Web accessibility

CONCEPT and GUIDELINES

POLITECNICO
DI TORINO

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e-Lite

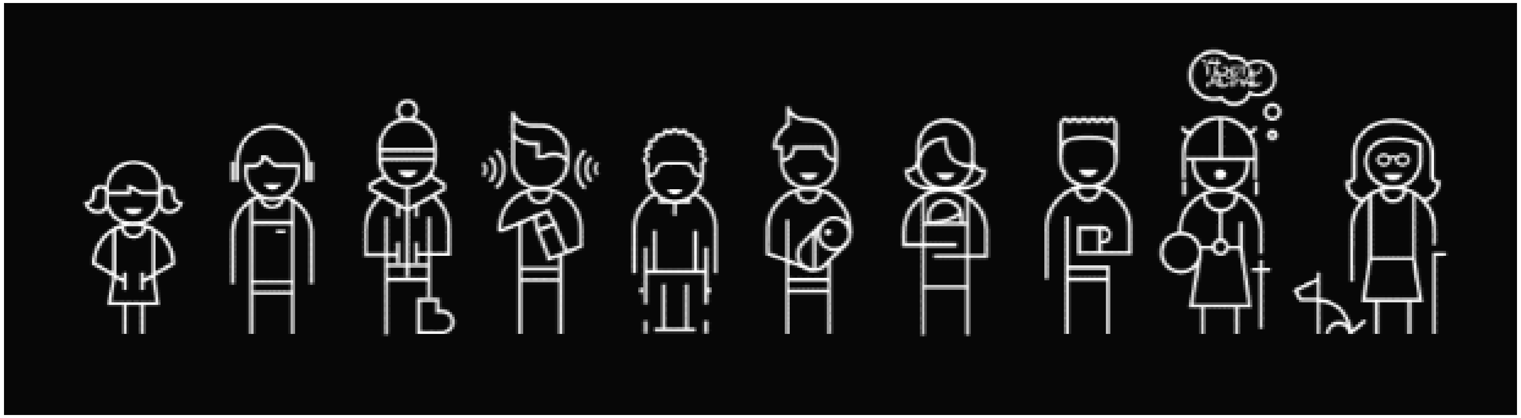
Summary

- Inclusive design and accessibility principles
- Web accessibility
- Screen readers
- Standards
  - WCAG
  - WAI-ARIA
- Legge Stanca

INCLUSIVE DESIGN AND ACCESSIBILITY PRINCIPLES

Inclusive design

- When it comes to people, there’s no such thing as “normal.” The interactions we design with technology depend heavily on what we can see, hear, say, and touch. Assuming all those senses and abilities are fully enabled all the time creates the potential to ignore much of the range of humanity.



https://www.microsoft.com/en-us/design/inclusive

The goal of accessibility

- Users with disabilities have access to and use of information and data that is comparable to that of users without disabilities
- Disabled users should be able to use a system
  - In the usual way like other users
  - Without particular difficulties
  - Without help of others

Disability types

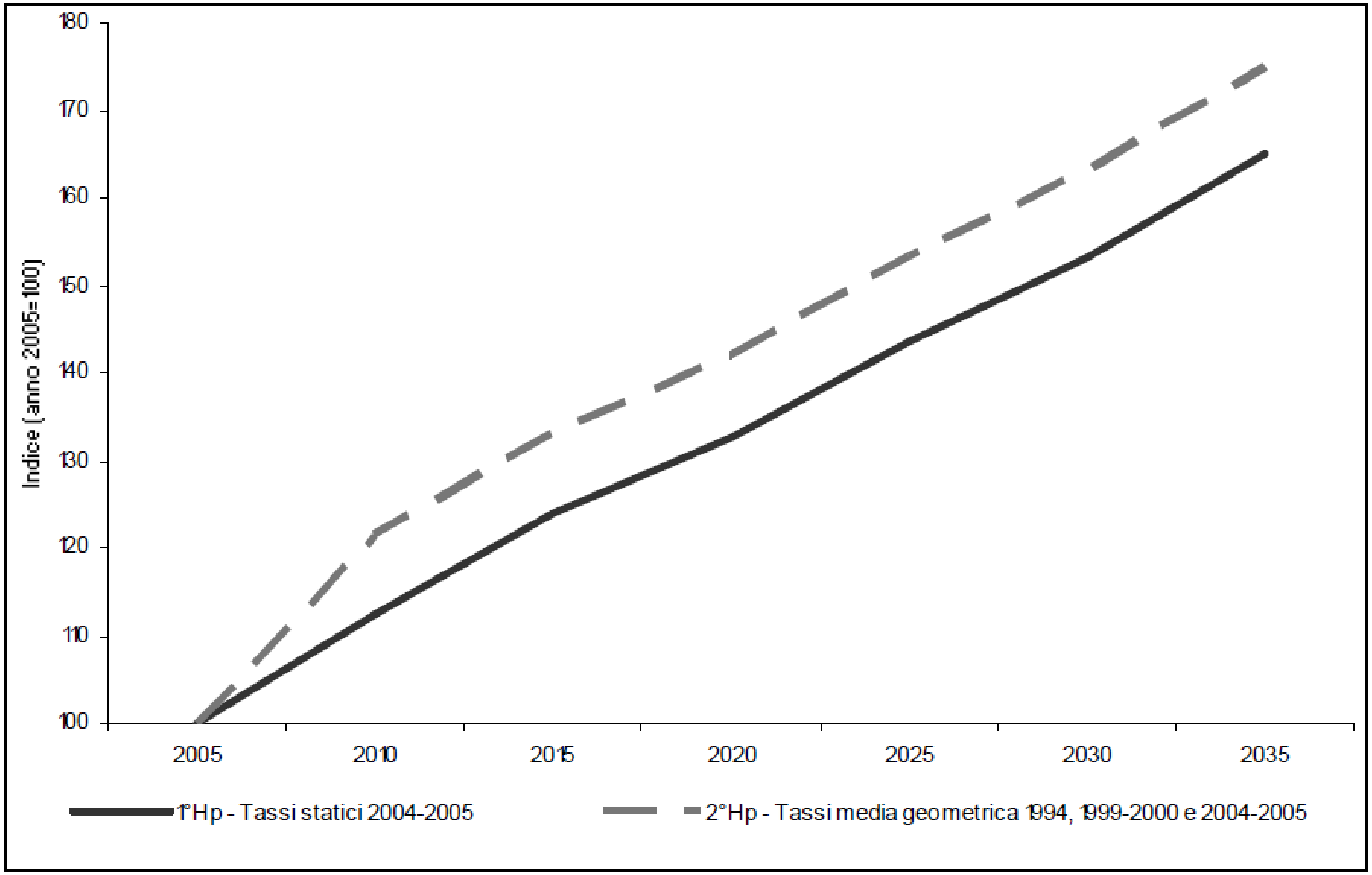
- Visual Blindness
  - Blindness, low vision, color-blindness
- Hearing
  - Deafness and hard-of-hearing
- Motor
  - Inability to use a mouse, slow response time, limited fine motor control
- Cognitive
  - Learning disabilities, distractibility, inability to remember or focus on large amounts of information

The target

- People with a physical or cognitive disability
  - Blind or visually impaired
  - Deaf or hearing impaired
  - Mobility or dexterity impaired
  - Reduced cognitive abilities
- Most disabled people became disabled as adults
- Elderly people often develop disabilities, e.g.
  - Reduced vision, reduced hearing
  - Reduced mobility or dexterity
  - Reduced tactile and fine motor abilities
  - Reduced short-term memory
  - Dyspraxia (difficulties to plan a task)
  - Dyslexia

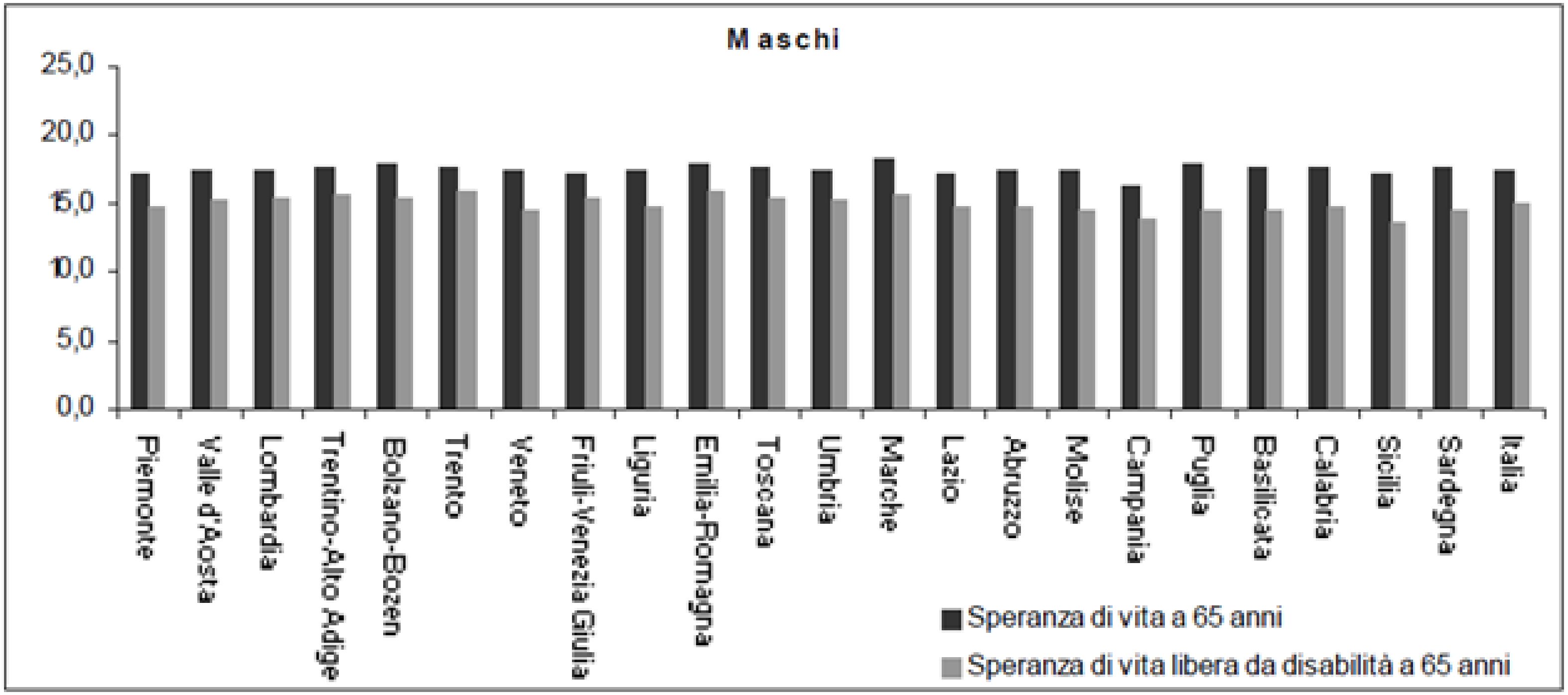
Data from ISTAT (2010)

Figura 1.4 - Proiezione del tasso di disabilità secondo le varie ipotesi - Anno 2005-2035 *(Numeri indice anno base=2005)*



Data from ISTAT (2010)

Figura 2.2 - Speranza di vita *(stime 2005)* **e speranza di vita libera da disabilità a 65 anni per regione e sesso - Anni 2004-2005**



Data from ISTAT (2010)

Istat.it

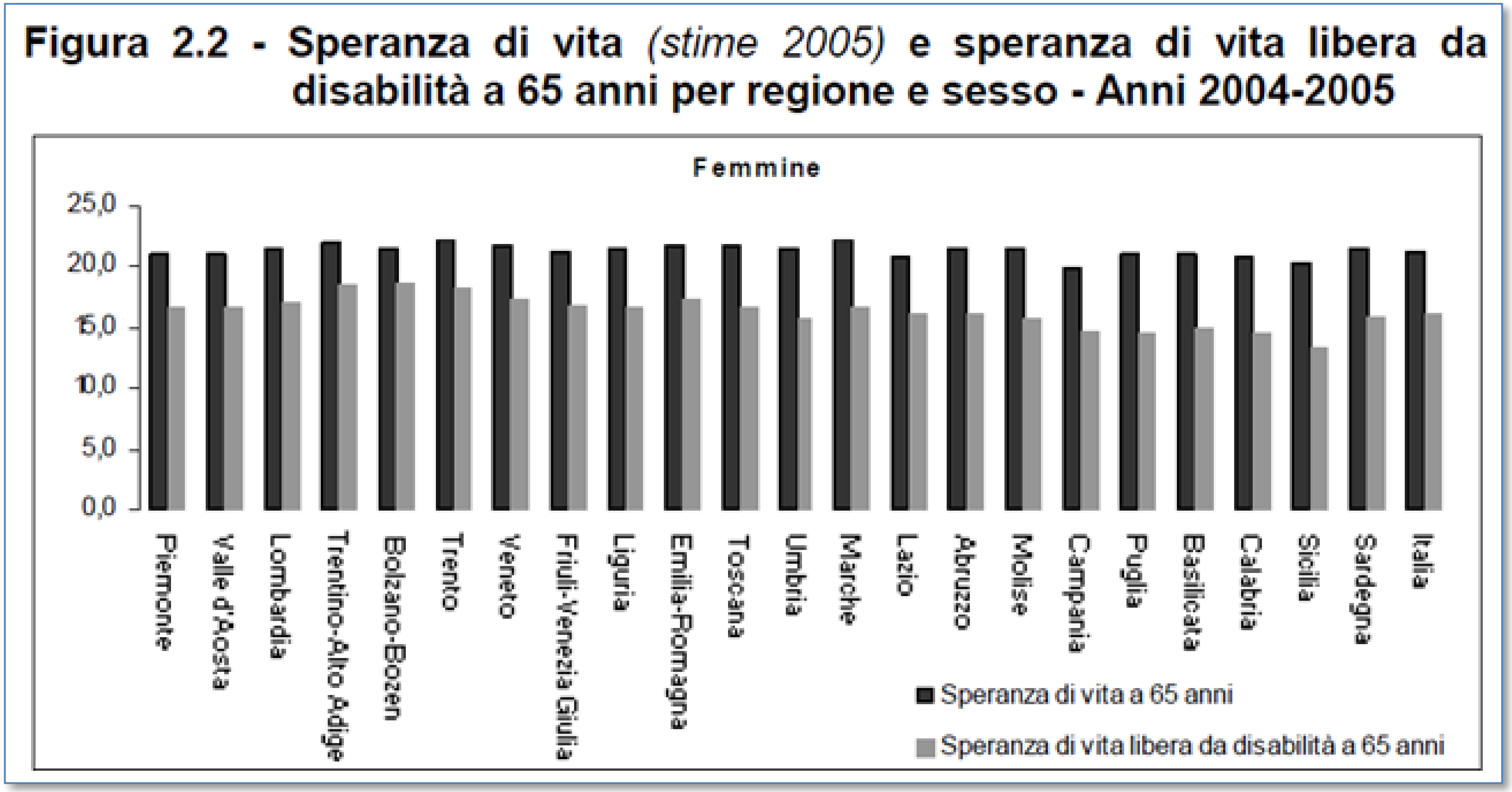
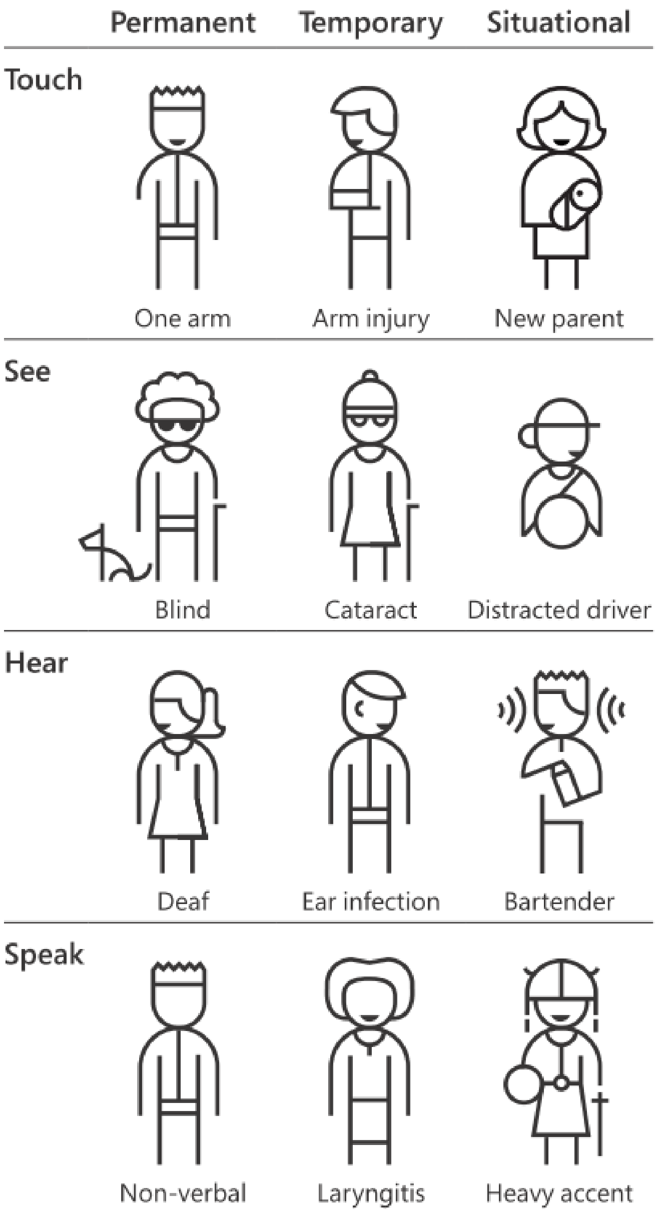


Figura 2.2 - Speranza di vita *(stime 2005)* **e speranza di vita libera da disabilità a 65 anni per regione e sesso - Anni 2004-2005**

Who else could benefit?

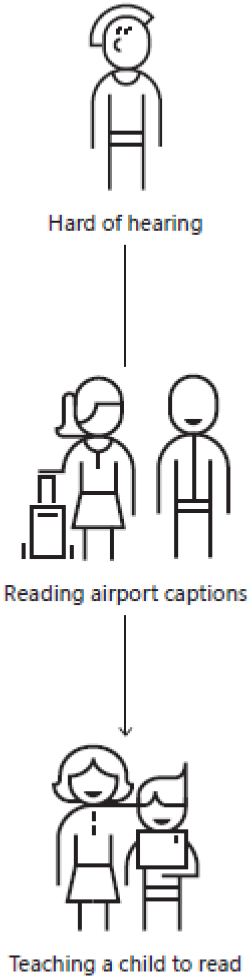
- People with temporary disabilities (e.g., after an accident or stroke)
- Users in a context causing a temporary reduction of abilities (handicapping situation), such as
  - Noisy environment (similar to reduced hearing)
  - Hands engaged in other tasks (similar to reduced mobility)
  - Eyes engaged in other task (similar to reduced vision)
  - Attention on more important task (reduced cognitive capacity)
  - Limited hardware features of mobile devices, etc. (similar to various physical handicaps)



The beauty of constraints

- Designing for people with permanent disabilities can seem like a significant constraint, but the resulting designs can actually benefit a much larger number of people

- Three principles of inclusive design
  - Recognize exclusion
  - Learn from diversity
  - Solve for one, extend to many



WEB ACCESSIBILITY

Why Web accessibility?

- Internet usage of disabled is higher than average!
  - “The internet is one of the best things that has ever happened to people with disabilities” (WebAIM.org)
  - ”The Web is not a barrier to people with disabilities, it is the solution“ (WebAIM.org)
- People who already use the Internet will continue to use it when becoming older, as long as it is accessible for them
  - eAccessibility is important for a large, increasing number of people

Why Web accessibility?

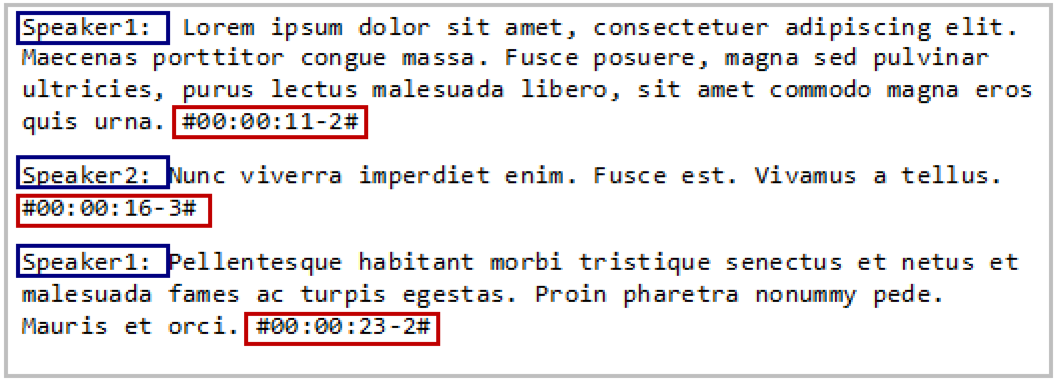
- Despite the web great potential for people with disabilities, this potential is still largely unrealized
  - Some sites can only be navigated using a mouse
  - Only a very small percentage of video or multimedia content has been captioned for the deaf
  - Very few sites are optimized for a screen reader

Web accessibility

- Websites, tools, and technologies are designed and developed so that people with disabilities can use them: perceive, understand, navigate, interact with the Web, contribute to the Web
- Web accessibility encompasses all disabilities that affect access to the Web: auditory, cognitive, neurological, physical, speech, visual
- Web accessibility also benefits people without disabilities
  - People using mobile phones, smart watches, smart TVs, and other devices with small screens, different input modes, etc.
  - Older people with changing abilities due to ageing
  - People with “temporary disabilities” such as a broken arm or lost glasses
  - People with “situational limitations” such as in bright sunlight or in an environment where they cannot listen to audio
  - People using a slow Internet connection, or who have limited or expensive bandwidth

Auditory disabilities

- To use the Web effectively people rely on
  - Transcripts and captions of audio content, including audio-only content and audio tracks in multimedia
  - Media players that display captions and provide options to adjust the text size and colors of captions
  - Options to stop, pause, and adjust the volume of audio content (independently of the system volume)
  - High-quality foreground audio that is clearly distinguishable from any background noise



Speaker1: Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Maecenas porttitor congue massa. Fusce posuere, magna sed pulvinar ultricies, purus lectus malesuada libero, sit amet commodo magna eros quis urna. #00:00:11-2#

Speaker2: Nunc viverra imperdiet enim. Fusce est. Vivamus a tellus. #00:00:16-3#

Speaker1: Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Proin pharetra nonummy pede. Mauris et orci. #00:00:23-2#

Auditory disabilities

- Examples of barriers
  - Audio content, such as videos with voices and sounds, without captions or transcripts
  - Media players that do not display captions and that do not provide volume controls
  - Media players that do not provide options to adjust the text size and colors for captions
  - Web-based services, including web applications, that rely on interaction using voice only
  - Lack of sign language to supplement important information and text that is difficult to read

Cognitive, learning, and neurological disabilities

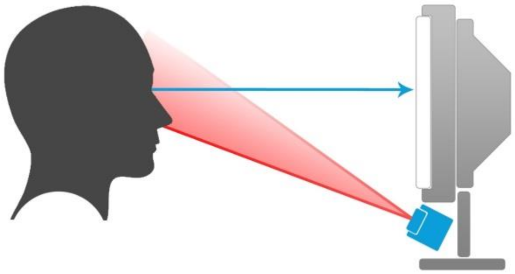
- Depending on the individual needs, people often rely on
  - Clearly structured content that facilitates overview and orientation
  - Consistent labeling of forms, buttons, and other content parts
  - Predictable link targets, functionality, and overall interaction
  - Different ways of navigating websites, such as hierarchical menu and search
  - Options to suppress blinking, flickering, flashing, and otherwise distracting content
  - Simpler text that is supplemented by images, graphs, and other illustrations

Cognitive, learning, and neurological disabilities

- Examples of barriers for people with cognitive, learning, and neurological disabilities
  - Complex navigation mechanisms and page layouts that are difficult to understand and use
  - Complex sentences that are difficult to read and unusual words that are difficult to understand
  - Long passages of text without images, graphs, or other illustrations to highlight the context
  - Moving, blinking, or flickering content, and background audio that cannot be turned off
  - Web browsers and media players that do not provide mechanisms to suppress animations and audio
  - Visual page designs that cannot be adapted using web browser controls or custom style sheets

Physical (or motor) disabilities

- To use the Web, people often use specialized hardware and software
  - Ergonomic or specially designed keyboard or mouse
  - Head pointer, mouth stick, and other aids to help with typing
  - On-screen keyboard with trackball, joysticks, or other pointing devices
  - Switches operated by foot, shoulder, sip-and-puff, or other movements
  - Voice recognition, eye tracking, and other approaches for hands-free interaction



Physical (or motor) disabilities

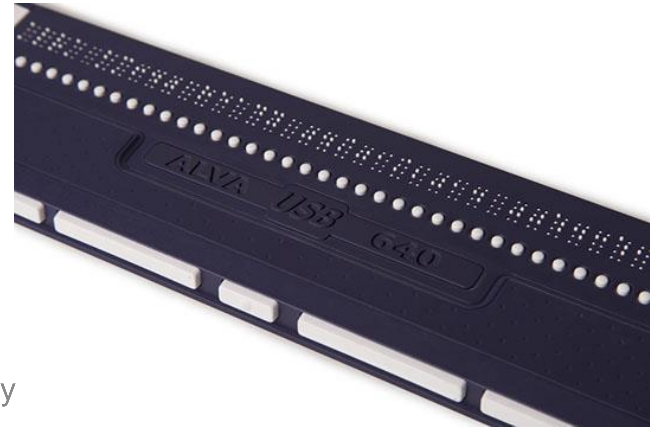
- Examples of barriers for people with physical disabilities
  - Websites, web browsers, and authoring tools that do not provide full keyboard support
  - Insufficient time limits to respond or to complete tasks, such as to fill out online forms
  - Controls, including links with images of text, that do not have equivalent text alternatives
  - Missing visual and non-visual orientation cues, page structure, and other navigational aids
  - Inconsistent, unpredictable, and overly complicated navigation mechanisms and page functions

Speech disabilities

- People need alternative modes of interaction such as a text-based chat to interact with hotline representatives and keyboard commands to operate web applications
- Examples of barriers for people with speech disabilities
  - Web-based services, including web applications, that rely on interaction using voice only
  - Websites that offer phone numbers as the only way to communicate with the organizations

Visual disabilities

- People typically rely on changing the presentation of web content into forms that are more usable for their needs
  - Enlarging or reducing text size and images
  - Customizing settings for fonts, colors, and spacing
  - Listening to text-to-speech synthesis of the content
  - Listening to audio descriptions of video in multimedia
  - Reading text using refreshable Braille



Visual disabilities

- For these web browsing methods to work, developers need to ensure that the presentation of web content is independent of its underlying structure and that the structure is correctly coded so that it can be processed and presented in different ways by web browsers and assistive technologies
  - For instance, some people do not see the content and rely on lists, headings, tables, and other page structures to be properly coded so that they can be identified by web browsers and assistive technologies

Visual disabilities

- Examples of barriers for people with visual disabilities
  - Images, controls, and other structural elements that do not have equivalent text alternatives
  - Text, images, and page layouts that cannot be resized, or that lose information when resized
  - Missing visual and non-visual orientation cues, page structure, and other navigational aids
  - Video content that does not have text or audio alternatives, or an audio-description track
  - Inconsistent, unpredictable, and overly complicated navigation mechanisms and page functions
  - Text and images with insufficient contrast between foreground and background color combinations
  - Websites, web browsers, and authoring tools that do not support the use of custom color combinations
  - Websites, web browsers, and authoring tools that do not provide full keyboard support

SCREEN READERS

Screen readers

- Software programs that convert text into synthesized speech
- Screen readers allow users to navigate through web content in many ways
  - The user can simply let the screen reader read everything from top to bottom, one line at a time
  - The user can use the tab key to navigate from link to link
  - The user can also navigate from one heading to the next (if the web content has headings), from one frame to the next (if there are frames), or by other methods

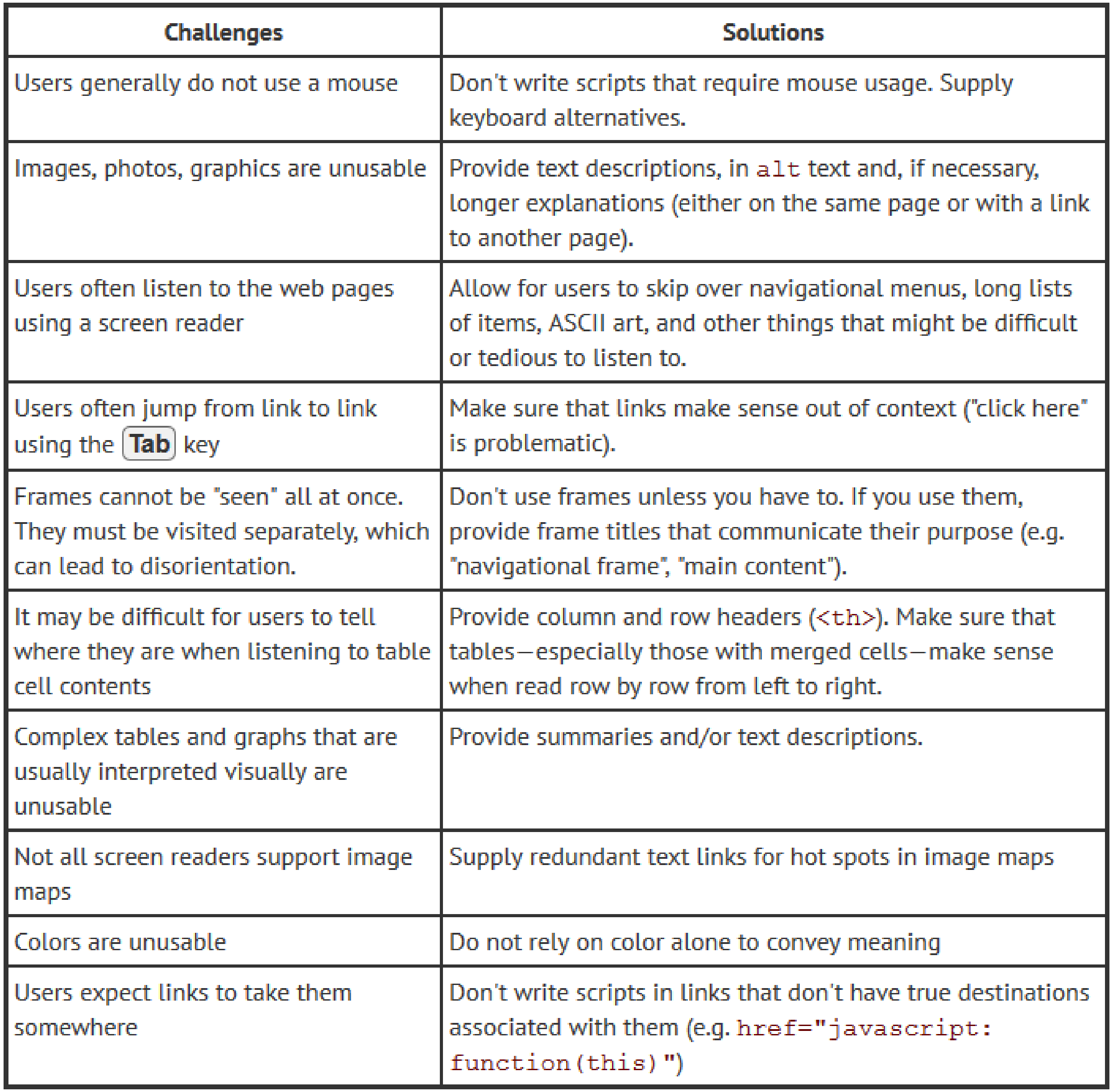
Screen readers limitations

- Screen readers cannot describe images
  - The only way that a screen reader can convey the meaning of an image is by reading text in the document that serves as a substitute, or alternative, for that image
  - If there is no alternative text (“alt” text) the screen reader cannot accurately convey the meaning of an image
- Screen readers cannot survey the entirety of a web page as a visual user might do
  - A visual user can look at a web page and quickly realize how the page is organized, and then focus on the most important content
  - A screen reader is not able to do this: it reads in a linear fashion, one word at a time. It cannot always intelligently skip over extraneous content, such as advertisements or navigation bars

Keyboard accessibility

- Screen reader users use the keyboard as their primary means of navigating the web
  - Developers need to pay attention to
  - Avoid functionalities that work only if accessed using a mouse
  - Most of the time, keyboard inaccessibility is a result of JavaScript events that depend on either the click or the movement of the mouse
  - E.g., any event triggered by the "onmouseover" event will only work when the user moves the mouse over that particular object: there is no way to access this type of content using a keyboard alone without providing some other method, either in addition to, or instead of the onmouseover event

Key concepts for blindness



Challenges	Solutions
Users generally do not use a mouse	Don't write scripts that require mouse usage. Supply keyboard alternatives.
Images, photos, graphics are unusable	Provide text descriptions, in `alt` text and, if necessary, longer explanations (either on the same page or with a link to another page).
Users often listen to the web pages using a screen reader	Allow for users to skip over navigational menus, long lists of items, ASCII art, and other things that might be difficult or tedious to listen to.
Users often jump from link to link using the Tab key	Make sure that links make sense out of context ("click here" is problematic).
Frames cannot be "seen" all at once. They must be visited separately, which can lead to disorientation.	Don't use frames unless you have to. If you use them, provide frame titles that communicate their purpose (e.g. "navigational frame", "main content").
It may be difficult for users to tell where they are when listening to table cell contents	Provide column and row headers (`<th>`). Make sure that tables—especially those with merged cells—make sense when read row by row from left to right.
Complex tables and graphs that are usually interpreted visually are unusable	Provide summaries and/or text descriptions.
Not all screen readers support image maps	Supply redundant text links for hot spots in image maps
Colors are unusable	Do not rely on color alone to convey meaning
Users expect links to take them somewhere	Don't write scripts in links that don't have true destinations associated with them (e.g. `href="javascript:function(this)"`)

https://webaim.org/articles/visual/blind#screenreaders

How screen readers read content

- Screen readers pause for: periods, semi-colons, commas, question marks, exclamation points, paragraph endings
- Screen readers try to pronounce acronyms, if there are sufficient vowels/consonants to be pronounceable; otherwise, they spell out the letters
  - NASA is pronounced as a word
  - SQL is pronounced “sequel” even though some humans say “S. Q. L.”
  - NSF is pronounced “N. S. F.”
  - URL is pronounced “U. R. L.”
- Users can pause screen readers and go back to repeat a word or passage
  - They can even have the screen reader read words letter by letter, with the screen reader shouting/emphasizing the uppercase letters
- Screen readers say “star” or “asterisk” for password fields
- Screen readers announce the page title (the <title> element in the HTML markup) when first loading a web page

How screen readers read content

- Screen readers will read the alternative text of images, if alt text is present
  - JAWS precedes the alternative text with the word “graphic”
  - If the image is a link, JAWS precedes the alternative text with “graphic link"
- Screen readers ignore images without alternative text and say nothing, but users can set their preferences to read the file name
  - If an image without alternative text is a link, screen readers will generally read the link destination (the href attribute in the HTML markup) or may read the image file name
- Screen readers announce headings and identify the heading level
  - NVDA and JAWS, for example, precede <h1> headings with “heading level 1”
- Some screen readers announce the number of links on a page as soon as the page finishes loading in the browser
  - JAWS says “same page link” if the link destination is on the same page as the link itself and “visited link” for links that have been previously accessed

How screen readers read content

- Screen readers in table navigation mode inform the user how many rows and columns are in a data table
  - Users can navigate in any direction from cell to cell in table navigation mode
  - If the table is marked up correctly, the screen reader will read the column and/or row heading as the user enters each new cell
- Screen readers inform users when they have entered into a form
  - Users have the option to enter form navigation mode
- Screen readers may or may not read out punctuation, depending on the user's verbosity setting: ensure that your intended meaning will be conveyed in either case
  - Let's eat, grandpa!
  - I'd like to thank my parents, the pope, and Mother Teresa.
  - He finds inspiration in cooking, his children, and his cat.

Design for screen reader compatibility

- Adhere to accessibility standards and generally accepted accessibility techniques
  - To accommodate differences between screen readers
- Document language
  - Web pages specify document language with a lang attribute on the <html> tag
  - Sometimes text is interspersed with foreign phrases: the lang attribute should be applied to a <span> tag
  - The lang attribute can be applied to nearly any HTML element
  - Although it makes no visual changes, it does provide a convenient hook for CSS: a common convention is to italicize foreign phrases

```
span[lang] { font-style: italic; }
```

Design for screen reader compatibility

- Content Linearization
  - Audio interfaces present content linearly to users, one item at a time, in contrasts with the way in which most people use visual interfaces
  - Sighted users can scan an entire screen almost instantaneously, comprehending the overall layout, the artistic style, and other macro-level aspects of the content
  - Screen reader users cannot comprehend these macro-level aspects as quickly
  - Users must progress through such systems in a step-wise manner (somewhat like automated telephone menu systems which do not reveal all of the options at once)
  - The insight that audio interfaces are linearized versions of web content is an important one that should guide web developers during the engineering and design process

Navigating content

- Despite the linear nature of audio interfaces, screen readers do provide ways for users to navigate content quickly
- Links and Form Controls
  - Use the Tab key to jump from link to link
  - Drawback: the user does not hear any of the non-link content and may miss important information
  - Implication: links should make sense when read out of context
- Headings
  - Another way to get an overall impression of a page content is to jump from heading to heading
  - The main drawback to this technique is that it relies on headings, which too many pages lack
  - Implication: authors should organize content with headings; to the extent possible, the headings should represent an accurate outline of the content

Navigating content

- Landmarks and page sections
  - Users can navigate via HTML5 sectioning elements (<main>, <nav>, <header>) and ARIA landmarks
  - Implication: define appropriate ARIA landmarks and use HTML5 elements appropriately
  - WAI-ARIA: Accessible Rich Internet Applications Suite
  - Defines a way to make Web content and Web applications more accessible to people with disabilities
  - It especially helps with dynamic content and advanced user interface controls developed with Ajax, HTML, JavaScript, and related technologies
  - Landmark roles, or “landmarks” can de defined to identify sections of a page

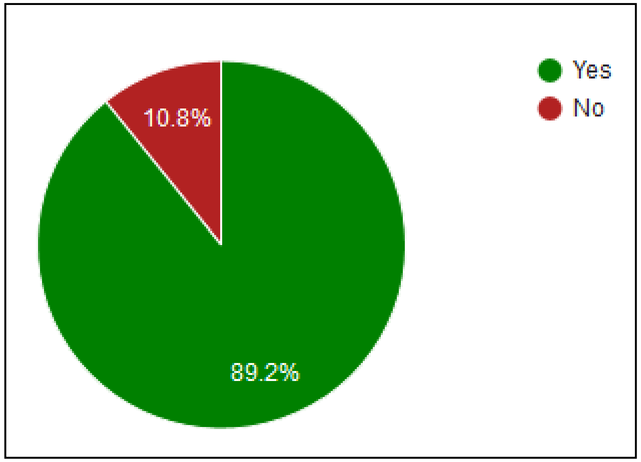
Navigating content

- Paragraphs and page elements
  - Users can jump from paragraph to paragraph, listening to the first sentence or two before moving on to the next paragraph
  - Users can also jump from element to element, such as <div> tags, links, form elements, list items, or other units of content
  - Implication: when possible, place the distinguishing information of a paragraph in the first sentence
- “Skip navigation” links
  - Skip links at the top of the page allow users to bypass the main navigation and go directly to the main content
  - They speed up the reading process and help users distinguish between the main navigation and the main content
  - Implication: where appropriate, allow users to skip over repetitive navigation links

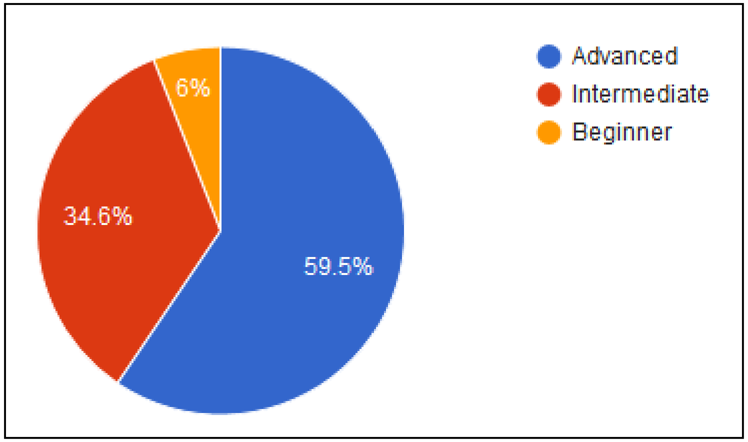
Screen reader user survey

- In October 2017, WebAIM surveyed preferences of screen reader users
  - https://webaim.org/projects/screenreadersurvey7/

- Disability

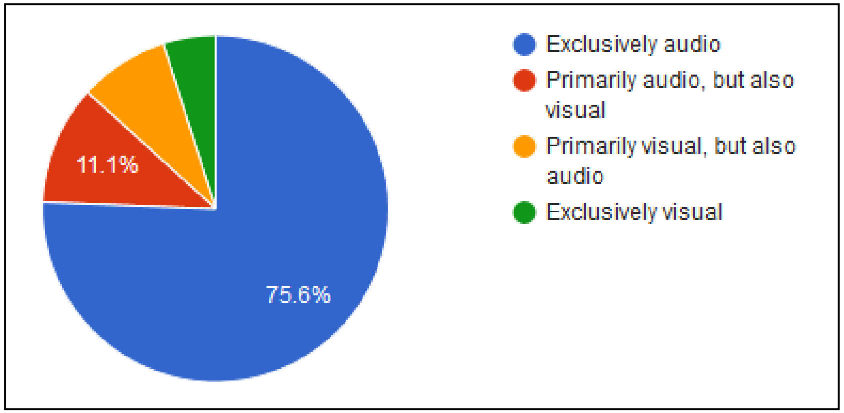


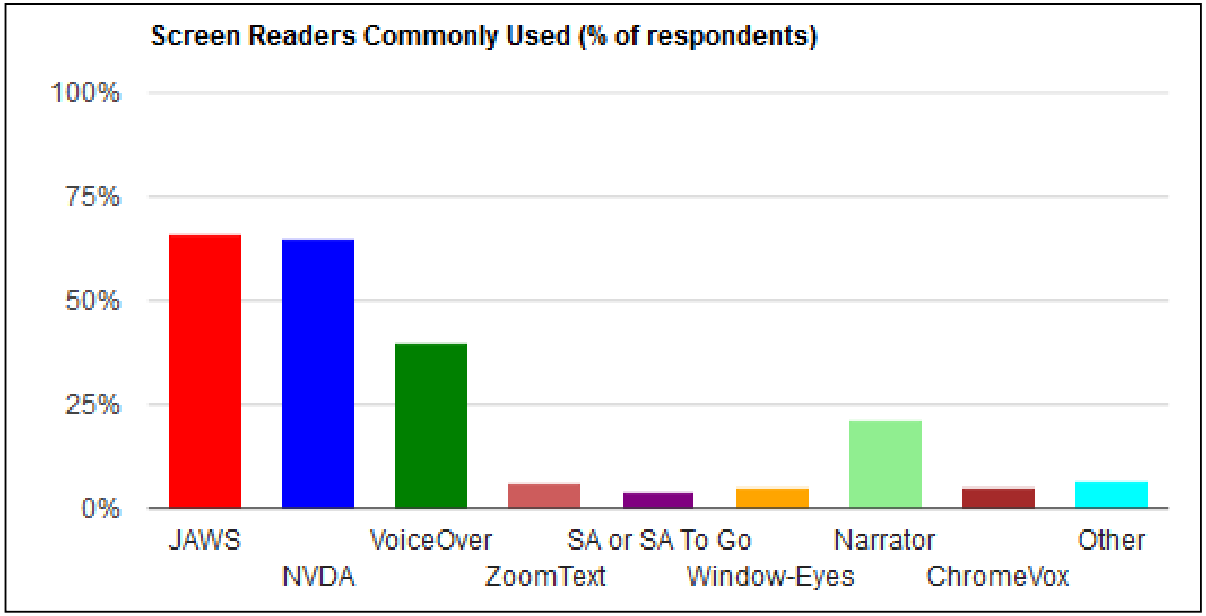
- Screen reader proficiency



Screen reader user survey

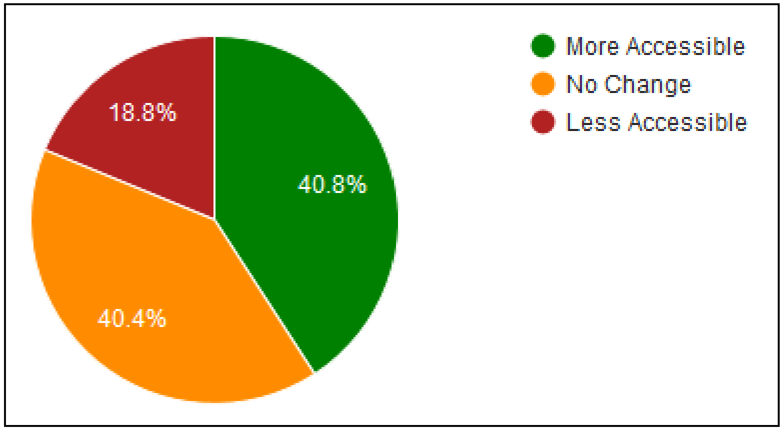
- Screen reader usage

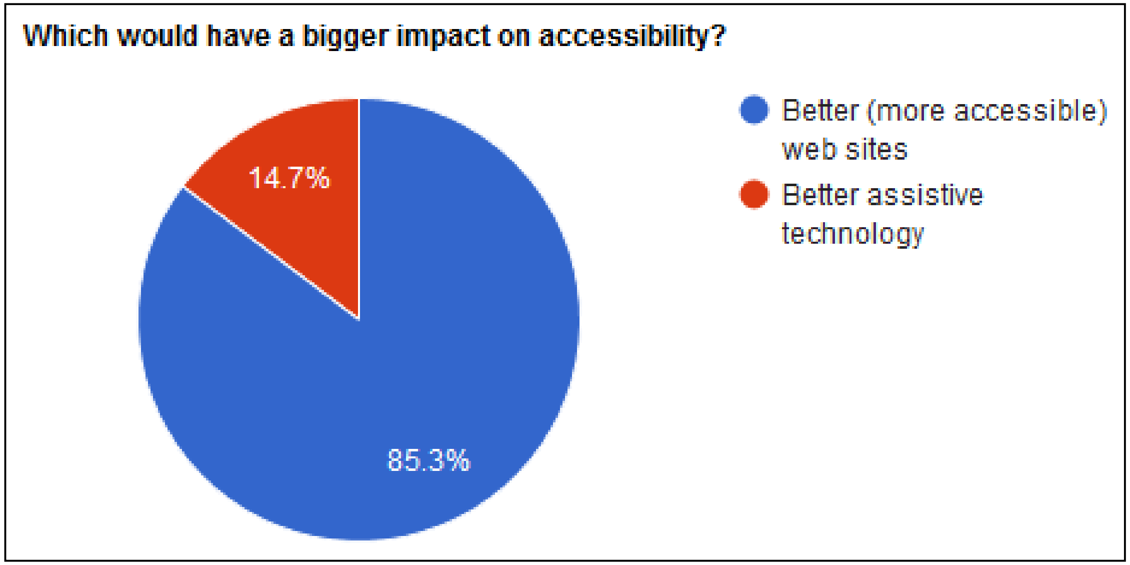




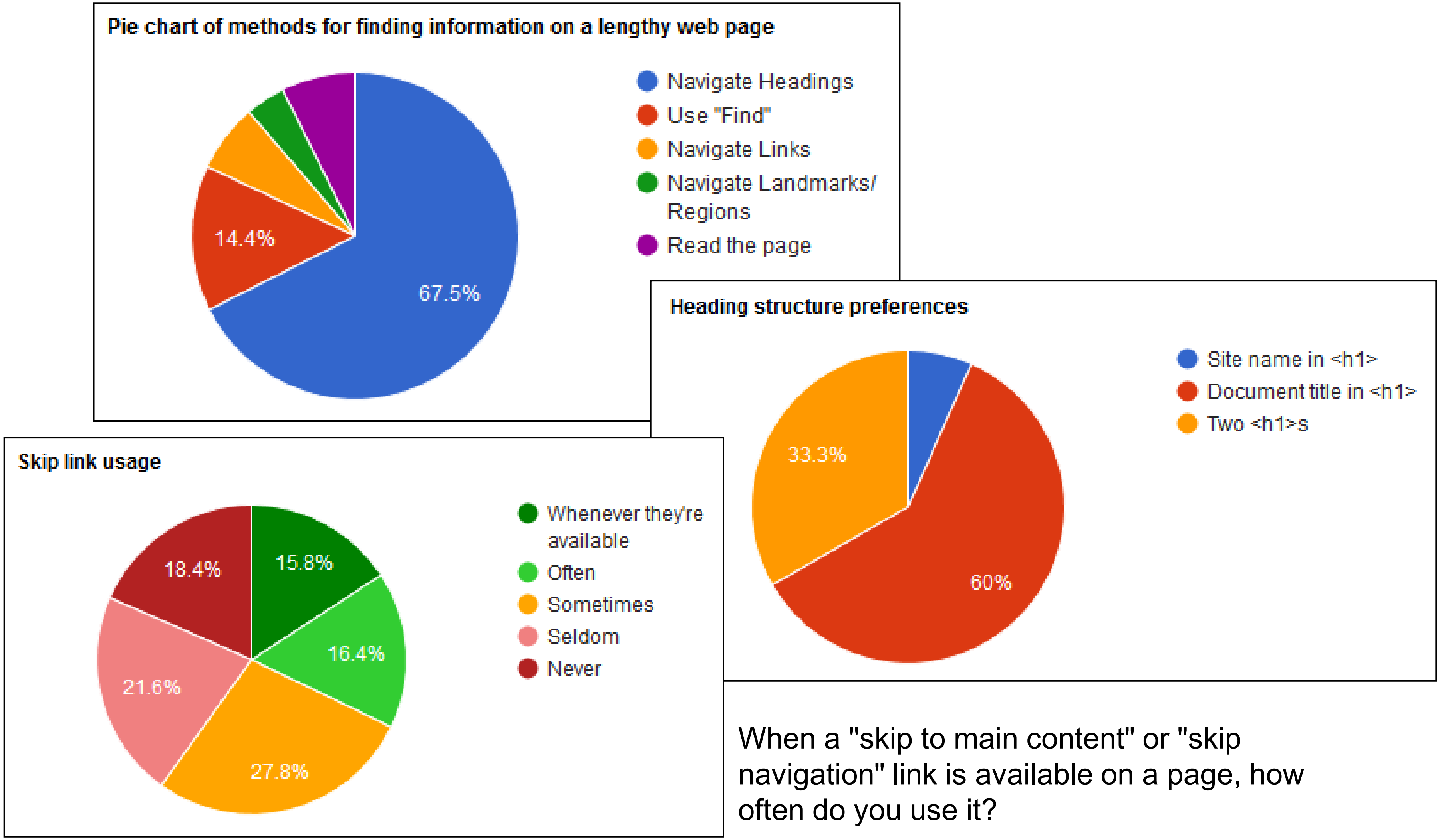
Screen reader user survey

- Web accessibility progress



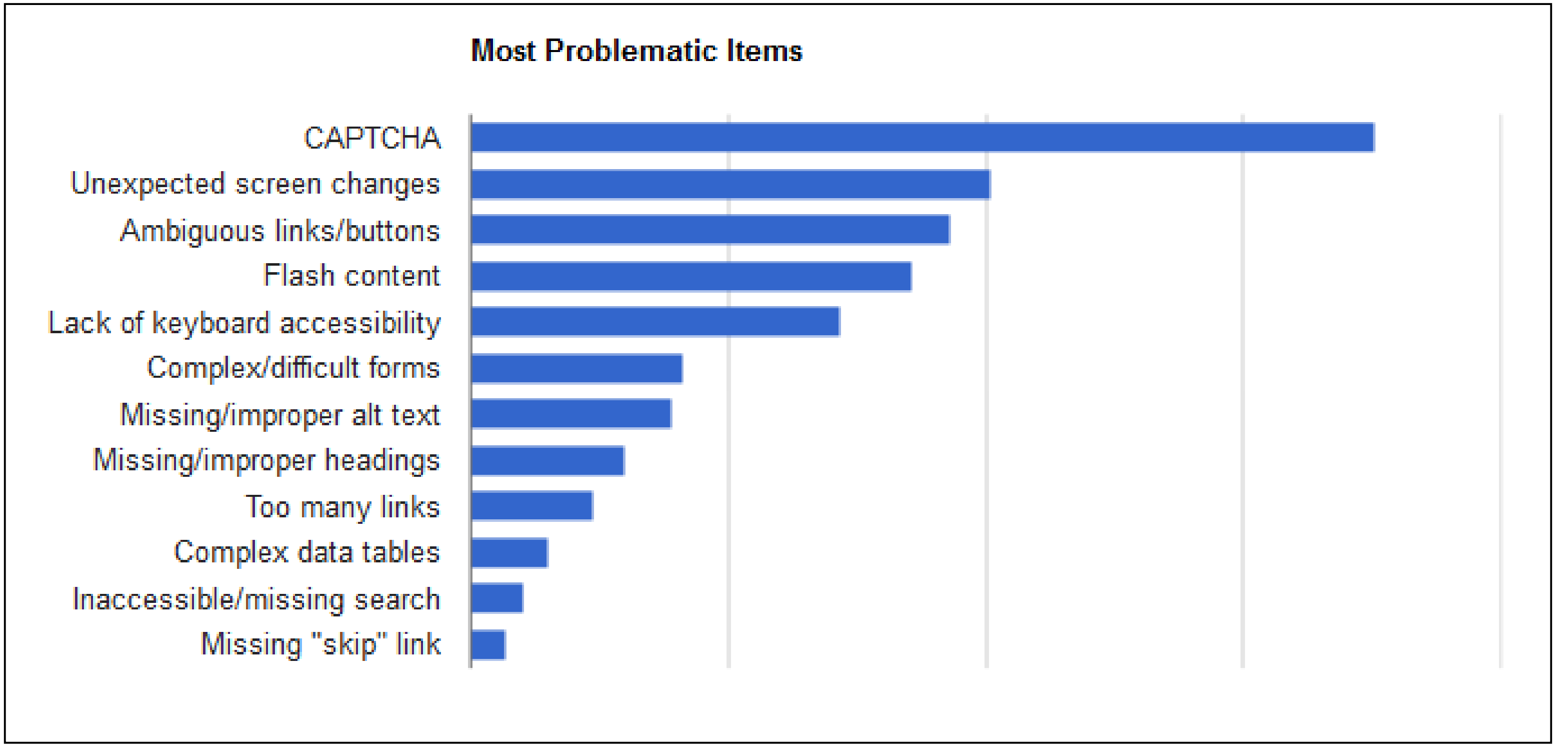


Screen reader user survey



When a "skip to main content" or "skip navigation" link is available on a page, how often do you use it?

Screen reader user survey



Commercial screen readers

- Recommended pairings
  - Firefox with NVDA
  - Chrome or Internet Explorer with JAWS
  - Safari with VoiceOver (Apple)
  - Edge with Narrator (Windows 10)
- NVDA – Non Visual Desktop Access
  - Free, open-source, portable screen reader for Microsoft Windows
- VoiceOver
  - Screen reader built into Apple macOS, iOS, tvOS, watchOS, and iPod operating systems

Testing with NVDA screen reader

- It is important to evaluate the accessibility of web content with a screen reader, but screen readers can be very complicated programs for the occasional user, so many people avoid them
  - Start: Ctrl + Alt + N
  - NVDA key (default): Insert o Caps Lock
  - Quit: NVDA + Q
  - Dozen of keyboard shortcuts to read content by line, sentence, word, character, … and to navigate
  - Read https://webaim.org/articles/nvda/

Testing with VoiceOver screen reader

- It is important to evaluate the accessibility of web content with a screen reader, but screen readers can be very complicated programs for the occasional user, so many people avoid them
  - Start: Command + F5
  - VoiceOver Activation keys (VO): control + option
  - Dozen of keyboard shortcuts to read content by line, sentence, word, character, … and to navigate
  - Read https://webaim.org/articles/voiceover/

References

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  - https://www.microsoft.com/en-us/design/inclusive
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  - https://www.w3.org/WAI/intro/people-use-web/diversity
- WebAIM: Web Accessibility in Mind
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  - http://www.freedomscientific.com/JAWSHQ/JAWSHeadquarters01
- WCAG 2.0 guidelines
  - http://www.w3.org/TR/WCAG20/#guidelines
- WAI-ARIA
  - https://www.w3.org/WAI/intro/aria.php

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