Written Testimony to the US Access Board from the California Council of Citizens with Low Vision

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Abstract:

The California Council of Citizens with Low Vision finds the Access Board's decision to include WCAG 2.0 Level A and AA (henceforth WCAG) by reference is admirable to harmonize standards, but inconsistent with the 1973 Rehabilitation Act. By applying 1194.22(d) from the current 508, removing the author's visual style, readers with low vision could achieve limitless enlargement with no need to scroll horizontally on mainstream browsers. The new rules drop this capability without suitable replacement. This is a major loss to citizens with low vision. Our Council cannot see how text enlargement without word wrapping can be considered reasonable accommodation in 2015, the age of responsive Information Communication Technology (ICT).

Comments

On behalf of the California Council of Citizens with Low Vision, I would like to thank the Access Board for inviting written comment.

My name is Wayne Dick. As a person with congenital low vision and as a member of the Council, I am writing to register my and our concerns with those rules of the Section 508

refresh that are intended to address our needs. From the perspective of our Council, they do not.

We believe that as stated, the new 508 rules cannot translate to accommodations that are reasonable in the sense of the 1973 Rehabilitation Act. We are respectfully asking the Access Board to strengthen the rules relating to low vision. In particular we would like the Board to modify rules based on the WCAG 2.0 Guideline 1.4 Level A and AA Success Criteria that are intended to address the accessibility needs of people with low vision. We would also like the Board to extend the rules based on WCAG Guideline 1.3 so that the concept of flexible data is interpreted to include visual presentations of data that support effective reading of text.

We begin with a definition of support for reasonable accommodation for reading documents delivered through Information Communication Technology (ICT).

Reasonable Accommodation Support

An Information Communication Technology document supports reasonable accommodation for visual reading whenever the user can transform the document with software so that it can be read from a distance that supports healthy posture with self-reported effectiveness of end users. Required horizontal scrolling to obtain text enlargement is not a reasonable accommodation.

This definition is based on 5 principles:

1. **Flexible Data:** ICT is not paper. The visual presentation of modern ICT can be modified extensively to support reading needs. Given this flexibility, horizontal scrolling is never a necessity.
2. **Programmatic Determinism:** Users can use software to obtain the transformations of visual presentation needed to support their individual reading needs.
3. **Reading Enabled:** Documents can be given a visual presentation that can be read. The focus is on visual readability not just visual perceptibility.
4. **Comfortable Distance:** Sixteen inches is the average distance most people use to read in comfort, but this can vary. The *Psychophisics of Reading* (Legge, 2007) defines low vision for reading to be: The inability to read news print from a distance of 16 inches (40 centimeters) with full correction. All readers need sufficient size to support reading with healthy posture.
5. **User Centered:** Reading effectiveness can be determined by the end users, the readers. Users are not limited to preset choices determined by decisions of people who cannot know their individual visual needs.

Example:

Consider reading professional material on a smart phone. Take the Affordable Care Act as an example(PDF and HTML). Both of these files appear on US Government sites. As a person with low vision I keep a gallery of visual aids and assistive technologies. I will describe the reading experience with each:

Unreasonable Accommodation

- Screen Magnification using the PDF version. To obtain a perceivable reading size one must enlarge to the size where the width of lines exceeds the width of the view port. This requires horizontal scrolling which among many problems, increases the cognitive load required to read. It is unlikely any but the most determined reader could finish this long and complex document with this accommodation.
- Screen Magnification with the HTML format. Most normal readers can read this on a cell phone. However, the size is well below 9 point, the optimal reading size for normal readers. The reader will probably attempt to read the smaller print, but will be forced to quit because the print is too small to prevent fatigue.
- Use reading glasses with (PDF). My reading glasses enlarge 700%. That is enough to read, but I have to hold my device to my nose. My posture is bad. I could not finish the law that way.
- Using telescopic glasses with (PDF). My telescope glasses give me a 5x pop. That is good, and I don't have to hold the book so close. With this device my visual field is smaller and I have a harder time going from line to line. Again, I could not finish the text.

Note that none of these examples use the programmatically deterministic nature of the media being used. The ICT documents are being treated like they are paper.

Reasonable Accommodation Support:

- With text only enlargement in a single column format that supports word wrapping the HTML Version works very well. With Firefox on a laptop, I can easily enlarge to 48 point.
- Apply 1194.22(d) to the HTML document. First, strip the author's style. This puts the document in a one column format that can be enlarged without limit in Firefox on a laptop. Better yet, some browsers like IE, Safari, Opera and Firefox support user style sheets. In these browsers the document could be restyled to the exact needs of the user.

Support of Reasonable Accommodation for Reading can be implemented using the following functional requirements:

Functional Requirement

Document Structure Must Support

1. User Choice of column format, single column being essential
2. Freedom from horizontal scrolling at all font sizes
3. Ability to read visually from a comfortable distance with self reported effectiveness.

Users Must Be Able to Change Text Style

1. Spacing (letter, word and line)

2. Font (size, weight, style, family) including the ability to substitute new font values for regions of type that are hard to read because of the author's choices.
3. Color (fore and back)
4. Visual Guides - borders, level indicators
5. Width of reading area - margins, column width

Note that choice of color gives choice of contrast because contrast is functionally determined by fore and back color.

Need

I am a professor emeritus of computer science. I received my PhD in Mathematics with my central retina damage in 1980 from the University of California, San Diego. It was not easy. Inflexible reading material and horizontal scrolling have been the bane of my professional career. I have probably read as much professional content using horizontal scrolling as anyone in the world.

Section 508 and the data flexibility enabled by subsection 1194.22(d) enabled me to read more professional content between 2000 and 2010 than I did in the previous 30 years. The ability to enlarge without limit and word wrap was the key to my new reading ability. I also took advantage of my own style sheets to adjust the visual environment to my exact needs. While normal readers with low vision cannot write style sheets, there are plenty of programmers like me who can prepare customizations for them. That is, if we are still permitted access to visual style after the 508 Refresh passes.

In its current form the 508 Refresh sanctions ICT documents that do not permit the necessary level of access. When HTML 5 developers start embedding text in documents in open web pages that do not use the document object model, the problem will become acute.

At my university CSU Long Beach we currently have 10 students with low vision enrolled with our Disabled Student Services. There should be close to 100 students enrolled at our campus of 35,000 (Vitale, Cotch, Sperduto, 2010). Are we failing to attract students to the Disabled Student's Office or is our campus dramatically under represented? If the answer is under representation then the representation rate of people with low vision would be lower than that of any ethnic minority on campus. We do not know the answer. To my knowledge, in my 30 years teaching in the computer science undergraduate and graduate programs at Cal. State Long Beach we had one student with low vision who graduated. While this information is anecdotal it is also cautionary.

In either case, the importance of adopting ICT that supports reasonable accommodation is clear. If students with low vision are just failing to enroll with Disabled Student Services, then ICT documents that support reasonable accommodation and cover university reading requirements will surely help them succeed in their stealthy journey through college. If students with low vision are under represented then ICT that supports reasonable accommodation will increase the number of students that meet college entrance requirements.

One last observation on need, our one student to finish a Computer Science program with low vision, eventually got an MS in Computer Science. He is now a lead technical manager at Dreamworks. I taught more than 2000 students in my career. He was one of the most brilliant. Maybe success in college with low vision just requires exceptional talent at this time.

The Significance of 508—1194.22(d)

Paragraph 1194.22(d) states, "Documents shall be organized so they are readable without requiring an associated style sheet."

Whenever a page satisfies 1194.22(d) and does not include layout tables, the style sheet can be removed, the page becomes a one column format, and the text can be enlarged without limit and no horizontal scrolling is required. Using the access I get from 1194.22(d) I could enlarge text 400% to 500% without horizontal scrolling. In my case that capability has meant the difference between reading fluently and a consistently painful struggle to read.

The only Level AA success criterion of WCAG that refers to text enlargement is WCAG SC 1.4.4, but SC 1.4.4 allows horizontal scrolling and also restricts enlargement to 200%, an unacceptably small factor. Given that the 508 Refresh includes WCAG Level AA through reference, this means that a key accommodation enabled by the old 1194.22(d) is nullified and is replaced by an ineffective success criterion.

Horizontal scrolling has been labeled as a web design error (Cappel & Huang, 2007), and usability professionals have strongly discouraged web developers to incorporate horizontal scrolling within their page simply because users with normal vision will not make the effort to move the page to see all content (Johnson, 2000; Nielsen, 2005; Sherwin, 2014). How can we call horizontal scrolling a reasonable accommodation when computer users with normal vision prefer to avoid it? For normal readeres horizontal scrolling is a usability annoyance, but when you must encounter this annoyance to read everything, the annoyance becomes a barrier to reading. It prevents equal access. (Note: Horizontal scrolling is not the horizontal swiping used on mobile and other touch devices. Swiping does not cut off part of the viewable page.).

In the United States a person must have visual acuity worse than 20/60 to be classified as having low vision. That means to perceive letters at 20 feet a person who is classified with low vision in the US can not perceive letters a normal person can see at 60 feet. This means by US standards of low vision, a person with low vision must have letters enlarged by more than threefold (300%+) in order to perceive them from the same distance a normal person perceives them. For example, a person with low vision must have newsprint enlarged more than 300% in order to read it from 16 inches, a comfortable distance. The ceiling of 200% enlargement as recommended by WCAG does not seem to be oriented to the needs of people with low vision in the US. It is unreasonable.

When I read long paper documents that have been enlarged 200%, I use my 2.5x magnifier. Any reader with low vision will find some way to close the reading distance to a point to simulate at least 300% enlargement.

A natural question to ask is why 200% is suggested by many sources recommending font size for low vision. The answer is quite simple, 200% is an upper bound for print size recommended for paper, hard copy (Council of Citizens with Low Vision, 2011). When a document is on paper the number of pages required is approximately the square of the enlargement factor. Thus a 200% enlargement will require four times the pages; 300% will require nine times the pages, and 500% will require 25 times the pages. For paper, 200% is a ceiling that avoids undue burden for the publisher.

Electronic documents are broadcast media. That means the number of pages a user requires to read a document has no impact on the cost of the dissemination. We know that conformance to 1194.22(d) enables unlimited enlargement without word wrapping. The accommodation is reasonable and many have satisfied it without undue burden.

If the Guideline 1.3 of WCAG interpreted flexible data to mean visually flexible as well as capable of being transformed to audio, 1194.22(d) would be replaced and improved. Unfortunately the WCAG Working Group is certain that they never meant visual flexibility to be an interpretation of Guideline 1.3. As far as the WCAG Working Group is concerned screen magnification is all the accessibility support

that is needed by people with low vision who require 200% enlargement or more. To them, reading with horizontal scrolling is reasonable for people with a low vision disability.

The California Council of Citizens with low vision strongly advise 1194.22(d) be replaced by a stronger recommendation of user access to visual presentation. At the minimum this should support very large enlargement with word wrapping. The functional requirements regarding user choice of visual style listed above would go far in this direction. Of course, 1194.22(d) breaks down for documents that use layout tables, so the functional rules given here would close that gap while continuing the essential functionality of 1194.22(d).

The Council also recommends that the Access Board extends 1194.22(d) by allowing access to the full range of visual style modifications for text that are currently available to document authors. In our functional requirements we highlight the most important of these factors. Text includes many visual conventions that express meaning. Users with low vision should have access to these presentational aspects of text and be able to change them to formats that support their reading needs.

Specifically, the Board should study Guideline 1.3 of the WCAG document, and write a rule that ensures that the data flexibility stated in the success criteria 1.3.1 and 1.3.2 applies to the visual semantics of text as well as the semantics of block structures. The new rules should require that all meaning conveyed in the visual formatting of text should be

programmatically determined, an extension of the current WCAG interpretation of success criteria 1.3.1. Similarly, all sequential relationships expressed by textual formatting must be programmatically determined. This is the cleanest possible way to enable writing assistive technology for reasonable accommodation of low vision.

Estimated Cost

The primary cost to developers will be to organize documents structurally so that multiple column and single column modes are available to users, and so that horizontal scrolling is never an issue at any size. This is the equivalent to the normal cost developers face whenever they convert to WCAG conformance. There is an initial cost followed by a change in development practice that often improves production efficiency. The cost effectiveness of this development methodology is well known.

With regard to restructuring the page format to accommodate the reduced content capacity caused by large type, the cost effectiveness has been proven with responsive web design (Marcotte, 2010). This technique is used to restructure pages to cope with the reduced content capacity of mobile devices caused by small screens.

Counting EM Boxes: an alternative to enlargement factors

When SC 1.4.4 recommends 200% enlargement the question always is: "200% of what?" Just the units are a problem, points, pixels? Given the variety of resolutions and screen sizes available and font-size scales what is needed is a way to

specify a maximum practical character size for any view port without referencing resolution or font size units. One way is to set a character count per line.

Example: Size by Character Count Table

The table below gives some standard monitor sizes with character counts for the long side. The entries in the boxes represent the point sizes of the em boxes. These are squares that hold the capital M. Their size represents the point size supported on that screen with that character count.

Character Count Table

Chars → Size↓	12ch	15ch	18ch	21ch
8"	42pt	33pt	27pt	23pt
13"	67pt	54pt	45pt	38pt
23"	119pt	95pt	79pt	68pt
32"	166pt	133pt	110pt	95pt

Technical Details

Here is how it works. Each monitor is given a size x that is its length across the diagonal in inches. The length of the longest side is about L= (0.86)(x) inches where x is the size of the monitor. If there are n characters along the long side then each character is L/n inches long or P=(72)(L/n) points long. To find the number of lines on the short side just multiply (n)(0.58) and truncate the fraction. Each square in this array

of squares has side measure of P. Each of these is an em box, designed to hold a letter capital M. They represent the point size of the letters that the screen will hold. **Note:** Most screens are 30/60/90 triangles approximately; cos(30)=0.86 and tan(30)=0.58.

Application to Low Vision

Just as responsive design takes into account screen size and resolution and sets thresholds that change presentation, a disability oriented responsive design should be able to set thresholds based on numbers of characters per line. Cases like 12, 15, 20, 30 and 40 characters per line should be supported. For sufficient enlargement many users will have to choose their screen size. However, one can get very good enlargement on an iPad, better enlargement on a 13 inch laptop, and superior enlargement on a 23 inch desktop monitor.

Conclusion

The California Council for Citizens with Low Vision strongly advise the Access Board to change their rules to meet the needs of people with low vision. The rules in the 508 Refresh do not address these needs and even take away access that was given in the current 508. As stated we cannot see how reasonable accommodation for reading with low vision can be achieved given the rules that are included by reference from WCAG.

Our Council applauds the attempt to harmonize Section 508 with international standards, but the Access Board is a creation of Section 502 of the Rehabilitation Act, a civil rights law. Conformance to United States civil rights law is the Board's primary responsibility. Citizens with low vision are a protected class and need equal access to government. The low vision rules included by reference from WCAG will not give equal access to government documents. This creates a barrier to, "equal protection of the laws," (United States, 1868) caused by an inability to read laws and regulations based on law. To protect the civil rights of US citizens with low vision the Access Board needs to exceed the WCAG success criteria that relate to low vision.

We encourage the Board to adopt the, functional rules we proposed above. They provide a more stable foundation for reasonable accommodation than the referenced rules from WCAG. They are a technology independent replacement for 1194.22(d) that give all the visual flexibility needed for our population to have visual access to documents.

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