Beyond Compliance: Rethinking Web Accessibility Through a Multi-Level Perspective

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Abby Dhakal

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Advisor

Kathryn A. Neeley, Associate Professor of STS, Department of Engineering and Society

Introduction - Examining the Need for Web Accessibility on the Internet

A study done by Utah State University's WebAIM analyzed the top one million websites and found that "96.3% of home pages had detected WCAG 2 failures" (*WCAG Conformance*, 2023). This means that over 96% of websites discriminate against those with disabilities since they fail to meet the Web Content Accessibility Guidelines (WCAG). These internationally recognized standards, set by the World Wide Web Consortium (W3C), serve as a benchmark for creating digital environments that are accessible to people of all abilities. Ensuring that a website meets the current web accessibility guidelines should not have low priority on a web developer's mind, considering that 96.1% of all the compliance errors detected in the study fall into one of six categories. Figure 1 highlights that out of all the websites analyzed, most of the issues were easily fixable. For instance, ensuring that text sufficiently contrasts its background would make roughly 84% of websites meet the accessibility criteria. This shows how many people, especially web designers and developers, lack an understanding of how simple it is to make their work WCAG-compliant.



Figure 1: Home Pages with Most WCAG 2 Conformance Issues (WebAIM, 2023, WCAG Conformance)

The internet hosts billions of websites, serving as a global platform that caters to users with diverse abilities and needs. To ensure that all users, including those with disabilities, can access digital content on these sites, it is essential to make web accessibility a top priority. As defined by the W3C, "Web accessibility encompasses all disabilities that affect access to the Web, including auditory, cognitive, neurological, physical, speech, and visual" (W3C, 2022, para. 7). While some people may have visual impairments and require a screen reader to convert text into speech or high-contrast color coding, others may have auditory impairments that make them rely on visual elements, captions, and transcripts. Considering the diverse spectrum of user capabilities, web designers and developers should be mindful of accessibility considerations when they build websites that everyone can navigate and trace.

While many individuals tend to attribute the responsibility for web accessibility solely to designers and developers, it is crucial to recognize that web accessibility is part of a broader, multi-faceted system with shortcomings. One evident flaw within this system is the lack of awareness in society regarding accessibility issues. A study on webmaster perceptions claims that "The people who decide whether a site will be built for accessibility or not are the web developers and the clients. It is likely that if neither of these groups of people are aware of or passionate about web accessibility, then a web site will be built to be inaccessible" (Lazar et al., 2004, p. 272). When the stakeholders are unaware of accessibility concerns, the consequences reverberate globally. More than 1.3 billion people who have a disability (World Health Organization, 2023), or the five billion people who use the internet (World Bank, 2022), will not be able to effectively gather information, communicate, and connect with others. This lack of awareness not only sustains a cycle of exclusion but also impedes the internet's ability to foster a more inclusive and equitable digital environment.

In this paper, I argue that the lack of awareness surrounding web accessibility is not an isolated issue but rather a systemic problem affecting billions worldwide. This paper reviews sources that identify a multi-level perspective framework that establishes the importance of web accessibility and how it is a complex system that needs fixing. After identifying the systemic problems, the paper analyzes potential changes to web accessibility.

Section I - Defining Web Accessibility as a Broken System

In May 1999, W3C created the WCAG to make web content accessible to those with disabilities. The WCAG serves as the "de facto standard for the Americans With Disabilities Act, and Section 508 of the Rehabilitation Act" (Gibson, 2022, para. 2). These two laws form the basis of protection towards individuals with disabilities in the United States since they prohibit discrimination based on one's abilities. They also mandate that federal agencies make their digital content and resources accessible to people with disabilities by ensuring that everyone can perceive, understand, navigate, and interact with the web content on a screen–even if that is through assistive technology like screen readers. The acts provide the legal framework to challenge and rectify discrimination based on disability, and the WCAG provides specific technical and design guidelines to ensure that digital content complies with accessibility standards. Together, these resources formulate the legal foundation of web accessibility.

Despite the clear and achievable standards to make websites navigable, the reality of the digital world paints a stark picture of the systemic failures of web accessibility. Former Senior Trial Attorney Ken Nakata, from the U.S. Justice Department's Disability Rights Section, asserts that "Our current web accessibility [model] is broken" (Nakata, 2021). His extensive experience conducting accessibility audits uncovered a recurring issue: development teams implement

suggested improvements, only to face QA test failures in the subsequent months. As illustrated in Figure 2, while QA feedback is promptly addressed by the development team, a substantial portion of inaccessible content requires attention from the user experience design team. Unfortunately, this critical feedback loop is often incomplete, with audit insights failing to reach the design team. This breakdown in communication traps the development and QA teams in a cycle where the root compliance issue remains unattended. A more sustainable high-level model for web applications is proposed to address this gap, as depicted in Figure 3. This model emphasizes the need for consistent feedback across all aspects of design and development to ensure accessible design choices and fixes are integrated effectively.



Figure 2: Current Design and Development Flow Model (Nakata, 2021, Accessibility is Mostly a

Design Problem)



Figure 3: Improved Design and Development Flow Model (Nakata, 2021, A Better Approach)

Acknowledging the shortcomings in the current web accessibility model, particularly the breakdown in communication between design, development, and QA teams, prompts the exploration of the broader implications of excluding users from the internet. Rahul Tongia and Earnest J. Wilson III, two professors at Carnegie Mellon University and the University of Southern California, research infrastructure and technology for sustainable development. They explore in a study how network laws impact the digital divide, revealing that systematic exclusion of people with disabilities from technology leads to a roughly exponential growth in the disparity of exclusion (Tongia & Wilson, 2009, p. 1). Network laws, which describe patterns and behaviors within social, communication, or computer networks, often uncover positive correlations between network characteristics and values. Tongia and Wilson's study introduces a critical perspective that challenges common notions about network laws by highlighting the consequences of exclusion and the exponential increase in associated costs. To explore the need for a more inclusive approach in digital environments, we can study the dynamics of actors and power structures in this intricate network.

Section II - Using Multi-Level Perspective to Understand Actors and Power Dynamics in Complex Systems

The multi-level perspective (MLP) serves as a theoretical framework for investigating technological transitions and socio-technical systems. According to Frank W. Geels (2011), a renowned scholar in this field, systemic changes, often referred to as socio-technical transitions, "involve alterations in the overall configuration of [systems], which entail technology, policy, markets, consumer practices, infrastructure, cultural meaning and scientific knowledge" (p. 24). Geels highlights the multitude of individuals and groups operating on various levels within a systemic problem and how the diversity in actors makes transitions inherently complex. He suggests that addressing systemic issues requires significant structural changes at all levels. With that in mind, MLP can be a useful framework for analyzing web accessibility as a system and addressing potential socio-technical transitions.

MLP identifies three levels in the non-linear transition process: socio-technical regimes, niches, and socio-technical landscapes. Regimes are "the semi-coherent set of rules that guide and coordinate the activities of social groups reproducing various elements of socio-technical systems" (Geels, 2011, p. 27). They are the current arrangements, structures, and rules governing the interaction between social and technical elements. These norms, practices, and frameworks direct activities within a socio-technical context. While representing the existing order and structure, regimes may face challenges and transformations to address emerging needs as socio-technical systems evolve. Regimes need spaces for experimentation and innovation, which is where niches come into play.

Niches are the "protected environments" that act as incubators for innovation and experimentation. Geels (2011) notes that "Niches are crucial for transitions because they provide the seeds for systemic change" (p. 27). Niches offer actors the freedom to develop groundbreaking ideas, technologies, and practices that challenge established regimes. They provide alternative spaces that diverge from the norms set in regimes and allow actors the opportunity to experiment and learn in an isolated environment. Niches also attract a diverse range of actors, including entrepreneurs, researchers, and enthusiasts who bring different perspectives and expertise and uplift one another. Innovations cultivated within niches can influence and initiate transitions, which highlights the pivotal role they play as catalysts for systemic change.

Landscapes represent the overarching societal and contextual factors that shape the dynamics of socio-technical systems. Geels (2011) elaborates on this definition when he says, "The landscape level…highlights not only the technical and material backdrop that sustain society, but also includes demographic trends, political ideologies, societal values, and macro-economic patterns" (p. 28). This means that landscapes have external influences that affect technological progress but remain beyond the control of actors. The advancements in a landscape can put pressure on the pre-existing rules of the regime, which either creates opportunities for the emergence of new technologies or closes avenues for their development. Some examples of landscapes include pandemics or environmental crises shaping the direction and pace of technological change.

Overall, the three levels of the MLP framework illuminate how developments within one level can influence and interact with others. Figure 4 provides a visual representation of the complex interplay driving socio-technical transitions.

Increasing structuration of activities in local practices



Figure 4: Multi-level Perspective on Transitions (Geels, 2011, p. 28)

The figure illustrates how changes in the landscape exert pressure on the existing regime, leading to the creation of "windows of opportunity" for new and innovative ideas. Niche-innovations gain internal momentum when expectations are more defined and widely embraced. This framework enhances our understanding of web accessibility as a system.

The next section explores various levels of web accessibility, examining any disparities or disconnects in the system. There are several key steps in applying MLP to analyze web accessibility. Firstly, identifying the socio-technical regimes will require a comprehensive examination of existing rules and arrangements governing the interaction between social and technical elements within the web accessibility domain. This step aims to unveil the frameworks, norms, and practices shaping the current regime. Secondly, exploring niches involves identifying the specific environments recognized as innovation hubs within the web accessibility landscape and understanding the opportunities within these niches that have the potential to challenge and reshape established norms in the field. Lastly, investigating broader societal and contextual factors influencing the dynamics of web accessibility, such as demographic trends and emerging technologies, is crucial in recognizing elements impacting the progress of web accessibility initiatives in the landscape.

Section III - Applying the MLP Framework to Web Accessibility

The web accessibility regime relies heavily on guidelines, yet a flaw identified in Section I undermines its effectiveness. The current design and development process lacks a feedback iteration from quality assurance tests to designers, disrupting the flow and diminishing the priority of web accessibility. This break reflects broader issues within the entire regime, characterized by fragmentation and a lack of safeguards for a cohesive and iterative cycle. For instance, accountability is not enforced in the current system, as noted in a Boston College Law Review study, which describes the enforcement regime as "highly unstructured." The study further claims that the private enforcement regime, in the absence of Department of Justice (DOJ) regulations, is inefficient and generates backlash (Sorger, 2018, p. 1145). This demonstrates the challenges of enforcing web accessibility without regulatory guidance from the DOJ. Without a clear legal precedent, it is difficult to compel designers and developers to ensure their work is WCAG and ADA-compliant. The lack of a streamlined and consistent enforcement process impedes the effectiveness of the web accessibility regime, emphasizing the critical need for greater accountability.

Addressing challenges in the current web accessibility regime involves considering creative approaches, such as certification programs. Drawing inspiration from successful

certification models in other sectors, such as the U.S. Food and Drug Administration (FDA), can offer valuable insights. The FDA is widely known for its rigorous certification processes, ensuring the safety and efficacy of a range of products critical to public health. One example is the mandate that requires companies to demonstrate safety, effectiveness, and adherence to quality standards before marketing new drugs and biological products (FDA, 2022). Adopting a similar certification framework for web accessibility could establish standardized criteria, create transparency, and foster a culture of accountability in digital spaces. A certification program can also help companies demonstrate their commitment to accessibility in case of legal scrutiny. Working towards the program will require documented effort to comply with accessibility standards, mitigating legal risks associated with accessibility-related lawsuits. Overall, a web accessibility certification program can resolve regime issues by providing clear standards, incentivizing compliance, helping with legal compliance, and fostering a culture of accessibility within the web development industry.

In parallel with industry initiatives, addressing the educational aspects of web accessibility is equally crucial for systemic change. The lack of education regarding web accessibility can be viewed as a niche within the MLP framework because it represents a focused area for innovation and improvement within the broader regime. An important factor to consider is how people learn about accessibility concerns. A study investigated how much exposure students had to web accessibility in their software development courses at U.S. universities. It was found that "55% of the participants had never taken web development courses that discussed web accessibility...[and] nearly 60% of the participants were unfamiliar with national and international accessibility guidelines (ADA, Section 508, WCAG)" (AlMeraj et al., 2023). The results of this study are significant because they highlight the fact that people often are not

mindful of accessibility considerations unless they have a disability, someone close to them has a disability, or they learn about it in school or at work. If none of the criteria is met, then those without disabilities simply remain unaware of accessibility issues. This is especially problematic when web designers and developers don't understand the value of making their work meet accessibility standards since they never had to consider a world where they had an impairment that hindered their ability to use the internet. To address this knowledge gap, educational initiatives focusing on web accessibility can serve as a niche within the broader web development landscape. These initiatives aim to introduce accessibility concepts early in curricula, fostering an understanding and appreciation for inclusive design practices. By reshaping how accessibility is integrated into educational frameworks, we can cultivate a generation of web developers who prioritize inclusivity.

Educational initiatives are crucial for bridging the web accessibility knowledge gap, but fostering cohesive collaboration within the community is equally vital for systemic change. Communities are great examples of niches as they provide a supportive environment for innovation. However, there is an evident lack of a singular, cohesive community for web accessibility, and the fragmented structure holds the web accessibility community back from flourishing. Complex systems researchers define social spaces as "the place where people meet and interact" and "group cohesion is strongly influenced by internal communication" (Hedayatifar et al., 2019). Currently, there are many smaller web accessibility communities scattered across the internet, whether it's on social media platforms like Twitter, forums like Stack Overflow, communication servers like Discord, or academic institution-related sites. Often, these groups don't overlap in communication, which hinders the progression and support of web accessibility in society. Geels' Multi-Level Perspective highlights the significance of

cohesive structures and interactions in social spaces. Therefore, creating a communication platform for designers, developers, accessibility specialists, researchers, and the public would be a crucial move to promote collaboration and knowledge-sharing, and address the diverse needs of the web accessibility community. Consolidating these scattered communities into a unified social space could lead to increased group cohesion, and collective problem-solving and create a more robust and interconnected network. The platform can serve as a hub for interdisciplinary discussions, which enable professionals, advocates, and enthusiasts to share insights, collaborate on projects, and stay informed about the latest developments in web accessibility. By breaking down communication barriers and promoting a sense of unity, this centralized space has the potential to amplify the impact of web accessibility initiatives and contribute to a more inclusive digital environment.

There will always be unpredictable factors in the web accessibility landscape that are beyond the immediate control of actors, with new technologies standing out as a prime example. Accessibility specialists predict that emerging technologies and advancements, such as "voice recognition, eye-tracking, and haptic feedback" will reshape the landscape soon (Akinyemi, 2023, para. 6). Drawing from the principles of the MLP, which emphasizes the importance of understanding how systems evolve, anticipating these technological shifts is essential for the web accessibility community to stay ahead. Taking proactive measures, such as identifying trends and directions within technology, puts the web accessibility community in a favorable position to adapt to rapid changes in the landscape. By closely monitoring emerging developments, the community can proactively draft new standards and regulatory frameworks based on the potential shifts in user interfaces and technology interfaces. Having the foresight to plan ahead of

landscape changes will give the web accessibility community a strategic advantage needed to foster a more inclusive digital environment.

As seen below, Figure 5 puts the MLP framework together, highlighting unavoidable changes that would affect the landscape, current practices as part of the socio-technical regime, and safe spaces and tools that make up the niches. The model cannot capture all elements of web accessibility as a system, so these components serve as examples of interactions between levels. They also form the basis for web accessibility improvements as part of a socio-technical transition.



Figure 5: Web Accessibility MLP Framework (Created by author, adapted from Geels)

Conclusion

This paper explores the systemic challenges within web accessibility and introduces a multi-level perspective (MLP) framework to understand its complexities. Originally, it was clear that a lack of awareness regarding web accessibility contributed to a broader problem. However, analyzing web accessibility as a system, through the MLP framework, uncovered other issues, such as flaws in the current design and development process, fragmented educational initiatives, the absence of a cohesive community, and the need for the web accessibility community to stay attuned to technological advancements. These problems highlight a complex set of issues that permeate the entire web accessibility ecosystem, rather than being an isolated problem.

Utilizing the MLP framework, which includes socio-technical regimes, niches, and landscapes, is valuable because it offers a comprehensive and structured lens through which to analyze the intricate relationships, dynamics, and structures within the web accessibility system. By analyzing the actors and power dynamics in web accessibility, the framework sheds light on the complexities inherent in the system. Examining the web accessibility regime unveiled a broken web design and development cycle where accessibility testing feedback failed to get to the correct teams and inconsistent enforcement practices discouraged accountability. Delving into niches brings attention to the lack of a cohesive community and highlights fragmented educational initiatives. Exploring landscapes highlights the importance of the web accessibility community staying attuned to technological advancements and developments. The identified flaws contribute to inequitable access to digital content for individuals with disabilities. To achieve universal accessibility on websites and promote inclusivity and equal opportunities for everyone regardless of their abilities, we must implement transformative changes.

While considering solutions like web accessibility certification programs, education initiatives, and the creation of a unified space for collaboration, it is essential to recognize the inherent limitations within Geels' framework. The proposed solutions may encounter challenges when achieving widespread adoption, accessing resources, and overcoming potential resistance within existing systems. The MLP framework simplifies the complexity of real-world systems by categorizing them into three levels. However, this oversimplification may neglect certain interactions between levels such as the dynamics within niches and landscapes. For instance, the framework might overlook the nuanced relationships between educational initiatives and the effectiveness of certification programs in specific cultural or economic contexts. Moreover, the MLP framework sometimes underplays the role of human agency, potentially underestimating the influence of individual actors and their decisions in driving technological transitions. These considerations stress the importance of looking beyond the MLP framework when addressing web accessibility challenges. Nonetheless, despite these limitations, the proposed measures offer promising avenues for initiating positive changes within the web accessibility landscape. By confronting these challenges head-on, we strive towards a digital world where no one is left behind, fostering inclusivity and accessibility for all on the internet.

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