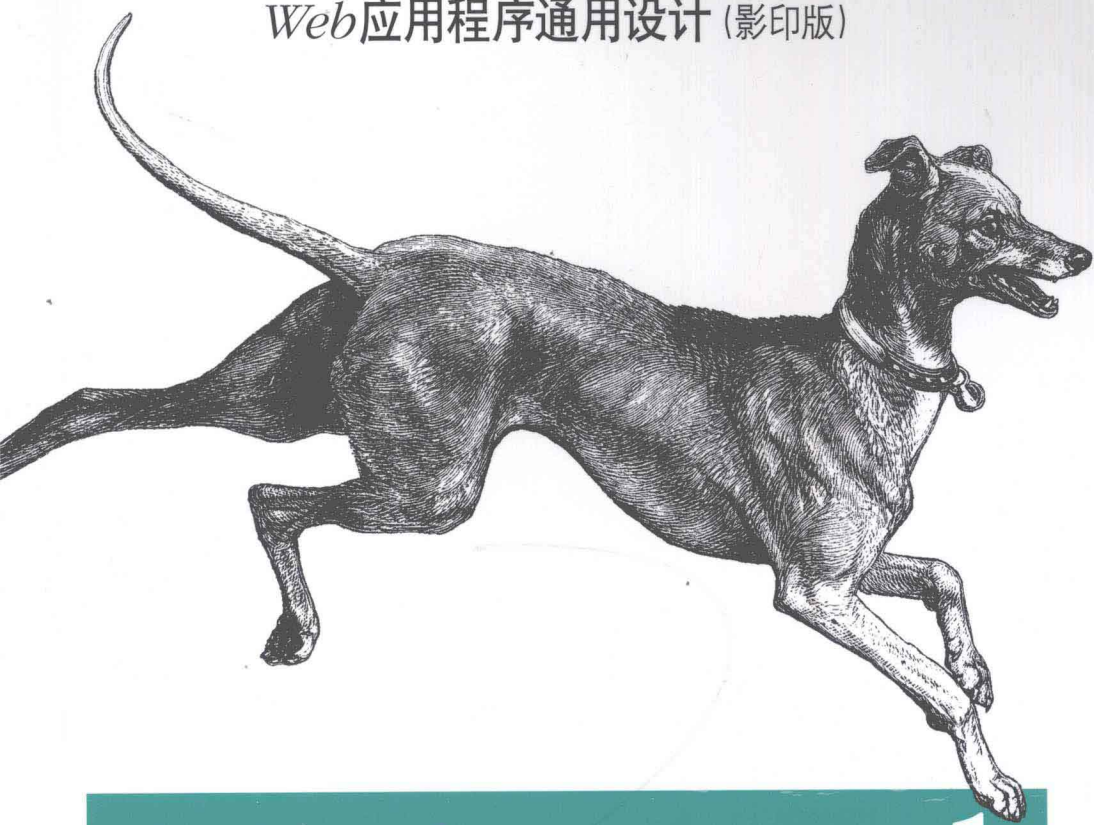Web应用程序通用设计（影印版）

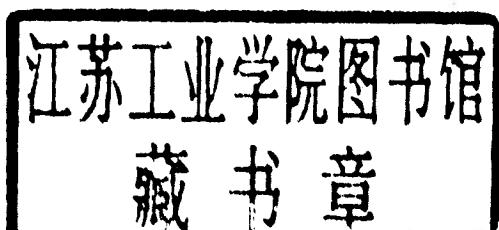# Universal Design

for Web Applications

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Web 应用程序通用设计(影印版)

Universal Design for Web Applications

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Introducing Universal Design

There's a popular, and probably apocryphal, story that features a naval officer (sometimes it's a businessman) who receives a performance review that reads: "This officer never makes the same mistake twice. However, he appears to be attempting to make them all once."

Over the life span of the Web, we've learned a lot about what not to do. Sometimes, this trail of "don'ts" leads us in the direction of the "do." But all too often, another "don't" is lurking around the corner. Because of all of the complexities involved with heterogeneous servers and protocols and languages and authoring tools and browsers—and don't get us started about the *users*—we as web tradespeople are all too happy to give up on finding the *right* way to build our content, once we've found *some* way to build it.

Before web production can grow into a profession, we first need a science, a calculus—or at least, some kind of broadly applicable line of reasoning on which we can rely to keep the don'ts at bay. In this book, we put all those pieces together, to help ensure that we don't all keep making the same, or worst of all, self-perpetuating mistakes.

If our job is to create a science, we'll need to determine the core value against which we measure all our progress. In the past, many have advocated adherence to a technical standard—say, HTML—and we agree that web standards are important. (You should expect as much from two alumni of the World Wide Web Consortium, which has published nearly all of those standards.)

Still, adherence to a technical document does not a profession make. It's still possible to code oneself into a corner in fluent HTML. Real expertise comes from people who use their code and content to anticipate problems before they arise and to improve the user experience wherever they can.

For the purposes of this book, we will approach every problem we face with the ultimate goal of providing the greatest benefit to the greatest number of people possible. This is the principle of universal design (UD).

The field of UD grew out of disciplines where exclusion is common, and the consequences of that exclusion can be dramatic. We are specialists in one of those disciplines: accessibility to users with disabilities. People with disabilities often represent the most compelling cases for inclusive design—not just in information technology but also in the physical world. However, UD encompasses all possible contingencies involved in the design of an object or experience, whether they are physical, cognitive, economic, geographic, ergonomic, or even something as simple as user choice.

Ron Mace, an architect who dedicated much of his career to designing a more usable world, coined the term:

> Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.

Over the years, we've found that web practitioners tend to discover an affinity for architecture. Matt, for one, has taken more photos of buildings over the years than he has of people. Conversations in some web design circles are as likely to gravitate toward names like Frank Gehry or Santiago Calatrava as they are to Tim Berners-Lee or Eric Meyer. We have come to recognize that it is because, like them, we deal with architecture every day. Although our failed designs rarely result in a physical catastrophe, we do make decisions that affect people's ability to navigate, interact, and seek and participate in communities of their own. Our architecture in many ways is their architecture—and so, we have a lot to learn from their rules and rigors. This book is our attempt to apply the architectural field of UD to the Web.

One of the biggest opportunities for universal design to take hold on the Web is with something you probably already own: a mobile phone. It is estimated that mobile devices will overtake computers as the method of accessing web content within the next few years, if they haven't already. As this transition takes shape, all of the contingencies we just outlined will play a role in how a piece of content is designed.

You will find that we come back to mobile and accessibility as our criteria throughout the book. This is not at all accidental. Between these two issues, we find concrete examples of nearly every kind of eventuality that will arise when humans come into contact with web content. We have concrete guidance to offer in order to make today's web content work better for both user groups because the techniques for making web applications work on mobile

devices overlap so often with the techniques used to make content accessible to people with disabilities.

Mobile and accessible design are also at opposite ends of the spectrum when it comes to meeting our stated goal: while good mobile design has the potential to reach the greatest number—perhaps billions of people—accessible design practices can mean the difference between participating in many of the most basic life activities and being marginalized. It is a stunning example of the greater good.

Accessible Design: A Story

Even today, many grocery stores have a phone-in service, allowing people to place their orders and have a clerk gather the items for customer pickup. For someone who is blind, or who uses a wheelchair, or who can't lift heavy items, a service like this allows them to live unassisted. Those of us without these disabilities tend to think of things like grocery shopping as a chore, but it is so much more to those who can't do it themselves.

In 1998, Matt was a web developer at an online grocery delivery service based in the Seattle area. When users who were blind started calling in, there was little that was known about making the web usable for them. At the time, and unbeknownst to Matt, Wendy was working on what would later become the first Web Content Accessibility Guidelines. But the most official accessibility policy in the U.S. in 1998 was an amendment to the Rehabilitation Act of 1973 called Section 508, which requires federal agencies to make or purchase electronic and information technology that is accessible to people with disabilities.

Standards aside, one thing was clear: while for the soccer moms of the Puget Sound an online grocer was a convenient service, for people with disabilities it was life-enabling technology.

Accessibility to people with disabilities has always been tough to sell on its merits, however noble and intuitive they may be. The stereotypes and stigmas attached to disabilities and people with them are all deeply ingrained in our culture. The sad fact is that even in 2008, in spite of an array of assistive technologies that enable people who are blind to be equal members of the workforce, the National Federation of the Blind reports that the unemployment rate among people who are working age and legally blind in the U.S. is approximately 70%.

Think about that. 7 in 10. Regardless of your position on the political spectrum, this should not only alarm you but also motivate you to work toward increasing access to information, community, and, most critically, work and

greater independence not only for people who are legally blind but anyone who has a disability.

Those of us who are passionate about accessibility are aware that continuing to ignore the design factors that create barriers only magnifies the problem. It is not a coincidence that the name of the leading screen reader, JAWS, stands for Job Access With Speech. Assistive technology, such as screen reader software, depends on machine-processable information—including names, descriptions, roles and states of objects, as well as the relationships between objects—which are not strictly necessary to create a visual user interface, Web or otherwise. This is why we must consider these needs in the everyday work we do.

On the other hand, the landscape for web design is changing for everyone. Since June of 2007, one device alone has driven a new, global awareness of designing for mobile devices. And it is rapidly enveloping us all.

When it comes to attracting users, the iPhone is an international phenomenon. Available in a growing number of countries, it appeals to early adopters—a common trait of Apple products—but also to people who prefer simple ways of getting things done. On July 11, 2008, the geeks and the seekers waited in line for hours to get one of the first iPhone 3Gs. To many of them, this was their own version of life-enabling technology. And woe to those who didn't understand the iPhone craze: at a store opening in the Los Angeles area, a reporter for KTLA descended on the crowd to poke the poor captive audience with a proverbial stick, and found himself a hair's breadth from being eviscerated.

It's easy to dismiss any discussion of the iPhone's impact on mobile computing as Apple fanaticism, but two features have undeniably altered the landscape:

- A mobile browser with desktop-like functionality
- A large user base with unmetered wireless access to the Web

Before the mobile Safari browser, the Web was a very different, very constrained experience. Users found the sites their carriers wanted them to find, thanks to the walled gardens constructed for them, and avoided straying too far for fear of outrageous bandwidth overage charges. But today, not only do millions use the iPhone for web access (some 94% of iPhone users, according to Apple, access the Web from their device), but full browsing applications have appeared on other platforms, and the possibility of returning to the tiny screens and minimum capabilities of the mobile Web of just a couple years ago already seems rather quaint. Furthermore, the market has spoken, and it doesn't want that mobile Web; it wants the Web that it has today, on any device, in any place. We know the market does not take no for an answer.

The web's post-hoc adaptation to mobile modes of interaction is not limited to phones, either. More and more portable electronics are coming equipped with wireless connectivity and embedded browsers: at least 71 million Nintendo DS systems and 38 million PlayStation Portables have been sold as of June 2008, and each one is Wi-Fi–equipped, as are instant-messaging devices like the Sony mylo. Amazon's Kindle e-book reader (which you may even be using to read this book) lets users get connected using a basic browser on the device's data service. And Nokia's N800 series Internet Tablets come complete with a full Mozilla-based browser, as well as the Adobe Flash 9 plug-in, all on an 800x480 display. The range of devices accessing the Web in the next few years will include both upgraded versions of the electronics we use today, and hundreds, perhaps thousands of new gadgets we haven't yet imagined.

In fact, not only will the number of non-PC Internet-connected devices pass that of Internet-connected PCs—on a global scale, it won't even be close. In 2007, Lee Kai-fu, the president of Google's China operation, said, "most Chinese users who touch the mobile Internet will have no PC at all." And the numbers prove it: according to a September 4, 2008 article in *The Economist*,[*] 29% of China's Internet users, or 73 million people, use the mobile Web—a 45% increase in the first half of 2008 alone. The article goes on to outline the efforts of the BRIC countries (Brazil, Russia, India, and China) not only to modernize their mobile and Internet infrastructures but to use new technology to leapfrog those of us in the so-called industrialized world. It's no coincidence that Google has invested heavily in creating a mobile platform called Android, or that Nokia has bought and committed the Symbian mobile OS to the open source world. All those new toys have to run something. And the web-browsing tech in nearly all of them will be more like a desktop browser than the comparatively slim mobile pickings of the last few years. For its part, Google has announced that the rendering engine behind Chrome, the browser it released in September 2008, will be in Android devices as well.

That isn't to say that this change will be without compromise. Let's look at the iPhone as an example. The iPhone's 480x320 display is just over 1/12 the resolution of a standard 1280x1024 monitor. Enabling the desktop-like experience on a screen that small requires the ability to zoom. Links are often hard to tap on with your finger because they are too small or too close together. (One critic has said it is like "clicking on a 20-pixel image with your 40-pixel finger.") And text entry, while arguably improved over competing phones' chiclet QWERTY keyboards, is still at best a third as efficient as a full keyboard.

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[*] *http://www.economist.com/science/tq/displaystory.cfm?story_id=11999307*

It is here that we see the nexus between mobile interaction and disability. People with low vision use screen magnifiers in much the same way iPhone users stretch and pinch their way around the browser. People with fine-motor disabilities often have trouble using a mouse to navigate web pages because links are too small or too close together. Some people with more profound motor disabilities, such as cerebral palsy, use onscreen keyboards to enter text on sites—and they don't like having to type any more than most people using their mobile devices do.

It could be that the current crop of mobile device users is the best thing to happen to people with disabilities for a long time. When else have millions of people stood in line with $199 or €129 or £99 in hand to purchase a functional disability? Where people with disabilities have long been treated as a weak force in the market, mobile users are now dominating, and by winning themselves some concessions from websites in their thrall, maybe, just maybe, they have the potential to enable those whose needs run far deeper than mere convenience.

Putting Universal Design to Work

The silver lining to this design approach can best be described with a little more history. In 2000, that online grocery site Matt was working on finally realized that its monolithic approach to the user experience was not going to succeed. The more features that were piled on, the more unwieldy the core of the experience—find item, add to cart, check out—became. When users woke up one morning to an entirely different experience as the result of a merger, they lost all they had learned, causing them to lose patience and interest as well.

At the same time, people had begun to ask about using the site via their mobile devices, over the primitive WAP, a protocol that displayed "decks" of content one screen at a time, on devices that could usually handle only four lines at a time. With a site that relied all too heavily on JavaScript, frames, and layout tables, there was nothing there that could be repurposed to enable other devices to do anything useful on the site.

And yet, even back in 2000, it was possible to practice universal design. It all started by taking each user action and breaking it down into atomic tasks that took place in a determinable order. Beginning with these basic building blocks, it was possible to reconstruct the entire online grocery site in line with each of these tasks. The product was a simple site that used standard HTML, textual links for every action, and basic HTTP requests for each interaction with the server.

Using this as a starting point, any kind of user experience was possible. The core site worked with screen readers, as well as the first generation of mobile phones that supported HTML. Using the strategy of progressive enhancement, which we will discuss later, it was possible to create the same experience for existing customers, more cleanly and more quickly, while giving them the same look and feel they had before. A focus on universal design is what allowed us to stop working *around* HTML and start working *with* it.

Selling It

The lights come up. You and your friends get up from your seats, shifting the popcorn tubs and candy boxes underfoot, and the discussion begins.

"That was amazing! I loved how the director was faithful to the novel it was based on."

"Yes. And I thought the ending tied all of the subplots together nicely."

You stand there, silently. You didn't get it. At all.

In fact, you look around at the others filing out of the theater, and the ruffled brows and other quizzical expressions you see indicate that maybe your friends are the only ones clued in to this particular masterpiece. You're inclined to shout out, "Did anyone else understand what just happened here?" But saying so would expose you as no more than a cola-slushy-slurping Neanderthal, forever doomed to scour IMDB for explications of any film more challenging than *Dumb and Dumber*. Instead, you say nothing. On the way home, you imagine that the director had stopped the film and explained it to your cohorts while you had stepped out for your ritual mid-film butter reload. You are searching for a way to prove to yourself that you are not as stupid as you were just made to feel.

No one likes feeling dumb, or being left out. But on some level, at some time, each of us has a barrier to overcome. This barrier can have its basis in your ambient environment, or in your cultural or educational background, or in how your brain is wired. It may just be too little sleep—and too little coffee. However it happens, though, the last thing that will occur to you is that you have a disability. What you are wishing for in this moment is some way to help yourself to the context necessary for you to understand what's in front of you, unaided.

Only very rarely does a film capture the essence of a complex subject so well that people with film-school degrees and 24 column inches in the *Village Voice* celebrate them along with the everyday moviegoer. And do you know what reviewers call a movie, novel, or song that has achieved that kind of success?

They call it "accessible."

They call its appeal "universal."

There Is No "Them"

We have made the pitch for accessibility to a number of organizations, from corporations to government agencies to open source projects to disability advocacy groups themselves. We do it because we want everyone to be able to participate fully in the online world. We hope that by giving people responsible for web applications a deeper understanding of the problems, and some practical guidance, we can help more people use universal design effectively and therefore help more people participate in our changing society.

That's the idealized view, anyway. What we usually encounter is hesitancy, if not hostility, to the idea of increasing a site's accessibility. *Why should we fix the site for disabled users? We don't even have any disabled users!*

The principal obstacle to overcome in making the case for accessibility is the stigma associated with disability. Among decision-makers, the word "disability" conjures thoughts of people with dark sunglasses and canes, or wheelchairs, or other noticeable distinctions between "us" and "them."

The reality, however, is that there *is* no "us" and "them." People with disabilities are the largest minority group, and any one of us can become a member at any time—either through injury or illness or age.

Specific to the Web, the issue has become less about the human user and more about how we are accessing web content. A person using an iPhone, for example, deals with tiny text, links that are hard to activate with a finger, difficulty with text entry, and other environmental issues such as screen glare. But there they are, using the Web by the millions. While using an iPhone is a choice and disability is not, there is enough overlap in the techniques and shared experiences that we believe the following: *On the Web, the issues we talk about can apply to every one of us, sometime, somewhere, even if they aren't always a problem.*

Audience Characteristics

So when we talk about accessibility, we're really just talking about people who are blind, right?

Well, no. While people who can't see well or at all are at a distinct disadvantage using visual resources such as the Web, far more people encounter unintended design barriers. With the rise in popularity of web video, tens of millions of people who do not hear well or at all are missing out. Mouse-driven sites prevent keyboard-only users from operating web applications. Depending on the person or the situation in which she finds herself, or the device she has chosen to use, someone may be facing one of these issues or all of them. This is not black and white; people's capabilities are on a continuum and change throughout their lifetimes, perhaps even within a single day.

How can change happen so quickly? You start your day checking email on your laptop in the kitchen. As you walk to the bus stop, you get an update on your mobile device, and you craft an answer as the bus rattles its way through the city. By the time you reach your office, you have five more emails. In the first two hours of your day, you have seamlessly shifted between different operating systems, browsers, screen sizes, and resolutions. Your kinesthetic surroundings change constantly: family distractions in the kitchen, noises from the bus and fellow commuters, vibrations and bumps from the bus. Lighting changed: soft lighting in the kitchen, sunlight on the bus, and bright overhead fluorescents at work. You went from a trackpad on your laptop, to keyboard-only operation via your mobile, to a wireless mouse at your desk.

These changes represent the four categories of disabilities:

- Cognitive, reading, and learning
- Hearing
- Movement
- Vision

Table 2-1 provides a grossly oversimplified look at disabilities. For more information, the article "How People with Disabilities Use the Web" (*http://www.w3.org/WAI/EO/Drafts/PWD-Use-Web/Overview.html*) is a good place to start. It describes how different disabilities affect web accessibility, provides scenarios of people with disabilities using the Web, and outlines the variety of assistive technologies and adaptive strategies that people with disabilities use.

Table 2-1. Disability by class and situation[a]

Category	Includes (but is not limited to)...	Statistics	Situational
Cognitive, reading, and learning	Dyslexia, ADHD, low reading level	ADHD—4.4% of adults	Search engines (low-level interpretation of meaning), international or young readers
Hearing	Hard of hearing, deafness	Deafness—421,000 in both ears Hard of hearing—36.4 million with "hearing trouble"	Riding a packed train while listening through ill-fitting earphones, watching TV in a pub with the sound off
Movement	Paralysis, tremor, missing or loss of limb, weakness	2.5 million can't "grasp or handle small objects"	With an iPhone, your 40–80-pixel finger has difficulty accurately selecting 20-pixel links
Vision	Low vision, blindness, colorblindness	14.1 million people with "vision trouble" (includes colorblindness) 1.3 million people are legally blind	Screen magnification on an iPhone/iPod touch

[a] Statistics are estimates and U.S.-based. Sources: CDC Viral and Health Statistics Series 10, Number 232, Dec. 2006 (vision trouble, hearing trouble, adult ADHD, grasp/handle objects); AFB (legally blind); Gallaudet, *http://gri.gallaudet.edu/Demographics/factsheet.html#Q3* (deaf in both ears).

It is also important to to consider *situational disabilities*—changes in one's abilities based on environment, device, or other temporary conditions. Consider the following:

Mobile
   Hearing, motor, vision

International
   Reading

Search engines
   Cognitive, hearing, vision

Also consider that disabilities increase with age: 2.7% of Americans between 5–17 years old have disabilities compared with 41.4% of people 65 and older.

Configurability

The variations among your users are increasing. We are living longer and starting to use computers younger and younger. (Wendy's two-year-old even has a favorite reading website that he likes to visit.) New devices coming to the market—the iPhone, of course, and other mobile devices and platforms, as well as tiny laptops, such as the Eee PC—are changing how people see the Web. We're accessing information in more situations—while we're cleaning the house or working out. The variety of languages and cultures accessing the Web is growing. Bandwidth varies from dial-up (yes, even in the U.S.) to countries that are starting with mobile networks (Africa) to some mobile networks reaching broadband speeds. The interfaces that we use to connect and contribute to the Web are branching—short messaging service (SMS) is now as universal among the world's younger generations as radio, and mobile video is on the march.

The combinations of devices, preferences, and abilities are infinite. You may want to use information sightless even though you aren't blind. Your preferences may change throughout the day or from application to application—do you want voice input while you're writing a book, voice output while you're reading web pages, and a large-font visual display while you're reading email?

Challenge your assumptions about users. Don't assume that someone who is blind, for example, doesn't want to buy car insurance. We recently heard about a man who is blind who wanted to research car insurance for his wife. The site he tried to access assumed that because someone who is blind can't drive, he won't need to read about car insurance.

Growth Opportunity

> As the Baby Boom generation ages, more and more people will face the challenges of reduced dexterity, vision, and hearing. So enabling accessible *technology* is a growth opportunity...[*]
>
> —Steve Ballmer, 2001

Designing for a variety of situations and abilities can not only change your perspective, but it can also increase your audience. Consider how the world is changing and what that means for people. In 2000, the World Health Organization (WHO) estimated that 7–10% of the world's population (500 million people) live with a disability.[†]

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[*] http://businessweek.com/bwdaily/dnflash/jun2001/nf20010613_081.htm

[†] http://www.who.int/inf-pr-2000/en/note2000-16.html

In the U.S., 1 in 5 people lives with a disability.‡

This number is expected to grow as people live longer—for example, predictions indicate that by 2011, people over 65 will make up 25% of Japan's population. According to the WHO, the fastest growing population group in industrial nations is the 80-and-over segment.§

There are two factors that tell us to pay attention to the number of older users on the Web. First, users in the 49–64 age group are coming online in increasing numbers, and with good reason: their stock portfolios, pay stubs, tax filing, and health-care information are now on the Web. These late-career workers are very attractive to marketers, particularly because "older" and "richer" are strongly correlated.

The second reason is that sooner or later, *they* are going to be *us*. We may be able to read 8-point text on our laptops today, but as we age, it's likely that that will become more difficult and we'll experience things such as headaches from squinting at that text. We may recognize that we're getting older, but what we will *say* is that the page we're using was poorly designed—and we'll be right. In fact, this is one of the problems with consigning features like magnification and high contrast to an accessibility link or control panel: people who are simply getting older don't think of themselves as disabled. You may know that your vision isn't 20/20 anymore, but why on earth would you look for solutions behind a picture of a wheelchair?

The beauty of universal design is in its capacity to enable everyone to use the same content according to their needs and wishes. *Universal design will help you reach more people and continue to reach them throughout their lives.*

Many devices "experience" limitations similar to those experienced by people with disabilities. In 2002, programmer Karsten Self declared that Google is a "blind user" in the sense that Google can only glean from a website that which can be programmatically determined—much the same way that a screen reader is limited (*http://zgp.org/pipermail/linux-elitists/2002-January/003912 .html*) . For both Google and screen readers, "text is king." Matt spun Karsten's statement for the current state of issues in accessibility:

> Google is, for all intents, a deaf user. A billionaire deaf user with tens of millions of friends, all of whom hang on his every word.‖

> —Bestkungfu Weblog, "Google is a deaf user"

‡ 1997 Census Brief

§ *http://www.who.int/mip/2003/other_documents/en/E%20AAE%20Towards%20Policy%20for %20Health%20and%20Ageing.pdf*

‖ *http://www.bestkungfu.com/archive/date/2004/11/google-is-a-deaf-user/*