design process, the task of composing alternate text becomes a deliberate part of providing image content. When an image is used in multiple locations, the catalog can be the source for the alternate text.

In a nutshell. Alt-text and text descriptions are integral to providing image-based content. Maintain an image inventory that includes alt-text and text descriptions, particularly for large-scale or collaborative projects.

4.3 SIZE

4.3.1 Keep image dimensions as small as possible

From a data perspective, images are much less efficient than text. A photograph of a toaster requires more disk space to store and more bandwidth to deliver than a paragraph of text describing the toaster.

400 × 500 high-quality JPEG = 28KB

400 × 500 low-quality JPEG = 12KB

300 × 375 high-quality JPEG = 20KB

200 × 250 high-quality JPEG = 12KB

FIGURE 4.10
Compression reduces file size, but also reduces image quality. An alternate method for producing small image files is to reduce image dimensions. Smaller images make smaller files and adapt better to different displays.

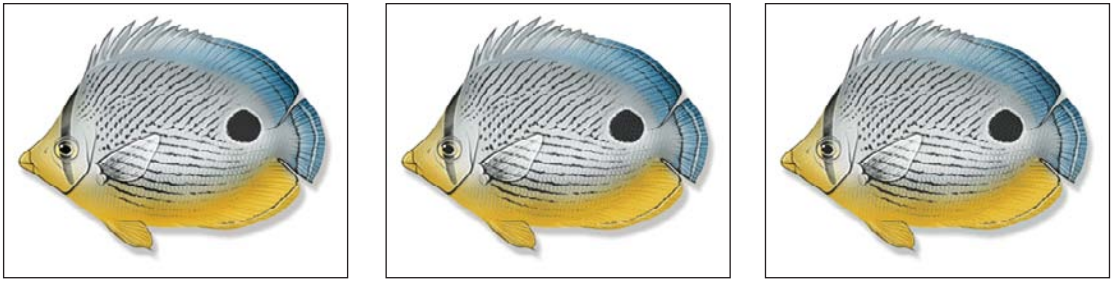
However, for the visual user, an image can be far more efficient at conveying what that toaster looks like. We use images because they are a powerful and effective way to communicate. For Web designers, the goal must be to capitalize on the advantages of images without overburdening the user.

Web images are demanding because they require more data than text. The commonly used Web image formats are bitmap images, which, unlike text and vector graphics, are not stored intelligently and therefore require more data. To make up for this, Web bitmap images, including GIF, JPEG, and PNG, use different compression schemes to reduce file size, so the images can traverse the network more quickly.

Images are also less flexible than text. While text can reflow to fit different display devices, images cannot. This means that a user viewing a 500-pixel-wide image on a 320-pixel-wide display device will be unable to see the entire image at once.

To make the best use of images, keep the image dimensions as small as possible. When it comes to file size and display speed, small images fare better than large ones (**Figure 4.10**). Also, smaller images work better on small display devices.

When saving images, use the image format that best suits the image. GIF and PNG work well for graphics and illustrations; JPEG works well for photographs. Use as much compression as possible to reduce the file size without overly degrading image quality. For GIF images, one of the



256 color GIF = 36 KB

64 color GIF = 24 KB

32 color GIF = 20 KB

FIGURE 4.11
One way to reduce file size when working with GIF images is to reduce the number of colors used to represent an image. Often, reducing the number of colors has little noticeable effect on image quality.

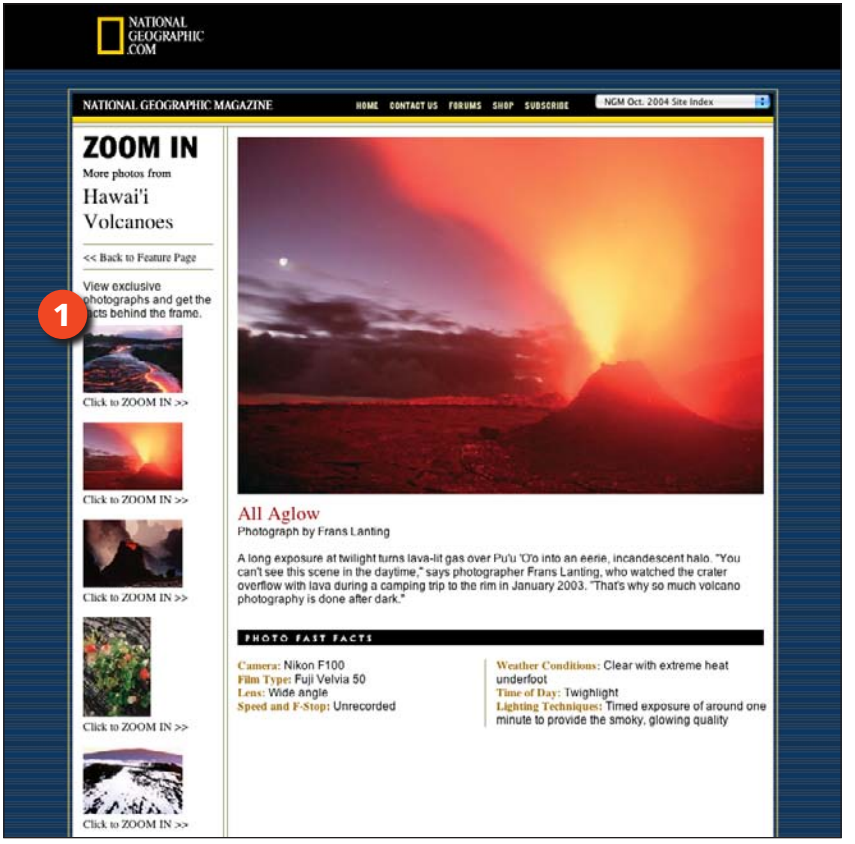


FIGURE 4.12
National Geographic provides thumbnail versions of its photographs (1), allowing users to choose which of the larger images they wish to view.

best ways to reduce file size is by reducing the number of colors in the image (**Figure 4.11** *previous page*).

In a nutshell. Large images take longer to download and limit page flexibility. Keep image dimensions as small as possible, and save images using as much compression as possible without significantly degrading image quality.

4.3.2 Use thumbnails for large images

Sometimes images need to be big. Product images must be large enough to display the details that are important to shoppers. Images for printing must be large enough to use in printed publications. Content images, such as those on museum or teaching sites, must be large enough to represent the content.

However, given the demands that images place on the user, large images should not appear on the main pages of a site. Most users will not want to wait to load a large image in order to move around a site. Instead, provide access to large images via a thumbnail or text link on a main page that invites the user to load the full-size image (**Figure 4.12**).

In a nutshell. Large images are sometimes integral to the purpose of a site. Provide access to large images using thumbnails or text links so users can choose whether to load the image.

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