Accessibility Compliance and Assessments for Gateway Websites in Life Sciences: Toward Inclusive Design

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Abstract

One main purpose of information architecture and site navigation is to enhance the effectiveness of user interfaces (UIs) by supporting and enabling task completion, accessibility, and sustainability. This is of particular importance for science gateways given the complexity of information on portal sites.

We examined the accessibility of 50 randomly selected gateway websites in the Life Sciences category in the Science Gateways Community Institute (SGCI) catalog, using both manual and automated methodologies. None of these sites produced an accessible website as per W3C, WCAG 2.1, and Section 508 standards. The most common accessibility success in these websites was URL structure, which enables web browsers and search engines to access content.

Keywords: accessibility, accessible websites, W3C (World Wide Web Consortium), WCAG (Web Content Accessibility Guidelines), user experience (UX), semantic markup, semantic HTML, ARIA, disabilities, information architecture (IA), gateway websites, life sciences, Section 508, inclusive design, semiotics web analytics

What is Accessibility?

According to the World Wide Web Consortium (W3C) **web accessibility** means that websites, tools, and technologies are designed and developed so that people with disabilities can use them [1].

Website accessibility includes, but is not limited to, the communication style of the text as well as the technical development of the website [2]. Web accessibility depends on several components working together, including web technologies, web browsers and other "user agents", authoring tools, and websites [3].

Web and site search engines are included in web technologies since search engines are the main way that users locate and discover desired content on the web.

WCAG 2.1 provides four current principles of accessibility [4] . The accessibility details include but are not limited to:

- **Perceptive.** Information and UI components must be presentable to users in ways they can perceive. The perceivable principle ensures that content is discernible by all users, including those who do not have command of one or more of their senses due to impairments.
- **Operable**. Features should be fully employable by everyone, regardless of the limitations of users. For example, operable features allow for alternative control input, such as a keyboard.
- **Understandable**. This principle relates to the cognitive abilities of users to comprehend the meaning of presented information. Formatting of elements should ensure the order (of elements) should be predictable and consistent. Content should also provide contextual help to guide users through actions.
- **Robust.** Robustness includes the sturdiness of content for both human users and the technologies that human users commonly utilize to access desirable content. This principle describes the flexibility of content in relation to its interpretation by an array of current and future user agents such as web browsers, search engines, and assistive technologies.

Information Architecture (IA) encompasses sustainable organization, search and navigation systems within a digital environment that make information findable and understandable. This organizing and labeling of content helps people complete tasks effectively.

Developed according to robust interoperability and accessibility standards, IA becomes a kind of assistive sense-making, for anyone, using any information portal, in any context.

Importance of Accessibility

Federally funded websites, including many if not most science gateways, must be compliant with Section 508 of the ADA. The U.S. Web Design Standards offers best practices for building an accessible website (https://18f.gsa.gov/2015/09/28/web-design-standards/).

Information architect and author Abby Covert explored the accessibility in her Information Architecture Heuristics [5], providing a framework for the evaluation of accessibility among other related principles, which we've simplified below:

- Can it be used via all user channels and devices, including assistive devices?
- Is it resilient and consistent when being used via nonstandard channels?
- Does it meet the levels of accessibility as required by Section 508 of the Americans with Disabilities Act (ADA)?

Common accessibility issues include but are not limited to:

- Is contrast sufficient?
- Is motion/flashing necessary or eliminated/reduced?
- Does the design follow common page layouts?
- Can a screen reader make sense of the content?
- Can a user navigate the page without a mouse?
- Does the information make sense in the order that it is shown?

The GSA's (U.S. General Services Administration) design agency 18f recommends using HTML5 and Accessible Rich Internet Applications (ARIA). This specification provides an ontology of roles, states, and properties that define accessible user interface elements and can be used to improve the accessibility and interoperability of web content and applications. These semantics are designed to allow an author to properly convey user interface behaviors and structural information to assistive technologies in document-level markup [6]. Information about ARIA is available at https://w3c.github.io/aria/.

According to a 2004 and 2006 AARP-sponsored study, much of what the authors found in the literature about designing websites for older adults is also good design for everyone [7]. This fact was reconfirmed more recently by author and researcher Jeff Johnson, who stated that user interfaces designed for older adults are often better for a lot of other people [8].

In other words, accessible and age-friendly design has wider benefits than allowing people with disabilities to use websites. UI researchers call this the **curb-cut effect**, which refers to the fact that designs created to benefit people with disabilities often end up benefiting a much larger user group [9].

Methodologies and Results

We examined the accessibility of 50 randomly selected gateway websites in the Life Sciences category in the SGCI catalog. None of these gateway sites were found to have produced accessible websites as per W3C, WCAG 2.1, and Section 508 standards.

The most common accessibility success in these websites was URL structure (67%), which enables web browsers and search engines to access content.

Quantitative data and qualitative data are necessary for architecting a positive user experience (UX) and inclusive design for gateway websites. Accessibility methodologies should include a combination of automated and manual methodologies:

- Automated assessment tools
- Expert reviews by accessibility professionals
- Review of technical implementations such as semantic markup and ARIA
- Iterative user/usability testing UIs with test participants who have various types of disabilities (visual, auditory, motor, cognitive, speech, neurological)

Data from automated assessment tools for accessibility can be misleading. A website can pass W3C, WCAG 2.1, and Section 508 standards and still have accessibility issues. That is the reason why qualitative data is critical for evaluating the accessibility of gateway websites. Nevertheless, automated assessment tools for accessibility can serve a purpose. These tools can help information architects identify and troubleshoot accessibility issues.

Information architects in both academia and industry are working together to develop an online learning and collaboration gateway. We are offering guidance and resources for portal designers to improve the IA and accessibility of their gateway sites.

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