Enabling people with disabilities:
Creating accessible electronic documents

Jeffry Ricker

A Flock of Scientists, LLC, Phoenix, AZ, USA

Correspondence to:

Jeffry Ricker
drjeff@drjeffryricker.com

Abstract

Rather than equating disability with personal identity, we can better understand disability as the consequence of disabling environments. This alternative view suggests that changing the environment can enable people with sensory, motor, and cognitive/learning impairments to participate more fully in everyday life. This view is also consistent with the goal of medical writers to be aware of their audience (i.e. their relevant abilities/skills, cultural beliefs, and knowledge base). To achieve this goal, we must strive to create electronic documents that can be perceived and understood by people with a variety of impairments.

The main objectives of this article are:
- to increase awareness of the difficulties caused by inaccessible electronic documents
- to describe guidelines for creating accessible electronic documents
- to provide resources for continuing education

I am completely blind. I face obstacles every day owing, in part, to electronic documents designed primarily for those with vision. For example, I cannot use charts that convey information through colour. I cannot participate in conferences when session links are not clearly identifiable with screen readers.

People with other sensory, motor, cognitive, and learning impairments often face similar obstacles caused by electronic documents (e.g. text files, videos, podcasts, web pages, etc.) designed for those without impairments. Some people cannot use a mouse because they cannot control their movements. Others cannot hear the sound on a video. Still, others cannot hold a lengthy sentence in mind long enough to make sense of it. Creating accessible electronic documents permits people with disabilities to participate more fully in everyday life.

The goal of creating accessible electronic documents may seem daunting. But by following some simple guidelines, your work can help to improve the lives of people that you might not be reaching as effectively now.

What is a disability?

To develop guidelines for creating accessible electronic documents, we must be clear about what counts as a disability. According to the International Labour Organization:[1]

"Virtually every existing definition of disability … mirrors a legal system and draws its meaning from this system. A definition of disability that can be applied universally is impossible, since every country, and practically every administrative body, works with different concepts of disability."

This conclusion seems justified when we consider the many questionably related conditions that have been called disabilities, such as paraplegia, blindness, autism, diabetes, HIV, arteriosclerosis, dyscalculia, and schizophrenia.[2]

"Disability results from impairments of body

- **Auditory:**[6] Deafness and hearing loss
- **Motor:**[7] Any condition affecting movement (e.g. spinal cord injuries).

In this article, I describe guidelines for creating accessible electronic documents. Unfortunately, I do not have the space to discuss the development of accessible websites. But at the end, I list resources that provide additional guidelines, examples, and educational opportunities.

Creating accessible text documents

This section focuses on documents created with Microsoft Office.[8] I discuss here only a few sets of guidelines. Please see the references and resources at the end for links to additional information.

Creating accessible headings

Headings are essential to creating accessible text documents: people often scan headings to get an idea of the topics to be addressed.[9] Headings are organized hierarchically into levels, with each level having its own distinct visual appearance.

Writers often create headings manually by altering font size, font colour, indentation and other characteristics to give the heading a distinct appearance. Headings made in this way, however, create difficulties for people like me who use screen reader software, which converts text or images into speech output. I use keyboard commands to display a list of headings on a page. When I do this for headings created manually, I get the following message: "There are no headings in this document." My screen reader does not recognise headings created manually.

Screen readers can read headings created with the Styles Gallery in Microsoft Office.[9] To create a heading, place the cursor in the text to be formatted, go to the Styles Gallery in the Home tab, and click the desired header (see Figure 1).

You should not skip heading levels (unless the style guide you are using requires you to do so). For example, don't skip past Heading 2 just because you prefer the look of Heading 3. Changing the appearance of a heading is a simple matter (see instructions in Reference 9).

> Headings are essential to creating accessible text documents.

Creating accessible links

Links should be easily identifiable. The default style for links is underlined blue text on a white background. Even people with low vision can see these links. But screen reader users cannot.

To be identifiable with screen readers, links need to be labelled with hypertext.[10] Hypertext is needed because screen reader users often call up a list of links on a page. If the links are not labelled or if they are labelled with "click here" or "link", screen reader users cannot quickly find the links they need.

The links should be labelled with hypertext that clearly indicates the purpose of the link. For example:

- Hypertext Example 1: Article on Links and Hypertext
- Hypertext Example 2: Article on Contrast and Colour Accessibility.

The hypertext labels in these examples are:

- Concise (i.e. brief yet comprehensive)
- Descriptive (i.e. summarise the specific purpose of the link)
- Distinctive (i.e. unique, not repeated in other links).

Lastly, links should not be labelled with URLs – these are not brief or descriptive. They can also be difficult to understand with screen readers.[10]

Creating accessible images

Images are helpful to most users. But they can create difficulties for people with visual impairments unless the content of images is fully described in alternative text (alt text).[11] Alt text should be included for any image in an electronic document, such as a blog post, pdf, Powerpoint slide, etc. Figure legends in journal articles might include a description that would meet the requirements of alt text.

To write appropriate alt text, two questions need to be answered:

1. What is the purpose of the image?
2. Given this purpose, what is the best way to describe its content fully and accurately?

To answer these questions, we need to look at the document text introducing the image. Let's look at an example.

A human karyotype is an image showing the

or mind that negatively impact social functioning."

One feature shared by many definitions is the notion that disability results from impairments of body or mind that negatively impact social functioning (e.g. occupational functioning).[1] The impairments usually addressed in the accessibility literature include the following:[3]

- **Cognitive/learning:**[4] Difficulties with cognitive functions such as memory, attention, reading, and numeracy
- **Visual:**[5] Blindness, low vision, and colour blindness

> Disability results from impairments of body or mind that negatively impact social functioning.
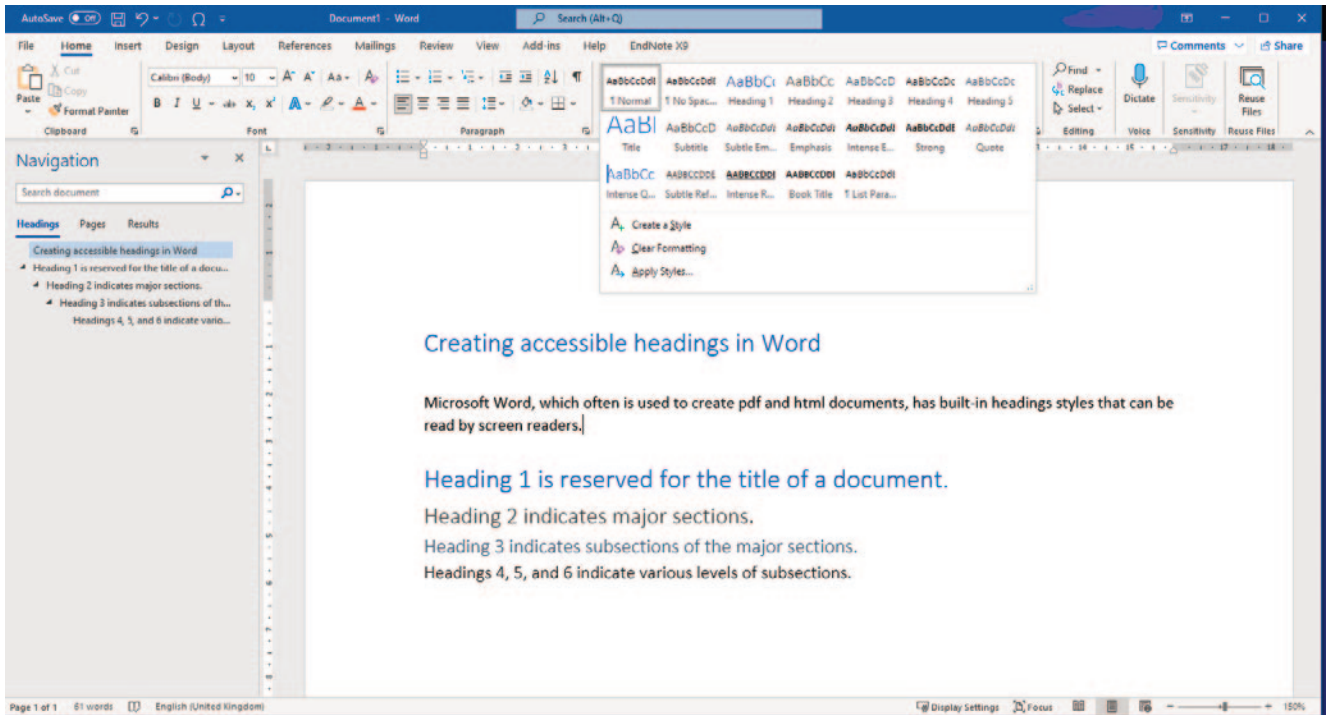
Figure 1. A screenshot of the headings style gallery in Microsoft Word

complete set of 23 pairs of replicated chromosomes during cell division. The 23rd pair is associated with sex development: females have two large X chromosomes and males have an X and a tiny Y chromosome. Some "disorders of sex development" are caused by inheriting an atypical number of sex chromosomes (see Figure 2).

Which of the following would be the best alt text for Figure 2?
- **Option 1:** A karyotype of a male with an extra X chromosome
- **Option 2:** An image of an XXY male
- **Option 3:** A karyotype of a male with Klinefelter's syndrome (47, XXY)
- **Option 4:** A karyotype of a male with a disorder of sex development (an XXY male).

I chose the first option. To see why, let's look at some guidelines for creating alt text.
- Alt text should describe an image briefly but also fully and accurately. In most cases, a short sentence or less is sufficient. All four options meet this guideline.
- Do not include words like "image of" or "graphic of". By default, the words "image" or "graphic" are included in alt text. The second option – "an image of an XXY male"– would

have been a good choice if it hadn't included the words "image of".
- Alt text should describe the appearance of objects in the image. The third option includes novel information the name of the syndrome, which cannot be inferred by non-experts from the image alone.
- Alt text needs to be brief so that screen reader users do not have many images with long alt text to read through. Thus, alt text should describe the contents of an image without repeating any document text near the image.

The fourth option fails to meet this guideline because it includes the words "a disorder of sex development".

I chose the first option because it briefly describes the image fully and accurately without adding novel information or repeating information presented in the document text.

Although simple images can be described in a few words, complex images contain more information than can be described in the alt-text field.[12] Examples of complex images are bar charts summarizing data, graphs, and maps. To make the information in a complex image available to people who cannot see it, the alt text needs to be presented in other ways. For instance, the data

Alt-text should describe an image briefly, but also fully and accurately.

presented in a bar chart can also be presented in a simple data table at the end of an article. A link to the data table could be placed next to the bar chart.

Depending on its purpose, a photograph may be a complex image. For example, NASA is including lengthy alt text for the images taken by the James Webb Telescope.[13]

Creating accessible tables
Screen readers are able to read simple data tables that have no merged, split, or empty cells. Tables with multiple row or column headers should be avoided as they cannot easily be read with screen readers.[14]

Creating accessible video and audio documents
Presentations that include audio or video components (e.g. conferences, podcasts, YouTube videos) can create challenges for people with auditory and cognitive/learning impairments. To accommodate people facing these challenges, spoken content should be converted to textual narratives. The textual narratives can take one of two forms:
- A caption is text that describes what is being said in a video presentation. The text appears at the top or bottom of a screen (i.e. computer, mobile device, television, or movie screen)
- A transcript is the entire textual narrative of an

A karyotype of a male with an extra X chromosome.   Cell No: 003

Figure 2. An example of a simple image.
The alt text for a simple image should be no more than a short sentence.

audio/video presentation. The text appears in a separate document.

Creating captions

Captions for live presentations can be created with "voice writing" (respeaking) or communi-cation access real-time translation (CART).

In voice writing (respeaking), the person producing the captions (the voice writer) listens to a presentation and quickly repeats a block of words,[15] along with punctuation, to create a recording that is processed by speech recognition software. The software produces the captions. While listening to the next block of spoken words, the voice writer tries to correct any errors in the captions. For each block of spoken words, this process takes about 4 to 10 seconds. The length of time it takes to produce corrected captions is called the 'latency'.

The greater the focus on correcting errors, the longer the latency. Long latencies can be distracting to users. One way to avoid long latencies is to have a time delay on the presentation, so that the voice writer hears the presentation's audio track before the audience

does. Another way is to use paraphrasing, which, of course, reduces accuracy.

CART captioners convert spoken language into text by using a stenotype machine.[16] The text is generated by specialised software. The CART captioner uploads a database of words that the programme uses to create the captions. The goal of captioners is to achieve at least a 98% accuracy rate.

Creating transcripts

Voice writers and CART captioners can create transcripts. But you can create transcripts yourself. For example, with Microsoft Word 365, you can dictate directly into a microphone and the speech recognition software will transcribe the spoken words.[17] You will need to proof the transcript to correct errors. You also can tran-scribe an audio file by uploading the file to Microsoft Office 365 Online. Again, the transcript needs to be proofed.

Conclusions

Accurately estimating the number of people in a population who have a disability is not possible

because no universal definition of 'disability' exists and people often must self-identify as disabled.[1]

It seems clear, however, that a significant proportion of the general population has one or more sensory, motor, or cognitive/learning impairments, especially in older age groups. Thus, to include the widest possible audience, medical writers need to focus on creating accessible electronic documents. This goal may be especially important in the area of patient education.

The guidelines discussed in this article are a good start. But these guidelines are just a beginning. The resources listed below provide more information.

Resources
- **Make your Word documents accessible to people with disabilities**
  This page contains information about creating accessible headings, images, tables, links, lists, and colour contrast.[8] It also contains directions for using the Word Accessibility Checker.

- **WebAIM Articles**
  https://webaim.org/articles/
  This page has links to articles about creating accessible headings, links, lists, and much more. It also contains information about creating accessible web pages. The articles are very informative.

- **WebAIM Accessible Documents Course: Word, PowerPoint and, & Acrobat**
  https://webaim.org/training/docs/
  This online, 5-week course will teach you the fundamentals of creating accessible Word, PowerPoint, Excel and Adobe Acrobat (PDF) documents. WebAIM also has other training events. You can learn more about these events by going to their website.

- **Digital Accessibility Foundations Free Online Course**
  https://www.w3.org/WAI/fundamentals/foundations-course/

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The author declares no conflicts of interest.

References

1. Geiecker O, Momm W. Disability: concepts and definitions: International Labour Organization. [cited 2022 Aug 31]. Available from: https://www.iloencyclopaedia.org/part-iii-48230/disability-and-work/item/170-disability-concepts-and-definitions#:~:text=The%20medical%20concept%20of%20disability,individual%20who%20has%20an%20impairment.

2. Wasserman D. Disability: definitions and models. In: Zalta EN, editor. The Stanford Encyclopedia of Philosophy. Stanford. The Metaphysics Research Lab, 2017. Clone. [Cited 2022 Sep 1]. Available from: https://plato.stanford.edu/archives/sum2022/entries/disability/.

3. WebAIM: introduction to web accessibility. Logan, UT. Institute for Disability Research, Policy, and Practice. 2020 [cited 2022 Sep 1]. Available from: https://webaim.org/intro/.

4. WebAIM: Cognitive – Introduction. 2020 [cited 2022 Sep 1]. Available from: https://webaim.org/articles/cognitive/.

5. WebAIM: Visual disabilities – Introduction. 2021 [cited 2022 Sep 1]. Available from: https://webaim.org/articles/visual/.

6. WebAIM: Auditory disabilities – Introduction. 2020 [cited 2022 Sep 1]. Available from: https://webaim.org/articles/auditory/.

7. WebAIM: motor disabilities – introduction. 2020 [cited 2022 Sep 1]. Available from: https://webaim.org/articles/motor/.

8. Microsoft. Make your Word documents accessible to people with disabilities. 2022 [cited 2022 Aug 31]. Available from: https://support.microsoft.com/en-us/office/make-your-word-documents-accessible-to-people-with-disabilities-d9bf3683-87ac-47ea-b91a-78dcacb3c66d.

9. Ricker J. Accessibility 101: creating document headings for people with disabilities. Knowing Ourselves. 2022 [cited 2022 Aug 28]. Available from: https://knowing-ourselves.com/2022/07/12/accessibility-101-creating-document-headings-for-people-with-disabilities/.

10. Ricker J. Accessibility 101: creating accessible hyperlinks for people with disabilities. Knowing Ourselves. 2022 [cited 2022 Aug.31]. Available from: https://knowing-ourselves.com/2022/07/12/accessibility-101-creating-accessible-hyperlinks-for-people-with-disabilities/.

11. Ricker J. Accessibility 101: creating accessible Image alt-text for people with disabilities (part 1). Knowing Ourselves. 2022 [cited 2022 Aug 28]. Available from: https://knowing-ourselves.com/2022/07/13/accessibility-101-creating-accessible-image-alt-text-for-people-with-disabilities-part-1/.

12. Ricker J. Accessibility 101: creating alt-text accessible to people with disabilities (part 2 complex images). Knowing Ourselves. 2022 [cited 2022 Aug 28]. Available from: https://knowing-ourselves.com/2022/07/22/accessibility-101-creating-alt-text-accessible-to-people-with-disabilities-part2-complex-images/.

13. National Public Radio. Alt text helps the visually impaired experience the James Webb Telescope images. 2022 [cited 2022 Aug 31]. Available from: https://www.npr.org/2022/07/22/1112878868/webb-telescope-alt-text-visually-impaired.

14. Microsoft. Avoid using tables. 2022 [cited 2022 Aug 31]. Available from: https://support.microsoft.com/en-us/office/make-your-word-documents-accessible-to-people-with-disabilities-d9bf3683-87ac-47ea-b91a-78dcacb3c66d#bkmk_avoid_tables_win.

15. AppTek Blog. The state of live captioning today: an expert's perspective (Accessibility Series Part 4). AppTek.Weblog. 2020 [cited 2022 Aug 28]. Available from: https://www.apptek.com/post/the-state-of-live-captioning-today-an-experts-perspective-accessibility-series-part-4.

16. Ricker J. Accessibility 101: creating accessible multimedia presentations for people with disabilities (part 1: real-time captioning). Knowing Ourselves. 2022 [cited 2022 Aug 28]. Available from: https://knowing-ourselves.com/2022/07/29/accessibility-101-creating-accessible-multimedia-presentations-for-people-with-disabilities-part-1-real-time-captioning/.

17. Microsoft. Transcribe your recordings. 2022 [cited 2022 Aug 31]. Available from: https://support.microsoft.com/en-us/office/transcribe-your-recordings-7fc2efec-245e-45f0-b053-2a97531ecf57.

Author information

Jeffry Ricker, PhD, is a freelance medical writer. He was an instructor and professor in the biological and behavioural sciences for 30 years. He began to lose his vision in 2017 and is now blind. He advocates for creating accessible documents, technology and websites.