How do disabled people use computers?

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Accessibility advocates and nondisabled people can both be wrong at the same time. Or if not wrong, misinformed or misguided. Case in point: Terminology.

We have decades of history of stigmatizing terms used for people with disabilities. *Crip* and *gimp* were seen as disparaging for decades (and still are in many usages), but have been slowly reclaimed by disability activists. *Handicap* really does derive from "hand in cap," which we would now describe as a "disempowering" mental image. *Deaf and dumb* technically means *deaf and mute*, which would be OK if the phrase weren't misunderstood to mean *deaf and stupid* and if deaf people were all unable to speak, which is hardly the case.

In any event, disabled people and their advocates (I suppose I would fall into the same category) have spent years raising the consciousness of average people so that outdated and stereotyped terminology might fall by the wayside. But unfortunately, a certain overcorrection has taken place.

Handicap was replaced by *disabled*, a value-neutral term that is and should be widely used. But then we were told a phrase like *disabled person* could never be used; we were to say *person with a disability* in order to "put the person first." (Up with people!) Well, maybe. Forcing people to use some maladroit, saccharine, ill-gotten catchphrase instead of plain words seems like a cure that's worse than the disease. (We are also told not to use constructs like "the deaf" or "the disabled" for similarly weak reasons.)

And of course many readers will be familiar with querulous but well-meaning ninnies overconcerned with "offending" anyone who love to suggest nauseating euphemisms like *handicapable* or my personal favourite, *physically challenged*. ("Challenged"? Meaning disabled people merely have to *try a bit harder*? Someone in a wheelchair merely has a bigger "challenge" in climbing stairs than a nondisabled person? If that person tries really, really hard, his or her "challenge" will disappear?)

Neither are disabled people "differently abled." A person who cannot hear or see or walk clearly does have abilities "different" from a nondisabled person's, and in accessible Web development we may in fact create "different" or analogous forms, but nonetheless, the term doesn't tell us much. *Differently abled* seems to apply more to zoology, where, say, raccoons can climb trees but dogs can't, or kookaburras can fly while ostriches cannot. Those animals are all *differently abled* when compared across species, but they aren't *missing an ability* that other members of their species typically have, which is actually the case when considering human disability. It's not as though disabled and nondisabled people merely hold different portfolios of abilities that are equal in number or capacity, like maintaining a diverse envelope of stocks and bonds.

Shall we cut the crap, folks?

Now, then. There actually *are* salient differences in meaning among the various terms used to describe disability groups. Some examples:

Deaf, hard-of-hearing, hearing-impaired

Everyone with significantly impaired hearing is *deaf* in a generic sense. But someone with a lower degree of impairment may be more accurately called *hard-of-hearing*. *Hearing-impaired* is a more medical-sounding term that not many people voluntarily use to describe themselves.

Deaf people tend to have the least hearing (and "culturally Deaf" people issue eye-rolling demands to capitalize the *D*); they are the most apt to use whatever sign language or language is native to their region. (American Sign Language isn't the only one in the world; yes, they are real languages; no, if you know one of them, you can't understand any other; no, you don't have to be deaf to be fluent in, or a "native speaker" of, a sign language.)

Deaf people are most apt to attend segregated deaf-only schools or classrooms, though "mainstreaming" of disabled students (including them in nondisabled classrooms) has been an ongoing trend for 30 years. There tends to be such a thing as a "deaf community" in any given city, state, or province.

Hard-of-hearing people tend to have a greater degree of usable hearing than deaf (or Deaf) people. They can often speak intelligibly (more often than deaf people, at least), and are more apt not to have attended a school for the deaf. If they receives special education for deaf students, it is more likely in the oral tradition (teaching lipreading and use of residual speech rather than sign language). Many hard-of-hearing people deny categorically that they are in any way different from hearing people. There is much less cohesiveness among hard-of-hearing people; it is difficult indeed to find a genuine "hard-of-hearing community."

The term used to refer to someone with no auditory disability is *hearing*.

Most deaf, hard-of-hearing, or hearing-impaired hearing either now have or used to have some actual hearing. In addition, a *late-deafened* person lost his or her hearing in adulthood or at least after completely learning a spoken language. Having been hearing people for many years, late-deafened persons tend to have the best understanding and production of spoken language (which comes up in discussions of reading level of television captioning, for example).

Whenever you have the time or space, it is generally preferable to refer generically to *deaf and hard-of-hearing people*. It's more inclusive and acknowledges that deaf and hard-of-hearing people actually are different. But it isn't wrong to use the single term *deaf*. In a long text like this book, you can mix and match according to the sense you require.

Blind, visually-impaired, low-vision

Everyone with significantly impaired vision is *blind* in a generic sense. But someone with a lower degree of impairment may be more accurately called *visually-impaired*. A low-vision person is not significantly different from a visually-impaired person, but the former term is preferred by some.

Blind people are most apt to have attended a school for the blind, though the same mainstreaming trend affects blind students. Not many people with any kind of visual impairment read Braille – estimates run as low as 10%. Visual impairment is largely a condition of age; there are not that many very young blind or visually-impaired people.

As in the previous case, when you can swing it, a phrase like *blind and visually-impaired* is most inclusive and correct, but in a pinch *blind* will do.

Mobility-impaired

A bit of a tricky group to discuss as far as this book is concerned. When you think of a disabled person, I'd wager that the first image that pops to mind is a *person in a wheelchair*. But *wheelchair users* are not a group that's entirely relevant to accessible Web design. Instead, people with *mobility impairments* have difficulty moving one or more parts of the body. Where Web design is concerned, a mobility impairment that affects use of a computer or device (chiefly a disability involving the hands and/or arms) is really the only relevant disability. Some of those people may also be wheelchair users (for example, quadriplegics).

Learning-disabled

Learning disabilities affect the perception, processing, understanding, and reception of information and other stimuli. Dyslexia is the most famous learning disability (it causes confusion in reading and a few other tasks), but there are many others. "Learning" per se is not always the issue; the last time you stepped foot in a classroom may have been 40 years ago and you may nonetheless have a learning disability.

You may also run across the term *cognitive disabilities*, where *cognitive* refers to the functions of the brain ("the mental process of knowing, including aspects such as awareness, perception, reasoning, and judgement").

What about mental retardation? It's not the same as a learning disability, and the phrase *mentally retarded* is somewhat stigmatized. (Actually, the worst similar term I've run across is "trainably mentally handicapped." How'd you like people calling you *that*?) Yet the suggested substitute, developmental disability, is too bafflingly vague. (Development? Like development of the fetus? Like not walking till you're three and a half years old?) At a conference I attended, a researcher in the field tended to use both terms together, as *mentally retarded/developmentally disabled*, a mouthful that is often contracted to *MR/DD*. I'm mentioning the issue because, if you develop educational Websites, you may be required to accommodate learning-disabled students (not very easy) and MR/DD students, too, the latter being even more difficult.

Adaptive technology

Here's a related term that comes up in the field of accessibility of computer hardware specifically: *Adaptive technology* is any implement that modifies existing hardware or software for use by a disabled person. It doesn't have to be anything special – an off-the-shelf trackball can constitute adaptive technology. Screen readers and magnifiers are two examples of adaptive technology relevant to Web development.

How do disabled people use computers?

Now that you know a bit more about disability in general, the obvious question becomes: How do disabled people use computers?

A typical nondisabled person (is that you?) does not have many – or any – disabled friends. This is understandable: Despite the insinutations of cheerily multicultural advertising, it's difficult to expand your social sphere outside your own group. Think of that smug expression "It's a black thing. You wouldn't understand." And even after decades of feminism, how many men have female *friends*?

Anyway, even if you did have a friend with a disability, what can your friend teach you about other disabilities?

On the whole, then, you probably aren't exactly conversant with the ways in which people with disabilities use computers. There's no shame in that.

Let's start with the basic issues. The "correct" thinking holds that disability is never the problem; it's barriers in the outside world, including barriers of attitude, that are the problem. This is a bit *de trop*, in my experience. Here in the real world, the general issue of accommodating people with disabilities does relate to the specific disability and to what the person is trying to do. One cannot separate the two.

In this case, the question to ask is: Is your disability severe enough to affect your use of a computer?

In some cases, the answer is a clear no. A single-leg amputee, for example, has no barriers at all to using a computer. But other disability groups do face barriers:

- If you're blind or visually-impaired, how do you read and interpret the text, graphics, menus, dialogue boxes, and other visual details on-screen? How do you read the legends on the keyboard? How do you read software documentation? What about multimedia?
- If you're deaf or hard-of-hearing, how will alert sounds (like error beeps) actually manage to alert you? How do you benefit from soundtracks found in multimedia?
- If you have a mobility impairment that prevents you from moving the mouse or typing on a keyboard, what do you do?
- If you have a learning disability like dyslexia, just how do you read and decipher all that colourful text onscreen?

It's actually not too complicated: Some disabled computer users do nothing different from nondisabled people, while others (indeed, for some disabilities, the majority) require so-called adaptive or assistive technology – hardware or software that eliminates barriers to using a computer. In the olden days (like the era of the Apple II, when adaptive technology first

blossomed as a consumer-level industry), adaptive technology was klugey and homemade; a lot of it looked like warmed-over Heathkit experiments. Now, though, after two decades of development and maturity, adaptive technology is generally quite sophisticated and impressive – or, to apply the highest praise the geek crowd could possibly confer, *cool*.

Here is a guide to disability groups and the relevant adaptive technology.

Mobility impairment

The requirements of someone who cannot readily type or use a mouse (or press a switch, or engage any other hardware interface) are the easiest for accessibility neophytes to understand. Why? Because the adaptive technology they use generally takes the form of alternative keyboards and mice, and hardware of that sort makes for tidy photographs. You can immediately see the necessary modifications, if not actually understand every detail of their operation.

For the purposes of this book, "mobility-impaired" people have trouble using the hardware of their computers rather than understanding or interpreting information.

So what's the solution? There are actually tons of options; only some have a bearing on writing accessible Websites, but as in every sphere of understanding, you need to know more than the bare minimum to be considered civilised.

- Keyboard guards and overlays: A sheet of thick plastic with holes lets you guide your fingers to just the right key. Useful if you have cerebral palsy or a tremor that makes you depress more than one key at a time, or if too many errant keystrokes precede or follow a correct keypress.
- Slow keys and onscreen keyboards: Software can automatically discard keystrokes typed in too quick a sequence, and can show you a picture of a keyboard that you can actuate with a switch or a mouse. (The really good onscreen keyboards predict the words you're trying to type, and the next word or phrase after that. It's surprisingly efficient.)
- Replacement mice: Everything from foot pedals to gigantic trackballs are used as direct mouse surrogates. An ordinary off-the-shelf trackball can be a good adaptive technology for some people.
- Switches and scanning software: If you can take one action reliably (blinking an eye, flexing your wrist, jostling your knee, or, in the best-known case, sipping and puffing on a straw), then you can acutate an on/off switch. Since computers are binary devices, that's all the ability you need. While still laborious, switch access is now much less so than, say, back in the mid-1980s, when quadriplegics' use of sip-and-puff switches began to be covered as a human-interest story in newspapers. (Just as people seem to know the phrase "carpal-tunnel syndrome" but nothing about repetitive-strain injuries in general, the use of personal computers by blowing on a straw seems to be a fact widely known in the absence of other disability knowledge.) Note, though, that the days of sip-and-puff switches are largely behind us. In the 21st century, "switch access" may still rely on a single on/off signal, but hardware switches are now more sophisticated (requiring, say, a simple head nudge). Software now does a better job of interpreting and predicting the intent behind that signal: Your onscreen keyboard may divide and subdivide itself into quadrants for you until the right letter appears under your cursor and also predict the words you wish to type.

How does this adaptive technology relate to accessible Web design? Page navigation becomes the big issue. If you the Website visitor are using particularly primitive adaptive technology (or none at all – some disabled people are too poor, or too proud and stubborn, to modify their machines), you may be stuck pressing the `Tab` key repeatedly to move from link to link, from link to image, from field to image, and every other combination within a Web page. If your site loads up three dozen (or a hundred, or 200) navigational links in a left-hand table cell, a visitor with this disability has to tab through them one at a time.

Just how long would *you* put up with that, if you don't already?

Fortunately, there are solutions – usually not great and often not really enough, but solutions nonetheless. I'll get to those in Chapter 8, "Navigation."

Hearing impairment

The access requirements of deaf and hard-of-hearing people are quite modest given that, even in a post-Napster demimonde, computers are largely silent devices that communicate visually. You can, for example, simply turn the alert-sound volume to zero, which might cause the menubar to flash as a replacement for an audible beep.

Adaptive technology? There really isn't any. A hard-of-hearing person may use amplified headphones or a particularly high-powered speaker, but those are off-the-shelf additions with no bearing on Web design or programming.

Visual impairment

Of all the disabilities affected by computer use, visual impairment is the most significant. As we have seen with devices varying as widely as the Palm (and the Newton – remember the Newton?) and a range of tablet computers and Internet refrigerators and whatnot, in real-world use *a computer is mostly a display*. And if you can't see a display, how do you use a computer?

Well, if you have a relatively modest visual impairment, all you may need is screen magnification. You can blow up the size of text, menubars, icons, and everything else to any necessary size. (That really means everything else. Your whole system, including menubars, has to be made accessible, not just the text in a single window in a browser.) Software designed just for this purpose can also scroll text horizontally for you within a window of fixed position, alter foreground and background colours, and turn the mouse cursor into a moving magnifying glass.

(Don't underestimate the issue of screen colours. Many visually-impaired people find dark text on a brilliant white background unbearable. Such settings are quite easy to change for Web sites, as we'll see in Chapter 9, "Type and colour," but it's a process of trial and error, and if you, as a Web author, don't code your pages properly, your text might just disappear altogether!)

If you're blind enough that you can't really see a monitor, you need something called a *screen reader* – a program that reads aloud onscreen text, menus, icons, and the like.

(They're not called "talking browsers," "text readers", or "speech browsers." There's one and only one generic term for the technology: Screen reader. Having made this categorical declaration, I note that there *are* programs that do nothing but provide voice output for Web browsers to the exclusion of all other software on a computer, like IBM Home Page Reader and pwWebSpeak, and I suppose we could call those talking browsers, but I am eliding that distinction for the purposes of this book.)

Screen readers don't simply spit out a monotonous sequential verbal itemization of a Web page. Developed in the late 1970s on character-mode platforms like Apple II and MS-DOS, screen readers have evolved out of view of the rest of the computer industry, like some form of underground dance music beloved by recherché klub kidz worldwide but unknown to their parents. Screen readers are sophisticated enough to use multiple voices and (limited) sound effects to interpret Web sites. It's quite commonplace to listen to screen-reader speech at speeds no human being, not even an auctioneer, could produce. At 300 words a minute (twice the speed of a vibrant human conversation), you can zip through even a verbose Web page pretty efficiently, though that is no excuse for you to produce verbose Web pages.

One crucial fact to understand about screen readers, though: They're run from the keyboard. The mouse is still usable but in practice is not used. A mouse requires hand-eye coördination, and a blind person is missing half of that. Accordingly, anything you design that seems to require a mouse also has to work without one.

Another curious factoid: Some totally-blind people don't bother installing a monitor at all. (Computers can often run "headless.")

A deaf-blind person will rely exclusively on a Braille display: Nylon or metal pins controlled by software protrude upward through a grid, forming the cells used in Braille writing. Characters are replaced ("refreshed") either automatically at intervals or after you press a switch. Typical Braille displays reveal two to four lines of text, but truly gigantic displays, almost equivalent to the 80-character-by-24-row screens of MS-DOS, can also be found, at prices rivaling the equivalent weight in platinum.

While a few blind people rely on Braille displays alone, without screen readers, of more interest are the few super-elite blind people who use a Braille display in tandem with a screen reader. One such use: The screen reader speaks onscreen text and interface elements, while the Braille display gives system and status-line messages. Practical for blind computer programmers especially.

Since the canonical group served by Web accessibility is indeed the blind and visually-impaired, the bulk of this book is devoted to documenting how to accommodate them.

Learning disabilities

Without a doubt the most neglected disability group online, and, not coincidentally, the very hardest to accommodate, learning-disabled Web surfers face frustrating barriers.

The issue here is comprehension of visible language in the broadest sense. Words are the biggest problem, one that is ostensibly alleviated by providing pictures and sounds. Yet even pictures and sounds may cause confusion, particularly if all the above are provided simultaneously. (I specifically advocate watching, listening, and reading simultaneously in Chapter 13, "Multimedia," but that may be unsuitable for a section of this population.)

However, the essence of the Web is text. Almost no Websites lack text altogether, and that cohort tends to cluster around all-Flash experimentation (like Praystation.com); while the Web is the delivery mechanism for such experiments, it is debatable whether they actually are Websites at all rather than online cinema.

Text is not a *feature* of Websites; it is a *primitive*, a fundamental and unalterable component.

An existing requirement of the Web Accessibility Initiative's Web Content Accessibility Guidelines (Nº 14, "Ensure that documents are clear and simple so they may be more easily understood") makes a feeble and inconsequential effort at solving the inaccessibility of textual Websites for people who cannot read well. Checkpoint 14.1 tells us: "Use the clearest and simplest language appropriate for a site's content." Nowhere does this guideline explain how you will afford an editor for your site, or how you or that editor will know *in specific* how to write so that learning-disabled people can understand you. Are there proven techniques? And if so, how do they apply to the tens of thousands of topics discussed online?

As I write this book, the Web Accessibility Initiative is actively considering an update to its Web Content Accessibility Guidelines that would require all Web authors – everywhere and without exception – to add images or other "non-text content" to their Websites if they wish their sites to be certified as complying with the WCAG. Essentially every concept would require an illustration, irrespective of these undeniable facts:

- Some concepts cannot be illustrated. (Remember the parlour game on *The Simpsons* in which the Simpsons' neighbours, the Van Houtens, are asked to illustrate "dignity"? Luanne Van Houten actually does it, but we never see the actual drawing, rather proving the point. I hope it is not bathetic to suggest the WCAG learn from cartoons.)
- Many Web authors are not professional illustrators; many do not own illustration software.
- The requirement discriminates against other disabled groups: How do blind Webmasters draw pictures?
- Similarly, each added image or multimedia file requires an equivalent (like an `alt` text or captioning). The addition of images implies the addition of more text, a tautology and a source of frustration for blind visitors.
- Image and multimedia files cause page sizes, hence download times, to balloon, in turn harming usability.
- The requirement naïvely assumes that all Websites are custom-created and continuously overseen by expert human beings; many Websites, like discussion fora and mailing-list archives, are autogenerated by software. Many pages at the World Wide Web Consortium's own site, W3.org, fall into this category. How do we illustrate them?
- There is no proof that illustrations will be as effective at guaranteeing comprehension for the learning-disabled as, say, `alt` texts are for the blind.

It is not at all clear that this proposed requirement will actually be ratified by the World Wide Web Consortium; it faces strong and reasoned opposition from people like me. The needs of learning-disabled Web visitors and everyone else with a mental impairment are real; they're also ill-understood by Web designers and by Web-accessibility experts both.

Still, the proposed cure is worse than the disease. It is apparent that there is no practical way to make textual Websites

genuinely accessible to people who cannot read well. Q.E.D.

So what are the real options? They don't have a lot to do with your work as a designer or developer. The use of adaptive technology in accommodating learning disabilities is relatively uncommon, but the big surprise is how applicable the gear intended for the blind can be. Dyslexic kids and adults often find speech output useful, though usually at far slower speeds than blind users are accustomed to. Screen magnification is helpful. There's certain limited evidence (included on this book's CD-ROM) that audio description helps kids with dyslexia concentrate. Long descriptions, used for blind access to Websites, may work the same way, but there is no research on that topic.

There is no plan of action available to you in order to accommodate learning-disabled visitors in the way that plans of action are available for other disability groups, however contingent and fractured those latter plans might be. There are no simple coding or programming practices – or even complex practices, for that matter – in which you can engage to accommodate this group.

We are left with the knowledge that our sites *are* inaccessible to a known group with next to nothing we can do about it. However antithetical that may seem at first blush, in fact it responds to the real world. Recall that antidiscrimination legislation includes exemptions for undue hardship or burden. Recall also that some features of the physical world cannot be made accessible without destroying or fundamentally altering them – antique streetcars, for example, or the ancient pyramids. On all counts, these are unavoidable exceptions which we have no choice but to live with.

CD-ROM extra

"Described Video Programming: Potential Application for Learning-Disabled Students," an article by Ann B. Morse.

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