Web Design with Accessibility in Mind

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Introduction

Principles and theory

Accessibility deals with making content usable for a wide audience in spite of disabilities. In this document, we will be discussing how to design websites to make them accessible. After reading this document, a web designer or developer should be able to begin implementing accessibility into their content.

Why put in the extra effort?

Designing a website to be accessible can be a lot of work. Here, we will overview a few reasons why one should design their website to be accessible.

Number of Persons with Disabilities

According to the Census.gov, Approximately 56.7 million people in the United States (18.7 percent) had a disability in 2010 (Brault). This number is a staggering percentage of people that need some assistance or alternative to viewing or interacting with content. If a website is not accessible to nearly 20% of potential users, it is likely that those users will look elsewhere for more accessible content.

Temporarily Able Bodied

Every single person living now has the possibility of becoming disabled during their lifetime. It is nearly unavoidable not to gain some form of disability in old age. Thus it would be prudent to refer to those who do not have a disability to TABs or Temporarily Able Bodied. It is a reminder that persons with disabilities are still humans and deserve equal treatment and access to the same things as those TABs. This means designing websites with the knowledge that, one day, we will also likely lose mental or physical acuity.

Social Contract

The idea of the social contract dates back to the 16th century where “Hobbes, John Locke, and Jean-Jacques Rousseau are the best-known proponents” (Friend). The social contract ties the lives of individuals together in a society for the betterment of its whole. All people make some sacrifices to allow for a minimum level of comfort and security to be reached by all. Regarding web design, this takes the form of sacrificing extra time to allow others to benefit from your content.

P.O.U.R. Accessibility

There are four key guidelines when determining if content is accessible. Accessible content must be perceivable, operable, understandable, and robust or POUR for short (Dynamit, 2018). These

guidelines can be applied to create a detailed set of rules that, when followed, ensure the content is accessible to a wide audience. Here is a more in depth look at each of the POUR principles:

P - Perceivable

A perceivable website is one that allows all users to process its information. Perceivability usually manifests in providing alternate means to digest information such as subtitles for those with hearing disabilities, and efficiently formatted content for screen readers for those with vision disabilities. In general, make sure your website does not depend on one sense to digest its material.

O - Operable

An operable website ensures that all content can interact with multiple ways. Users should not be limited to one peripheral device to interface with the website content. One example for this in making sure the website is navigable by keyboard instead of a mouse. Additionally, this also encompasses concepts like control over random motion and events (like animations, time limits, and warnings). A user should be able to configure these, so they are as forgiving as necessary.

U - Understandable

An understandable website makes sure that all of its content is easily comprehended. All actions have clear and immediate effects that leave nothing to be guessed. Any processes should be easy to follow and preferably, sequential. Finally, where possible, guidance should be provided.

R - Robust

Finally, a robust website works across common platforms (within reason) and does not limit users who use one platform. Robustness is usually achieved by following design and development standards on the creation platform you choose to use. Commonly, this category is dominated by the idea of responsive design which changes layouts of content depending on the device used.

Outline

This document will cover a range of categories that will help enable web developers and designers to create better, more accessible websites. Following are the categories that will be addressed.

Vision

- Provide text based navigation and content for website
- Use textures or text to differentiate information rather than exclusively color

Hearing

- Caption and/or provide transcripts for media
- Allow user control over audio-visual content speed and volume

Remembering & Learning

- Embed definitions

Thinking & Communicating

- Make sure that content is well structured and clearly written
- Limit options
- Clearly show website navigation

Movement & Motor Disabilities

- Keyboard/Non-mouse navigation
- Repetitive Presses
- Move away from controls that require high levels of precision
- Error Identification

Mental Health

- Minimizing User Anxiety
- Using Neutral Language
- Keeping User Focus

Discussion

Vision

Definition

Vision disability - An impairment that affects the user's ability to see. Vision disability can range in severity from full blindness where all vision is lost, to moderate visual impairment where vision is not correctable to above 20/40 (Maberley, et al., 2016). For this section, we will also consider color blindness and color deficiency visual impairments. Color blindness and color deficiencies are visual disorders where the user is unable to see the full range of colors seen by most individuals or in the case of color deficiency, sees them differently.

Effects on User Experience

Visual disabilities affect the entire user experience for surfing the internet and, to be accessible, websites need to implement specific tools to improve the user experience. In the case of blindness and low visual acuity, the user may not be able to distinguish small objects and icons present on the screen. In this case, other tools such as Braille keyboards, Braille displays, and

screen magnifiers can be used to translate text into a non-visual medium. In the case of color blindness and color deficiency, there are not widely used tools for these visual impairments. In both cases, it is up to the website designer to make the website accessible and compatible with assistive technologies.

Website Accommodations

To be accessible for individuals with total or partial blindness, the best way to make websites accessible is to include text-based alternatives to images, and audio present in the website ("7 Tech Tools…", n.d.) This accommodation includes captions for images and figures, transcripts of any video or audio present on the website, and ensuring that website navigation does not use any components that don't use text.

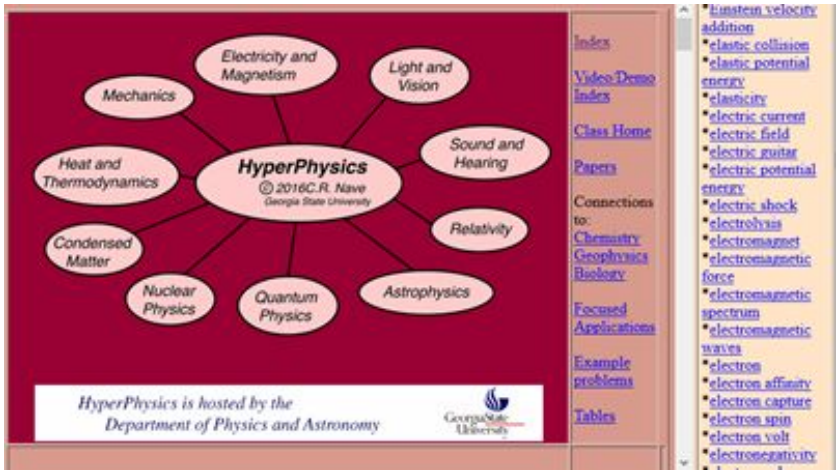


Figure 1: (Nave, 2001)

This image comes from hyperphysics and demonstrates some do's and don'ts of website design for individuals with visual impairments. The index on the right of the screen allows the user to navigate the website through text and without visuals which enables those who use Braille keyboards and displays to access the full contents of the site. However, since the index is in alphabetical order and does not show the connections of the subtopics, there is some information that is not accessible to individuals with visual disabilities. To increase the accessibility of this website for visually impaired users the developer may want to restructure the index to show how concepts are related.

Color Blindness and color deficiency are common visual impairments that require considerations when designing user accessible websites ("How to Meet WCAG 2", 2018). While different individuals with a color deficiency will see some colors the same as someone without this deficiency, not all color deficient or colorblind individuals can see the same colors. This lack of uniformity across the disability means that one should avoid using communicating information exclusively with color when designing a website. This accommodation can be achieved by using labels on colored objects, or by differentiating the information using designs and textures as well as color.

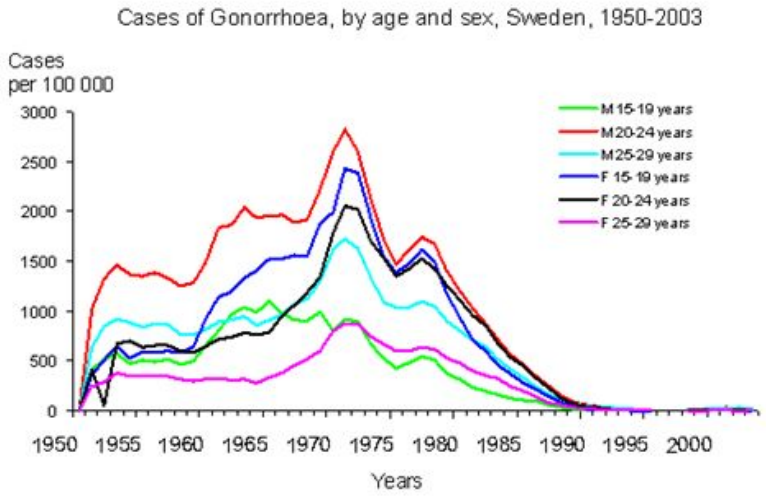


Figure 2: ("Line Graphs", n.d.)

This image is from the European Center for Disease Prevention and Control that illustrates an inaccessible figure when it comes to designing accessible websites for colorblind and color deficient individuals. By only differentiating the different lines on the graph by color, users may not be able to determine which line corresponds to which dataset without further information or assistance. To improve this figure, the authors could use different geometric designs or textures to differentiate their data which would allow color blind users to understand the data.

Summary

Visual disabilities drastically affect an individual's ability to consume online content because online content is often conveyed through visuals and text.

Hearing

Definition

Hearing loss - A disorder when an individual's hearing threshold is above 25 DB in both ears (Deafness and hearing loss, n.d.). There are varying degrees of hearing loss ranging from mild hearing loss to deafness (when an individual cannot hear at all).

Effects on User Experience

Hearing loss has a significant impact on one's ability to interact with others through speech in everyday life. According to the World Health Organization (n.d.), "Exclusion from communication can have a significant impact on everyday life, causing feelings of loneliness, isolation, and frustration, particularly among older people with hearing loss." Therefore it is crucial to design websites and their content, especially on social media platforms, to be accessible to individuals with hearing loss because access to the internet and online communities may help curb social isolation (Parfitt, 2018).

Website Accommodations

Hard of hearing individuals without accommodations have difficulty accessing website content like videos and audio. The best way to make these accessible to the user is through allowing the

user to control the volume and speed of the audio and using subtitles, captions, and transcripts. Many hard of hearing individuals can hear. However, they cannot perceive sounds as quiet as everybody else. By allowing the user of a website to control the volume of audio or a video, the user can raise or lower the volume to one that is understandable to the user. By allowing the user to control the speed of audio or a video, they can slow down the speed to one which lets them process the content. Even if a developer provides speed and audio control of audiovisuals on a website, it is imperative to provide subtitles and transcripts of any content on the site. Many individuals who have hearing loss use transcripts to understand audio and by including transcripts, a developer can make sure their content is available to most readers with hearing loss.

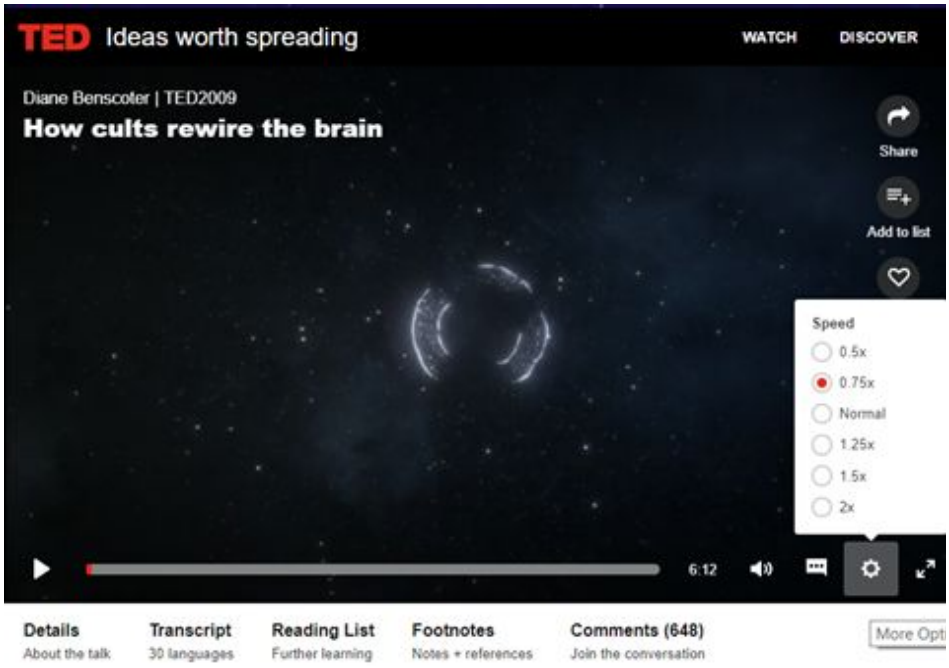


Figure 3: (Benscoter, 2009)

An ideal example of how to design audiovisual content to be accessible to hard of hearing individuals is the TED website. TED is a website that hosts lectures 'known as TED talks' that discuss a wide variety of topics dealing with Technology, Education, and Design. As can be seen, transcripts are easily accessible to the viewer, and the viewer can control the volume and speed of the video. These accommodations ensure most hard of hearing individuals can access the website and have the resources they need to enjoy and understand the TED talk.

Summary

Hearing loss is a common disorder that affects one's ability to communicate auditorily. This disorder mainly affects an individual's ability to hear video and audio content on a website. By providing the user with transcripts and the ability to control the speed and volume of the audio and video content, the developer can ensure their website is accessible to many individuals with hearing loss.

Remembering & Learning

Working Definition

A Learning Disability is a condition giving rise to difficulties in acquiring knowledge and skills to the level expected of those of the same age, especially when not associated with a physical handicap.
Remembering Disability - A condition in which a person cannot remember important information.

Effects on User Experience

Learning disabilities caused by Syndromes like Dyslexia, “A specific learning disability that affects reading and related language-based processing skills” and Dyscalculia, “A specific learning disability that affects a person’s ability to understand numbers and learn math facts” affect web accessibility by limiting the ability of the user to interpret presented information.

Memory disabilities are a common symptom of a disease. Most notably, Alzheimer’s and acquired brain injury (ABI). Memory disabilities will affect a user’s ability to connect information presented on different pages, their ability to navigate websites and their ability to remember website terminology.

Website Accommodations

To address learning disabilities, focus on limiting the number of words used. If the original information is written in a paragraph, condense it into bullet points. Also, present writing clearly. Keep fonts simple and text large and contrasting enough to provide a more comfortable reading.

Figure 4: (www.amazon.com)
Example of a large contrasting text.

When designing for users with memory disabilities maintaining orientation within the website is important. Designers should limit the amount of scrolling by condensing information and formatting the page to use the full width of the screen. Movement between pages should be tracked with arrow links: i.e., Homepage > Topic 1 >Sub-topic 2. Arrow links will give users a quick reference to fill in their memory gaps. Memory disabilities can affect a user's ability to remember words; this can be fixed by embedding definitions into words that appear when the user hovers above the word.

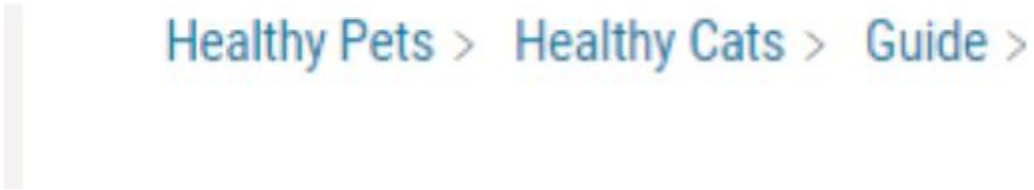


Figure 5: (webmd.com)
Example of arrow links, showing user progress through the website.

Summary

Including arrow links and improving the legibility of text enables users with learning and remembering disabilities to quickly retrieve and digest information which allows them to fully enjoy the website content.

Thinking & Communicating

Definition

Thinking disability– A condition in which a person struggles to interpret information, solve problems or make decisions.

Communicating disability – "Communication disorders include problems related to speech, language, and communication. Speech refers to the production of sounds that allow individuals to express themselves and includes articulation, fluency, voice, and resonance quality. Language refers to the use of a system of symbols, such as spoken words, sign language, written words, or pictures, that allow people to communicate in a rule-governed manner. Communication refers to any verbal or nonverbal behavior that influences the behavior, ideas, or attitudes of another person."(Psychology Today)

Effects on User Experience

Thinking disabilities become a significant hurdle when websites have timeout functions like online shopping sites that limit the time items are held in a users cart. Or websites that have distractions like animations, flashing lights or chat assistants that pop onto the screen. Users with thinking disabilities already struggling to organize and plan will be overwhelmed by moving images or too much information.

Communication disabilities make it difficult for users to comprehend language; written or spoken. Websites presenting information in only one medium may be unusable. This happens when online shopping sites provide product descriptions just in writing. Or when videos are not given subtitles or a transcript.

Website Accommodations

To make websites usable for people with thinking disabilities remove distractions, limit options, and extended time limits. Give users the option to disable pop up assistants, allowing them to focus on what they went to the site for. Limit navigation options by using expandable menus. This breaks down the decision making the process into a smaller step by step decision. To give disabled users enough time, remove timing from the website or if the timing is necessary provide an option to extend the time limit.

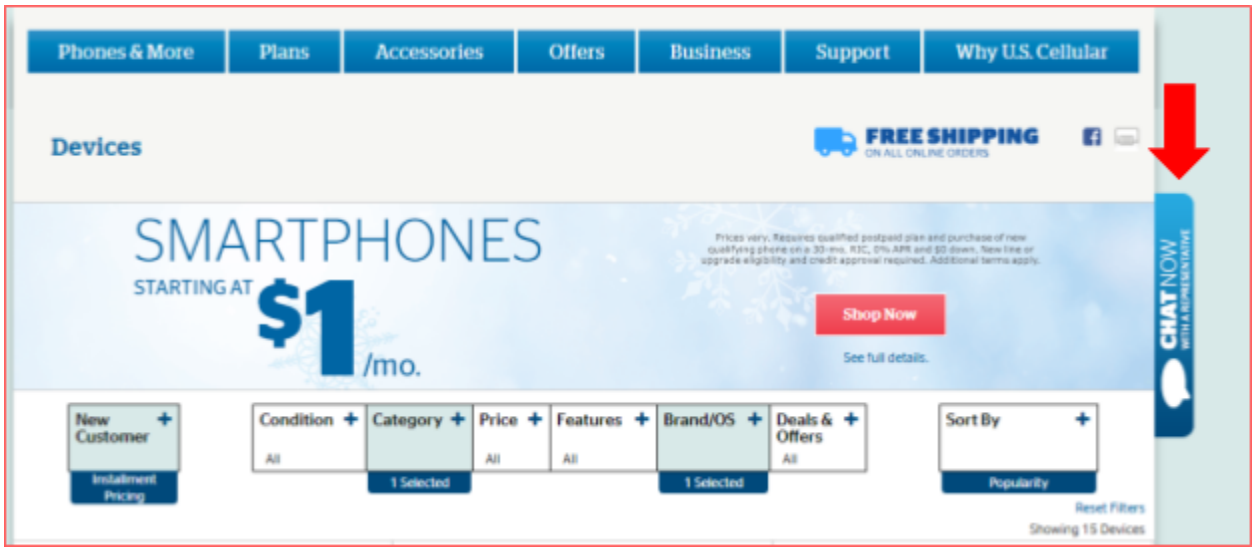


Figure 6: (uscellular.com)
Example of a non-intrusive chat assistant.

Adapt for communication disabilities by accompanying audio with transcripts and formatting writing so as to be easily read by third-party assistant apps. It is not uncommon for users to have problems with both text and audio, that is why it is vital to add symbols. Symbols are the most widely understood form of language so including symbols will adapt the website to the most users. A universal symbol used is the shopping cart, which identifies the checkout page in online shopping.

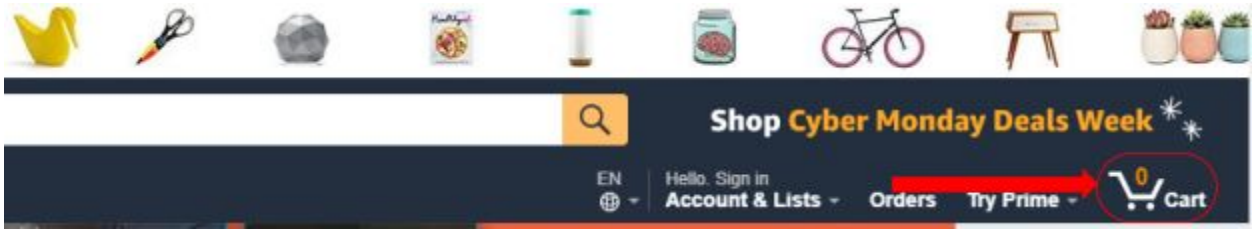


Figure 7: (amazon.com)
Shopping cart symbol on online shopping site.

Summary

Removing time limits and pop-ups allows users to focus on their original intentions for visiting the website. While providing transcripts and audio allow for users of all capabilities to enjoy the website.

Movement & Motor

Definition

Movement and Motor disabilities are those that affect a person at the physical level. With these disabilities, people are less likely to be able to use the fine-motor skills that people use on a day to day basis in order to navigate through the internet. For this section, we will be going more in depth about how you can go about creating your website so that people with these types of disabilities can traverse your website with ease.

Effects on User Experience

Movement and Motor disabilities, while able to be mitigated through correct website design, can really affect just how much a user is able to navigate through your website. Some of these things that can affect people with this type of disability include menus that involve repetitive clicks, small buttons that require a precise amount of motor control, items being incorrectly labeled, and little to no error identification.

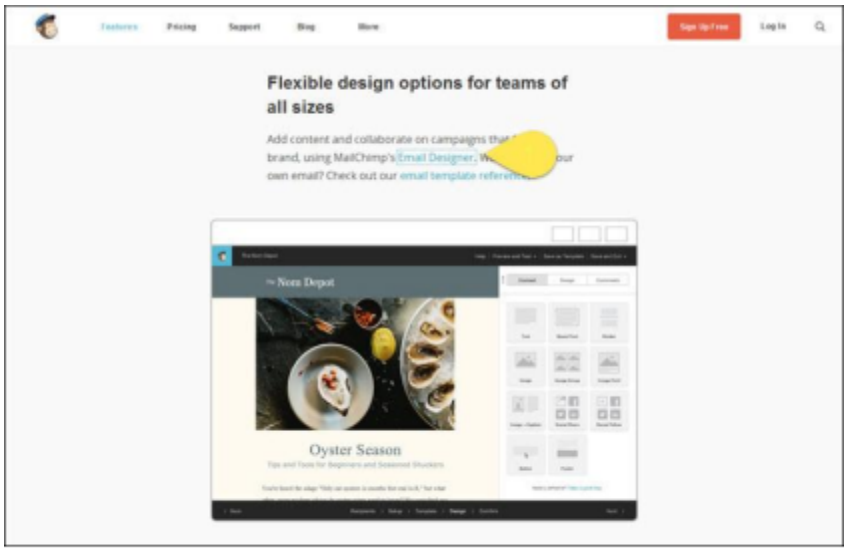
Website Accommodations

In this section, I will be going in depth about how to turn your website into one that will be easier to access to those with a motor disability. Here are some of the things that you should be looking at including with your website.

- Keyboard Navigation
  One of the biggest features you can add to your website to help users with a motor disability is keyboard navigation. Adding keyboard navigation in a website can be a lifesaver to those users that have problems using controls that require a higher level of precision or for those websites that require a lot of scrolling to view information. While there may be a couple of ways to do this effectively, one of the ways to accomplish this

while also keeping your website looking nice, is to use the keyboard focus indicator provided by the browser and redesign it to look more appealing (Figure 8). This can be done using CSS and the outline property that is provided.

Figure 8: (mailchimp.com)



This image shows off what the keyboard focus indicator could look like when implemented correctly.

Eliminating Repetitive Clicks

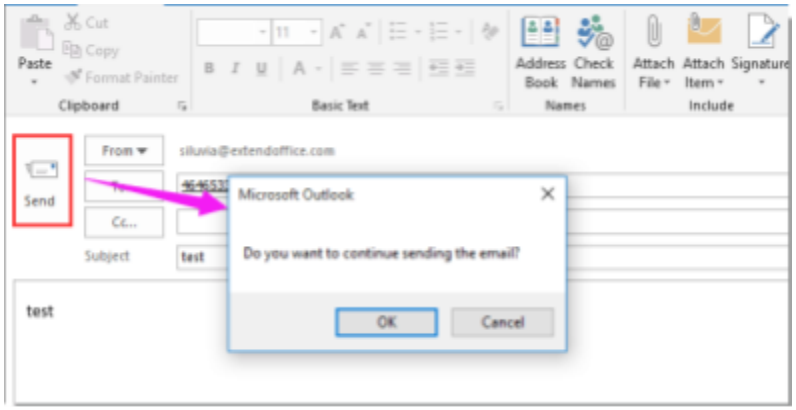
Making your website less repetitive and more efficient is another great way to make your website more appealing to those with motor disabilities. One of the best ways to do this is to really plan out your website and how you want everything to flow. A well planned out website will lead to fewer items needing to be clicked in order to get to the information that you want. In order to plan out your website accordingly, you should be descriptive in your navigation, use only text-style navigation, generally avoid drop-down menus, and by limiting the number of menu items to as few as possible (Crestodina).

- Eliminating Controls that Require a High Level of Precision
  Eliminating controls that require a high level of precision is another item that can be easily addressed. This feature, in particular, has to do with making sure that buttons and links are large enough to be easily clicked without high levels of motor control. The easiest way to go about fixing this is making sure the buttons and text on your website are large enough to be clicked for someone with this disability.

- Including Easy to Understand Error Identification

Error identification can play another big role in creating a friendly website for those with motor disabilities. Since people with motor disabilities may not be able to as accurately click on buttons that appear on your website, it is a great idea to include pop-ups when clicking on buttons that lead to results that can't easily be undone. An example of this would be a pop-up that occurs when you click a button to send an email (Figure 9). This would then ensure that a user doesn't accidentally send an unfinished email due to their lack of motor control.

Figure 9: (Microsoft Outlook)



This image shows an example of a pop-up box that could appear when sending an email.

Summary

In order to make your website more accessible to those who suffer from motor disabilities, you should look towards adding easy to read keyboard navigation, eliminating repetitive clicks, making sure all buttons and links are easy to click, and adding in extra confirmations into your website to reduce the number of errors on the user side of things.

Mental Health

Definition

Mental Health covers a wide range of topics that we could not hope to include in this document. Thus we will be focusing on three disorders that can affect a user's experience with your web content.

To design systems to help those afflicted with mental health conditions it is essential to understand what they are.

Anxiety

Anxiety is generally a fear or apprehension of coming events or situations. While natural in stressful times it is essential to know that normal anxiety does not impede everyday life while an anxiety disorder does just that.

Depression

Depression or Major Depressive Disorder is a mood disorder that affects the brain chemistry of the afflicted. Depression can cause symptoms ranging from feelings of sadness and hopelessness to a lack of energy to do daily activities.

ADHD

ADHD or Attention-deficit/hyperactivity disorder is a condition that negatively affects the focus and patience of an individual. It is also characterized by constant movement or fidgeting. Finally, individuals with ADHD are often impulsive and prone to take hasty action without a lot of thought into consequences.

Effects on User Experience

Mental health can play a huge role in the way a user interacts and perceives a website. While more physical requirements can deter users from using a website in the intended manor, an inability to allow users to move at their own pace, feel comfortable, or focus on your content is simply a non-starter. It is imperative that websites enable users to interact in a way that does not create barriers to entry.

Website Accommodations

This section goes over how to turn your website into one that will target and reduce triggering mental disorders and allowing users with these disorders to easily use your content.

- Minimizing User Anxiety

It is prudent to ensure that users experience as little anxiety on your website as possible to give the best experience possible. When a site “provokes a sense of urgency or scarcity was a commonly cited source of anxiety”(Swallow). One common trend in web design is using a countdown to stimulate a user to take action quickly. Figure 10 shows an example from Amazon that encourages the user to take action before a countdown has expired. Other examples of this are found in the Youtube and Netflix autoplay features.

It is essential to communicate to the user in these scenarios that the countdown is either crucial or non-crucial. In the case of Youtube, they provide a toggle which allows users to turn off the autoplay feature, thus returning a sense of control to the user without removing the element. Allowing the user to determine if countdown timers are displayed would go a long way in reducing anxiety in a website for users who find those features problematic.

Figure 10: (amazon.com)

This figure shows an example of time based deals. It may be best to avoid using this to ensure users will not experience anxiety from website design choices.

https://www.amazon.com/Accessibility-Handbook-Making-Compliant-Websites-ebook/dp/B0092UB21U/ref=sr_1_3?ie=UTF8&qid=1543465271&sr=8-3&keywords=accessibility+book

- Using Neutral Language
  It is essential that users feel that are free to interact with not only the website but also the community as a whole. This freedom may be limited if the community that uses a website turns hostile and begins to spite open discussion. One way to combat this would be to implement some code of conduct for community discussion and moderate content based on that. Figure 11 shows one such website (Stack Overflow) doing precisely that.

Figure 11: (stackoverflow.com)

This image shows the description of the Stack Overflow Community Code of Conduct. A code of conduct may encourage or remind users to respect other users.

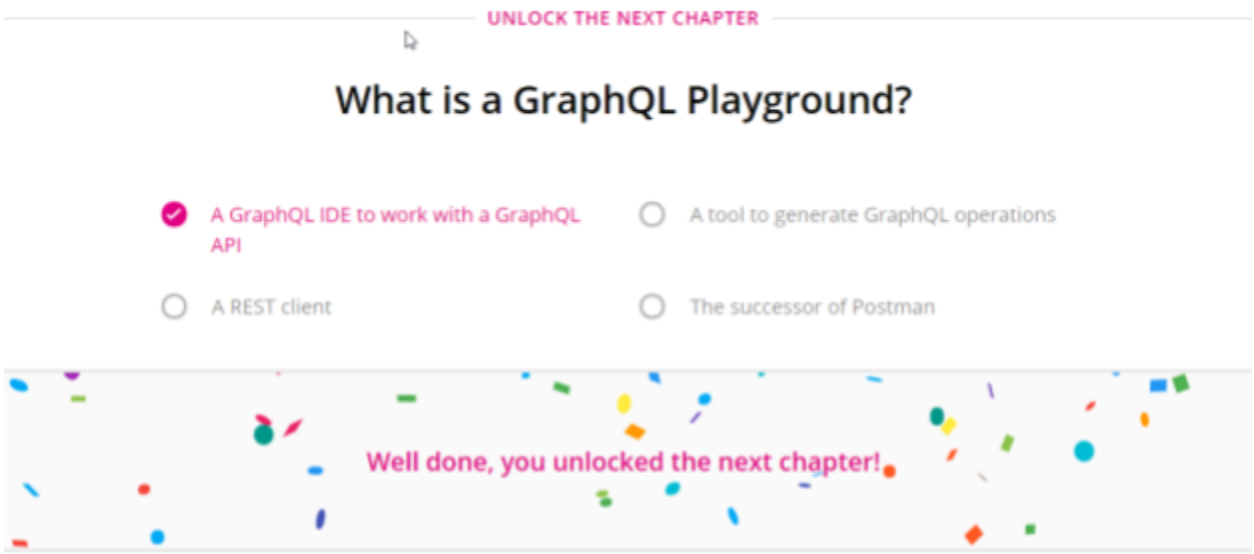
https://stackoverflow.com/conduct

Additionally, controlling the rhetorical content on your website is crucial. If you are not careful in how you write it may lead to material that is at best, insensitive and at worst, offensive or downright mean. One way to avoid this and keep your language tone more neutral or positive would be to run all content through a sentiment analysis tool and alter your rhetoric based on the results.

- Keeping User Focus

Finally, all users have a limited window of focus they are willing to give. Concentration varies from person to person and can be severely limited in persons with ADHD. To keep the attention of persons who are unable to provide their focus for long periods, you may consider reducing distractions on pages that require reading, implementing "active reading strategies like underlining and note-taking"(Low, 2017), and previewing content before moving on. Figure 12 shows a website that encourages users to answer a question on the content that they just read to ensure they sufficiently understood it before moving on.

Figure 12: (howtographqI.com)



This website asks users to answer a question before moving on to the next chapter. This helps ensure users ensure they have understood the content adequately.

https://www.howtographql.com/

Summary

Keeping your website accessible to those with mental disorders can be a challenging and abstract concept to some. However, by limiting anxiety producing scenarios, keeping the neutral or positive language, and keeping the user focused, content can be made more accessible by persons who suffer from mental disorders. Additionally, these measures will often be appreciated by all users because these symptoms appear in all persons to an extent and are generally undesirable.

Conclusion

What we accomplished

If you have reached this point in the article, congratulations, your website should have achieved a minimum level of accessibility for a general user base. Despite this sounding a bit disheartening, it is essential to know that many websites do not do well in this area and you are one step ahead here, users who need these features will appreciate your site having them immensely.

Further Consideration

This document should not be the end of the checklist in determining the accessibility of your website. However, it creates a base to work from that can only get better.

If you are interested in further improving the accessibility of your website then here are a couple of tips to follow...

- Take surveys of the user base
- Be open to feedback of users
- Take a look at WebAIM quick reference
- Try using your site with assistive tech

Glossary

Terms and Definitions

Web Accessibility

Web Accessibility is a category of accessibility that focuses on how a person with a disability or impairment is able to interact with online content, regardless of the severity of impairment.

Impairment:

An impairment is any loss or abnormality of psychological, physiological, or anatomical structure or function.

Disability:

A disability is any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being.

Handicap:

A handicap is a disadvantage for a given individual, resulting from an impairment or a disability, that limits or prevents the fulfillment of a role that is normal (depending on age, sex, and social and cultural factors) for that individual.

– World Health Organization (WHO), International Classification of Impairments, Disabilities, and Handicaps, 1980

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