

# SCREEN READERS AND SEARCH ENGINE ROBOTS: Do Accessible Web Sites Yield Higher Search Engine Visibility?

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## ABSTRACT

This paper is the result of research gathered from both search engine experts and search engine publications/guidelines. Because search engine algorithms are kept highly secret this is not a 100% accurate paper; instead it is common best practices. If time had presented itself, a test may have been conducted using two differently coded pages, one based on the guidelines listed below (WCAG) and the other not based on the guidelines. Then analyze the pages using a search engine and comparing the results and rankings of the two over time so see which pages rank higher. However, due to time constraints, this type of test was not possible and furthermore, this type of test would not be conclusive due to some of the attributes search engines use to rank pages. For example, the URL, web site popularity and time which the web pages are indexed are important but uncontrollable factors of search engine ranking.

## KEY WORDS

CSS, Search engines, Screen Readers, Accessibility

## 1. INTRODUCTION

As HCI practitioners, one understands that accessibility is an important aspect of design, however, its sometimes difficult to convey the importance of accessibility to business teams. To present an effective argument to building an accessible web site it might be beneficial to fully understand some of the secondary benefits that result from an accessible site. More specifically, do accessible web sites yield better search engine results? Are there commonalities between screen readers and search engines? How do they handle and read information? Could this provide tangible ROI?

## SCREEN READERS

Screen readers work by reading the text/content on a web page, allowing the visually impaired user to hear what most people see. It has been observed that with practice, a visually impaired user can navigate a web page just as

efficiently and effectively as a sighted person. According to a study entitled [1] "Observing Users Who Work With Screen Readers", "most users of screen readers listen at an incredibly fast rate. Some of our participants indicated that they were slowing the speech for us." It should also be noted that most visually disabled users highly customize their screen readers for maximum efficiency and ease of use. Some of these customizations include setting up quick keys and speeding up the voice in which content is being read.

In the study entitled "Observing Users Who Work With Screen Readers", it was observed that users of screen readers did not use a mouse when navigating a web page. "Instead they used a keyboard, tabbing from link to link within a page." Therefore, it is important to combine like content into navigational elements in a way that aligns with the user's mental model. This grouping of content can improve the efficiency of both visually impaired and non-visually impaired users.

Navigating via a keyboard rather than a mouse also provides the users with shortcut keys that can greatly improve the efficiency of navigation. However, to make use of these shortcut keys, a site must be coded correctly using semantic markup. Semantic markup is markup that is both meaningful to humans and computers. This includes header tags such as <h1>, <h2> and title <title> tags. This markup allows the visually impaired user to cycle through header, title and other markup via keyboard keys to quickly get a feel for what information exists on a page.

The use of shortcut keys to cycle through information can also reduce the cognitive load placed upon the user. It is important to remember that a screen reader is a separate application that lies on top of the Internet browser. Thus, the visually impaired have to interact with 3 layers of information: the web page, the browser and the screen reader. This puts a greater cognitive load upon the visually impaired user.

When using screen readers visually impaired users do not typically listen to every word on a page. Instead, they listen to the first couple words in order to determine the relevancy of the content, they then move to another hyper

link or section and repeat this process. Because of this, it is very important to structure and write the content on the page appropriately. Using simple relevant keywords and placing the most important content at the top of a page allows for the most efficient browsing.

Because screen readers are only interested with the content of a web site, its important that the presentation and content are separated. Using CSS (Cascading style sheets) can accomplish this goal. Separating the content from the presentation allows the screen reader to more efficiently scan and read a page; it also reduces errors resulting from complex formatting code being placed within the content. These errors appear in the form of screen readers literally reading the formatting code as if it were content.

## **SEARCH ENGINE ROBOTS**

Search engines operate by scanning and indexing the content found on a web page. They read from left to right, top to bottom, scanning the visual content of a page in the same way as screen readers. During this process, the search engines are separating the HTML and presentation data from the content while graphical and multimedia content are ignored.

Having the presentation data in a separate file using CSS allows the search engines to more efficiently scan the content of a document and it also cuts down on errors caused by complex code within the html content. An example of this is complex table elements, which can cause screen readers to back out of, or ignore a page completely. Furthermore, the search engine might rank the content within these table elements as not important.

Search engines are interested in unique keywords that describe the content on a page. Because of this, content is truly king when writing for search engine optimization. It is important that keywords are researched and then content is written around these keywords. These keywords can also be helpful for visually impaired users to efficiently determine the relevancy of a page.

Most search engines rank the importance of the content based on where it exists within the web page, giving higher priority to content at the top of the page. Because of this, it is important that keyword terms that describe the content are placed at the head of the document. This placement of keyword terms also benefits the visually impaired by allowing them to quickly determine the relevancy of a page without having to scan through the entire document.

Testing done by [2] Susan Harrison discovered that a "Screen reader user does not listen to every word on a page, but just enough to determine where to go next." And according [3] to Heather Loyd-Martin, President and CEO of SuccessWorks "Emphasize your main keywords

in the first paragraph and in your main and sub headlines. This is the first thing the search engines see."

One of the major factors overlooked in search engine ranking is link popularity. Thus, a search engine such as Google will rank a web site based on the amount of links going to that particular web site. By doing this the search engine is determining the relevancy of a web site based upon its popularity. Some search engines give even more weight to educational and government sites, according to [4] Shari Thurow an expert on search engine ranking.

Search engines can find web pages in one of two ways. The first is by submitting the web page directly to the search engines thus adding the web page to the cue of sites to scan. However, this is not necessary because search engines crawl popular sites such as Yahoo.com following all external links. When a search engine crawls a web page it indexes all of the content within that web page and inputting it into the search engine database. Thus, when a search is performed on a search engine such as Google it is not actually searching the web but indexed content within the Google database.

## **COMPARISON TABLE**

The table below lists key elements within the "W3C Checklist of Checkpoints for Web Content Accessibility Guidelines 1.0". I have not listed all W3C guidelines because this is only a comparative study between screen readers and search engines. Thus, if a W3C guideline had no effect on search engine results I did not list it. I did however list accessibility guidelines that is not in the W3C Checklist but do affect both accessibility and search engine ranking.

The various elements within the table below were rated based on the W3C Checklist of Checkpoints, usability principals and on search engine publication made available through Google, and various SEO experts. The ratings are from -2 (having a negative effect) to +3 (having a positive effect). When applicable, each element is listed along with its priority within the W3C Checklist of Checkpoints. (Example, 2 (3.3) reads as priority 2 section 3.3

## **ABOUT THE W3C ACCESSIBILITY GUIDELINES**

The checklist developed by the W3C provides a way for developers to measure the accessibility of a web page. However, this checklist is geared mainly towards the accessibility of coding (HTML, CSS) practices. Therefore, this checklist alone does not make a web site accessible. The web site must also be usable, which this document does not entirely measure.

The checklist is broken into 3 priorities as described below by the W3C

**Priority 1:** A Web content developer **must** satisfy this checkpoint. Otherwise, one or more groups will find it impossible to access information in the document. Satisfying this checkpoint is a basic requirement for some groups to be able to use Web documents.

**Priority 2:** A Web content developer **should** satisfy this checkpoint. Otherwise, one or more groups will find it difficult to access information in the document. Satisfying

this checkpoint will remove significant barriers to accessing Web documents.

**Priority 3:** A Web content developer **may** address this checkpoint. Otherwise, one or more groups will find it somewhat difficult to access information in the document. Satisfying this checkpoint will improve access to Web documents.

Issue	Comments		Detriment or Benefit –2 3	Priority 1,2,3 and section #
CSS	Screen Reader	Using style sheets allow the designer to separate the content from the presentation. Doing this creates a document that is more efficient and easier to read by screen readers. In the past, presentation data, such as font and spacer images, may cause problems for screen readers. This includes the screen reader literally reading aloud the presentation data within the html.	4	2(3.3)
	Search Engine	CSS allows a search engine to more efficiently spider and index a web site. This is because the presentation data is included in a file separate from the content/information that the search engine really cares about. With the absence of CSS, search engines have to filter what is presentation and what is content.	3	
Title	Screen Reader	The title tag provides the user with a general idea as to what content is on the page. With, a user can check what the title of a page they are on by pressing (insert T)	3	NA
	Search Engine	The title tag is the first piece of information that a search engine reads when visiting a web site, which makes the description in the title very important. Unique and descriptive keywords should be used on each page not just the company title.	4	
Headers	Screen Reader	Header tags provide the user with an overview of what content is on the page or within a paragraph associated with a header (H1, H2, H3, etc). Headers can also help a user orient themselves to where they are within a page or web site. With JAWS a user can move from heading to heading by pressing the H key inside a document.	4	2 (3.5)
	Search Engine	H1 tags are ranked as important content within a page and should contain a descriptive keyword that represents the content on the page. If more than one H1 tag is used per page, the page could be considered as Spam.	4	
Content Placement	Screen Reader	Having important content at the top of a page allows a person to efficiently gather and process information within a page by determining how valuable the content is without having to listen to every word on a page. Testing done by Susan Harrison discovered that a [1] “Screen reader user does not listen to every word on a page, but just enough to determine where to go next.”	3	3 (13.8)
	Search Engine	Most search engines place more weight on the content that is at the top of a page. Because of this, important content containing keywords that represent the information on the page should be placed at the top of the page.	3	

Navigation and Content Grouping	Screen Reader	Grouping similar content groups into navigational elements makes it easier and more efficient for visually impaired users to browse a web site. For example, content regarding help topics might be grouped into one central area, while content regarding contact information might be grouped into another area. This benefit both visually impaired and non-visually impaired users.	4	2(12.3) 3(9.4, 13.6)
	Search Engine	According to Shirley E. Kaiser in her article on Designing for Search Engines and Stars, [5] "When developing your site design, consider the user-friendliness of the navigation, which if high will also make it easy for spiders to crawl through your site."	1	
Page Formatting	Screen Reader	Having the most important content is at the top of the page allows users using a screen reader to more efficiently scan a page for relevant content.	3	2 (3.3)
	Search Engine	Because search engines give more weight to content placed at the head of the document one could use CSS to structure the hierarchy and content grouping so that more important content is presented first. For example, a page might be structured so that within the code of the document the main content area appears before the secondary navigation of a document. It is also important the content is written using keywords that are commonly searched.	2	
Strong	Screen Reader	Some screen readers place more emphasis on text rendered in <strong></strong> tags. This does not happen with the use of bold <b> tags.	1	NA
	Search Engine	Strong tags are used to let users know that a certain word or information is important. Because of this, search engines will usually deem this information as being important.	1	
Meta Tags	Screen Reader	Meta Tags do not have any direct effect on screen readers or accessibility.	0	(2)13.2
	Search Engine	Meta-Tags should contain unique and descriptive keywords that represent what information is on each page. However, Meta-Tags are often not given much weight within the search engine ranking. Meta-Tags are by no way the magic bullet to search engine ranking.	1	
ALT Tags	Screen Reader	ALT tags are read by the screen reader to allow visually impaired users to understand graphical information on a page. Alt tags should be descriptive, meaningful and useful. According to a conducted by the Communication Technologies Branch of the United States National Cancer Institute on individuals with blind and low vision problems. "Users complained bitterly about listening to the repetitive and meaningless words. 'decorative bullet image.' They said it kept them from getting the really meaningful words." Decorative items should be coded as alt=""	4	1 (1.1)
	Search Engine	Alt tags should contain descriptive keywords that represent the photo and content on the page. Using an excessive list of keywords or keywords that do not match the content on a page can be considered spam. Because of keyword abuse Alt tags have a very low effect on search engines	1	
Frames	Screen Reader	A page designed in frames will be split into two or more separately behaving sections, which can be disorienting for visually impaired users, especially if the frames are not coded correctly and are missing the appropriate title tags.	-2	1 (12.1) 2 (12.2)

	Search Engine	If a search engine robot gets dumped into an internal frame without the main navigation, there is no way for the search engine to follow the internal links and index the site. Furthermore, using frames within a web site may cause a search engine to return the content of an interior framed page upon a user search. This can cause problems when the interior frame does not have a sufficient method to navigate the web site. It has been reported that some search engines ignore frames completely.	-2	
Multi-media	Screen Reader	It is important that multiple formats of a given multimedia file are available for disabled users. A text base transcript accessible to screen readers should be provided.	4	1 (1.3)
	Search Engine	Because search engines cannot filter the data within an audio or video clip, it is important that a text description or transcript be present on the web page.	4	
Number of Links	Screen Reader	Before a screen reader begins to sound a page, it tells the user how many links exist on the page. Too many links on a web site can be overwhelming for an individual using a screen reader. It is recommended to keep the number of links below one-hundred (100). However, it is also important that a user can easily and efficiently navigate to a page of interest.	3	NA
	Search Engine	It is important that every page within a web site is reachable from the previous page. This allows the search engine to efficiently scan and index the web site.	3	
Descriptive Links	Screen Reader	Descriptive links provide the user with insight as to where the link is going to take them. The text within the link should be both meaningful and descriptive. For example, "Click Here" provides no meaningful information to a user when read by a screen reader. During observations conducted and a review in the paper [1] Observing Users Who Work With Screen Readers, it was also learned that users get frustrated when many links start with the same word.	4	2 (13.1)
	Search Engine	Most search engines give more weight to words that are within anchor tags. Because of this it is important to use keywords that represent the information targeted by the anchor tag. For example, "Learn More" might better be worded as "Learn more about Grant Park" or whatever the subject may be.	4	
Branded Product Names	Screen Reader	It is important not to create strange or branded product names for normal products or services. This includes putting two words together to form a new word causing Screen readers to not understand the word when it is read. Furthermore, a new non-descriptive brand name for a product can be confusing to able users. For example, "MortgageExpress" instead of "Access your mortgage account".	3	NA
	Search Engine	Because users do not typically search for branded or merged product names it is important to keep wording simple and straightforward.	3	
List Items and short sentences	Screen Reader	Ordered lists suggest a progression or sequence and contain a hierarchical content structure within a group of words or phrases. Use of list items and short sentences can make browsing for the visually impaired more efficient.	3	1 (14.1) 2 (3.6)
	Search Engine	This has little to no effect on search engines	0	

JavaScript & DHTML	Screen Reader	JavaScript/DHTML can cause problems with both screen readers and users who might have JavaScript disabled. Furthermore, some screen readers do not understand JavaScript or DHTML and if written poorly some screen readers will literally read the JavaScript aloud. It is important that the JavaScript/DHTML does not play a critical role in how the web site operates. The web site should function properly with the JavaScript/DHTML disabled.	-2	1 (6.3)
	Search Engine	Complex JavaScript can cause search engines to abandon a page and / or make it difficult to read a page.	-1	
External JavaScript & DHTML	Screen Reader	Having external JavaScript and CSS files allows a screen reader to more easily and efficiently scan a document and reduce errors.	1	NA
	Search Engine	Containing JavaScript to an external file allows search engines to more efficiently scan an HTML document. It reduces the amount of code the search engine has to separate from the content.	1	
Auto Redirects	Screen Reader	Auto redirects can be very disorienting to users of screen readers because they are automatically bounced to a new page after a specified amount of time.	-2	2 (7.5)
	Search Engine	If done haphazardly, moving HTML pages within your web site can cause search engines to find broken links, which can dramatically harm your search engine rankings. Furthermore, some JavaScript redirects are not accepted by search engines and can be labeled as Spam. For example, one could create a page on financial management and then have it redirected to a page that sells Viagra. The correct way to do a redirect is to edit the htaccess [is this right?] file within the web server.	-2	
Pop-Up Windows	Screen Reader	Pop-Up windows can be very confusing for individuals using a screen reader. In testing done on Assessable Web Content by Jennifer Mankoff, Holly Fait and Tu Tran it was found that [6] "Participant did not understand that he had encountered a problem due to a pop-up window." This can be very disorienting to disabled users.	-2	2 (10.1)
	Search Engine	In most cases, search engines will ignore pop-up windows.	-2	
Hiding Text	Screen Reader	Hidden text fields are often not visible to screen readers. For example, the code <div style="display:none;" would be ignored. This was discovered during a test entitled Screenreader visibility. This test discovered that the three most used screen readers do not discover and do not read material hidden with display:none. [7]	-2	NA
	Search Engine	Using hidden content and content that is in fonts that are the same color as the background color of a web site can be considered Spam by search engines.	-1	
Tables	Screen Reader	Tables should only be used for tabular data such as forms. Using tables to layout information can be awkward for screen readers because they read the information column by column from left to right: a table within a cell is completely read before continuing on to the next cell within the parent table. TH and TD should be used for table data and header.	-1	2 (5.3, 5.4)
	Search Engine	Tables become a problem when they are nested within each other because important content ends up being within the inner most table. When this happens, search engines have the possibility to rank the content as not important (due to its position) or if the tables are too complex the screen reader could back out completely.	-1	

Sitemaps	Screen Reader	Sitemaps give visually impaired users a central location in which to explore the contents of a web site. For efficient scanning it is important that the different sections within the sitemap are grouped using the appropriate header tags. It is also important that the sitemap remains up to date.	3	2 (13.3)
	Search Engine	Sitemaps give search engines an efficient way to scan and index an entire site and also allows for a page that is rich in keywords. From an SEO perspective, it is important that every web site contain a site map.	4	
Splash Pages	Screen Reader	Because splash pages usually exist for sighted users, they are not beneficial and can be inefficient for people using screen readers.	-1	NA
	Search Engine	Splash pages are not effective for search engines because they usually contain a limited amount of information. Furthermore, the use of a timed JavaScript redirect can also cause problems.	-2	

### 3. CONCLUSION

In conclusion, it is a combination of elements that determine the search engine rankings of a web page; there is no silver bullet. Writing content that consists of short sentences and keyword phrases placed at the top of the web page allows both search engines and visually impaired users to determine the validity and importance of the content. Having valid markup/code does not guarantee top search engine rankings, nor does it guarantee accessibility. But in both cases it does help.

From the published documentation on search engines and research I completed, I have concluded that creating an accessible site has a better chance of yielding higher search engine priority, which can result in a tangible ROI. Furthermore ROI is very easy to measure from an SEO perspective; it can be done by measuring web logs or other web traffic data. According to Jupiter “35 percent of organizations said SEO produces higher ROI than search ads and Consumers are 5 times more likely of purchasing a product after finding it from a web site through a search engine than through a banner ad.

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